



SANTA CLARA VALLEY WATER DISTRICT

NON-AGENDA

May 29, 2026

Board Policy EL-7 Communication and Support to the Board

The BAOs shall inform and support the Board in its work.

Page	<u>CEO BULLETIN & NEWSLETTERS:</u> None
	<u>BOARD MEMBER REQUESTS & INFORMATIONAL ITEMS</u>
	BMR/IBMR Weekly Reports: None
3	Memo from Rita Chan, ACEO, to the board, dated 05/26/26, providing a response to BMR-26-0001, which asks for copies of planning study reports related to Calero Dam.
	<u>INCOMING BOARD CORRESPONDENCE</u>
233	Board Correspondence Weekly Report: 05/27/26
234	Email from Scott Geffre to Director Varela, dated 05/22/26, regarding a proposed development at 15395 Sycamore Drive in Morgan Hill, CA. C-26-0043
	<u>OUTGOING BOARD CORRESPONDENCE:</u> None

BOARD MEMBER REQUESTS and Informational Items

**MEMORANDUM**FC 14 (03-11-25)
Page 1 of 2**TO:** Board of Directors**FROM:** Rita Chan**SUBJECT:** Response to BMR-26-0001 Relating to
Calero Dam Seismic Retrofit Project**DATE:** May 26, 2026

At the April 28, 2026 Board meeting, Chair Estremera requested that staff provide copies of planning study reports related to Calero Dam.

Planning Study Report

Attached is a copy of the Planning Study Report for the Calero Dam Seismic Retrofit Project prepared by GEI Consultants, Inc. in April 2015 ("GEI Report"). The 2015 GEI Report is primarily focused on the best engineering methods to address three main issues with Calero Dam: (a) to ensure that the dam stays stable and maintains its integrity during a major earthquake; (b) to ensure that the dam can safely handle an extreme flood event; and (c) to replace the outlet works facilities.

The GEI Report, which was provided to the Board in June 2015, first considered 15 different conceptual alternatives and narrowed them down to five feasible alternatives. The report did not consider a "no project" alternative or an alternative to remove the dam because neither alternative would address the safety risks associated with the dam and meet Valley Water's objectives to restore water supply capacity affected by the reservoir level restrictions imposed by the California Department of Water Resources, Division of Safety of Dams (DSOD). The five feasible alternatives were further evaluated and scored based on environmental impacts, long-term reliability and operational effectiveness, capital and life-cycle costs, and ease of implementation in light of technical constructability, regulatory approvals, and schedule considerations.

The report presented the staff-recommended project alternative, which includes the following main components:

- Strengthening the dam by removing unstable soil and adding an earthfill buttress to approximately 60% of the dam's height
- Raising the height of the main and auxiliary dam crests by up to 7 feet to provide adequate freeboard for the probable maximum flood
- Abandoning the existing outlet and constructing a new sloping intake on the left abutment if deemed necessary
- Replacing the existing spillway weir with a new weir to safely pass the probable maximum flood
- Breaching Fellows Dike and removing/relocating historical Bailey Ranch structures behind Fellows Dike

In 2019, staff presented an operations and system reliability analysis on Calero Reservoir to the Capital Improvement Program (CIP) Committee and then to the Board. The Board directed staff to proceed with the Calero Dam Seismic Retrofit Project.

Benefit-Cost Analysis Report

Also attached is a copy of a report titled "Calero Dam Benefit-Cost Analysis" prepared by AECOM in January 2020 ("AECOM Report").

While the 2015 GEI Report is primarily engineering-focused, the 2020 AECOM Report evaluated the

economic and cost viability of the Calero Dam retrofit project from different perspectives, including the option of removing the dam. AECOM concluded that restoring Calero Reservoir to its original capacity (the "Base Case") is the most fiscally responsible and operationally sound path forward and recommended that Valley Water proceed with the Base Case retrofit. In addition to the Base Case, the report evaluated two alternatives: Alternative 1 (maintaining restricted DSOD operations by only retrofitting the dam partially) and Alternative 2 (decommissioning the dam and building a low-capacity flood detention basin). Specifically, AECOM found that the Base Case retrofit provides the highest level of flood risk reduction and protects Valley Water's existing Calero Creek water rights. It also maximizes emergency water supply storage and provides the operational flexibility needed to manage long-term water demands.

Staff is planning to provide a Calero Reservoir project update to the Board at a future Board meeting and answer questions that the Board may have. In the meantime, if you have questions, please contact me at (408) 630-2620.

Signed by:


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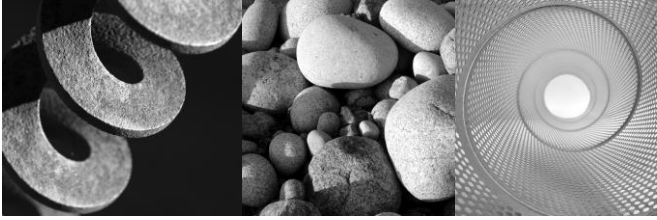
5/26/2026

Rita Chan, P.E.
Assistant Chief Executive Officer
Office of Integrated Water Management

Date

Attachments:

- 1) Calero Dam Seismic Retrofit Project Planning Study Report
- 2) Calero Dam Benefit-Cost Analysis



FINAL



Geotechnical
Water Resources
Environmental and
Ecological Services



Calero Dam Seismic Retrofit Project

Planning Study Report

Submitted to:

Santa Clara Valley Water District

5750 Almaden Expressway

San Jose, CA 95118-3686

Submitted by:

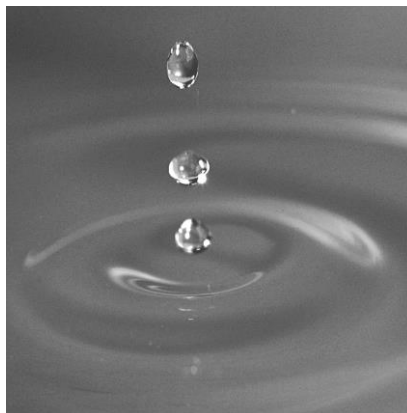
GEI Consultants, Inc.

180 Grand Ave, Suite 1410

Oakland, CA 94612

April 2015

Project 132838-0

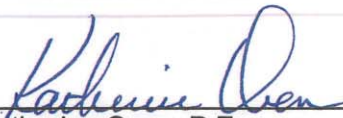


CALERO DAM SEISMIC RETROFIT PROJECT

PROJECT NO. 91084020

PLANNING STUDY REPORT

I have reviewed and concur with the alternatives analysis and recommendation presented in this Planning Study Report for the Calero Dam Seismic Retrofit Project and recommend proceeding with design to implement the project as recommended.


Katherine Owen, P.E.
Deputy Operating Officer
Water Utility Capital Division

5/19/2015
Date

I have reviewed and approve the alternatives analysis and recommendations presented in this Planning Study Report for the Calero Dam Seismic Retrofit Project and approve proceeding with design to implement the project as recommended.


Frank Maitski, P.E.
Deputy Operating Officer
Water Utility Technical Support Division

6/9/2015
Date

CALERO DAM SEISMIC RETROFIT PROJECT

PROJECT NO. 91084020

PLANNING STUDY REPORT

Prepared By:

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Reviewed By:

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Under the Direction of:

Emmanuel Aryee, P.E.
Dams & Pipelines Project Delivery Unit Manager

Katherine Oven, P.E.
Deputy Operating Officer

Frank Maitski, P.E.
Deputy Operating Officer

Jim Fiedler
Chief Operating Officer

Beau Goldie
Chief Executive Officer

The Planning Study Report has been prepared by the undersigned, who hereby certifies that he is a Registered Civil Engineer in the State of California



April 2015

DISTRICT BOARD OF DIRECTORS

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Acronyms and Abbreviations

AACE	American Association of Cost Engineers
ADAS	automated data acquisition system
AF	acre-feet
AQ	Almaden Quicksilver
AVP	Almaden Valley Pipeline
cfs	cubic feet per second
CDFW	California Department of Fish and Wildlife
CEO	Chief Executive Officer
CEQA	California Environmental Quality Act
CLFE	Calero local fault event
CMP	corrugated metal pipe
CNDDDB	California Natural Diversity Database
CNPS	California Native Plant Society
CRHR	California Register of Historical Resources
CRPR	California Rare Plant Rank
CSC	County of Santa Clara
CSFE	Calero San Andreas fault event
CY	cubic yards
DSM	deep soil mixing
DSOD	California Division of Safety of Dams
DSP	Dam Safety Program
DTSC	Department of Toxic Substances Control
EIR	Environmental Impact Reports
ESA	Environmental Site Assessment
FE	Federally Endangered
FP	Fully Protected
FT	Federally Threatened
HCP	Habitat Conservation Plan
HMR	Hydrometeorological Report
LEDPA	Least Environmentally Damaging Project Alternative
MCE	Maximum Credible Earthquake
MMRP	Mitigation Monitoring and Reporting Plan
M _w	Moment Magnitude
NEPA	National Environmental Protection Act
NMFS	National Marine Fisheries Service
NAHC	Native American Heritage Commission
NAVD88	North American Vertical Datum of 1988
NGS	National Geodetic Survey
NGVD29	National Geodetic Vertical Datum of 1929
NRHR	National Register of Historic Places
NTP	Notice to Proceed
OPAU	Water Operations and Planning Unit

Acronyms and Abbreviations (continued)

PDR	Problem Definition Report
PFMA	Probable Failure Mode Analysis
PMF	Probable Maximum Flood
PMP	Probable Maximum Precipitation
Project	Calero and Guadalupe Dams Seismic Retrofits Project
PSR	Planning Study Report
QEMS	Quality and Environmental Management System
QMS	Quality Management System
RCP	Reinforced Concrete Pipe
ROV	Remotely Operated Vehicle
ROW	Right-of-way
RWQCB	Regional Water Quality Control Board
RWTP	Rinconada Water Treatment Plant
SCCPRD	Santa Clara County Parks and Recreation District
SCVWD (District)	Santa Clara Valley Water District
SFPUC	San Francisco Public Utilities Commission
SRA	Staff Recommended Alternative
SSC	Species of Special Concern
SSE	Seismic Stability Evaluation
SE	State Endangered
ST	State Threatened
STID	Supporting Technical Information Document
SVOC	semi volatile organic compound
TM	Technical Memorandum
TDR	Transition to Design Report
UT	Ultrasonic Thickness
USACE	United States Army Corp of Engineers
USFWS	United States Fish and Wildlife Service
VHP	Valley Habitat Plan
VWP	Vibrating Wire Piezometers

Executive Summary

The Calero Dam facilities are located in Santa Clara County about 12 miles southeast of downtown San Jose. The facilities include the Calero Main Dam with an ancillary spillway and outlet works, the Calero Auxiliary Dam, and the Fellows Dike. The embankments impound Calero Reservoir with a capacity of 9,934 acre-feet at full storage (Elevation 486.8 feet NAVD88). Construction of the facilities occurred in the mid 1930's with completion in 1935.

Calero Main Dam is located about 0.3 miles off McKean Road and across Calero Creek. Calero Auxiliary Dam is located on a topographic saddle approximately 0.7 miles to the northeast of the Main Dam and adjacent to McKean Road. Fellows Dike is located about 1.5 miles east of the Main Dam.

Calero Main Dam is a 90-foot-high, 840-foot-long rolled earth embankment and the Calero Auxiliary Dam is a 40-foot-high, 510-foot-long rolled earth embankment. Fellows Dike is an earth embankment at the upstream end of Calero Reservoir that was constructed concurrently with the main and auxiliary dams to protect the Bailey Fellows Ranch complex from inundation by reservoir water. The dike is approximately 2,000-feet-long, and wraps the Bailey Fellows Ranch complex in a general "U" shape and ranges from zero to 12 feet high. Additional pertinent data for Calero Main Dam and Auxiliary Dam are provided in **Appendix A**.

A seismic stability evaluation of the Calero dams completed in 2012 (URS, 2012a), indicated inadequate seismic stability of the Calero Main Dam from postulated design earthquake events. The Calero Auxiliary Dam seismic stability was determined not to be an issue. As a result, Calero Reservoir is currently subject to operational restrictions imposed by the California Division of Safety of Dams (DSOD) due to seismic stability concerns with the main dam, and the inadequacy of Fellows Dike at the upstream end of the reservoir. Calero Reservoir is restricted to elevation 467.4 feet, approximately 19 feet below spillway level which limits storage to approximately 4,585 acre-feet or 46 percent of the normal 9,934 acre-foot storage capacity. Retrofit of the 80-year-old Calero Dam and associated facilities is necessary to address seismic safety concerns and other identified dam issues; to meet current regulatory requirements; to satisfy District operational requirements; and to remove the reservoir operating restriction and restore normal water supply capacity.

The seismic safety concerns and potential embankment retrofit options were identified in prior Seismic Stability Evaluations (SSE1B) (URS, 2012a, 2012c). These reports provided the initial basis for the planning study documented herein.

The planning study included additional investigations and analyses to further define the dam safety and operational deficiencies at Calero Dam that were summarized in the Calero Dam Problem Definition Report (GEI, 2014b). The investigations and analyses included flood studies (probable maximum precipitation/probable maximum flood; PMP/PMF), underwater outlet works inspections and condition assessments, and geotechnical and geologic explorations to further define the dam safety issues. The Calero Dam Problem Definition Report provides documentation of the existing conditions; identifies the problems and issues affecting the dam and appurtenant facilities; identifies constraints and options for

remediation of the issues; and documents the District's Project Requirements. The Project Requirements are also included in this report in **Appendix B**.

Based on the evaluations documented in the SSE1B Report (URS, 2012a) and the Problem Definition Report (GEI, 2014b), the following deficiencies have been identified at Calero Dam:

- 1) Seismic stability: the main dam embankment will experience excessive and unacceptable deformations under the maximum credible earthquake. Consequently, the California Division of Safety of Dams (DSOD) accepted reservoir operating restrictions that limit the storage at Calero to approximately 46% of its design capacity.
- 2) PMF passage: an updated PMP/PMF study identified that the PMF (HMR 59) exceeds the existing spillway capacity and will potentially overtop the Main Dam and Auxiliary Dam during this maximum flood event.
- 3) Outlet works capacity and condition: the existing low-level outlet works provides only marginal capacity for emergency drawdown in accordance with DSOD guidelines and its current condition will not provide 50-years of service without modifications, nor provide hydraulic capacity for a potential 30-foot crest raise and reservoir capacity increase.
- 4) Seepage: although not considered a significant dam safety problem, seepage through the main dam embankment and right abutment occurs as the reservoir level increases above key elevations, and;
- 5) Fellow Dike inadequacies: the dike is in poor physical condition and not stable under seismic loading.

The Project also considered the potential enlargement of Calero Reservoir in the future. The main dam stabilization, PMF passage, and outlet retrofit options must accommodate, or avoid precluding to the extent practical, a raise of the main and auxiliary dams by up to 30 feet without major removal/reconstruction of the planned work.

The planning process, including alternatives formulation, evaluation and screening was documented in the Calero Dam Alternatives Report (GEI, 2015a). Fifteen (15) conceptual alternatives to remediate the dam and mitigate the identified dam safety deficiencies were developed, and evaluated leading to five feasible alternatives. The five feasible alternatives were further refined and evaluated to identify the Staff-Recommended Alternative.

The Staff-Recommended Alternative includes the following:

- Partially removing the downstream embankment of the main dam to remove liquefiable alluvium below the downstream shell;
- Stabilizing the downstream portion of the dam with a buttress and installing an internal filter and drain system;
- Raising the crests of the main dam and the auxiliary dam up to 7 feet to pass the updated probable maximum flood (PMF) with adequate freeboard;
- Adding a new multi-level sloping intake on the left abutment;
- Adding a new outlet tunnel with carrier pipe below the left abutment that connects to the existing Almaden Valley Pipeline;

- Abandoning the existing outlet works by removing and/or backfilling/sealing the existing conduit;
- Replacing the existing spillway weir with a new ogee crest;
- Removing/relocating the Bailey Ranch structures behind Fellows Dike; and
- Breaching of Fellows Dike.

The Staff-Recommended Alternative is presented in the drawings included in **Appendix C**.

In conjunction with the planning study, evaluations of borrow and spoil disposal requirements are being completed. The evaluation concluded that soil and rock for the buttress could be obtained from on-site sources through the development of a borrow site on the north rim of the reservoir. Filter and drain material would be imported from off-site commercial sources.

The implementation of the Staff-Recommended Alternative will not only remove the DSOD storage restrictions allowing full operational use of the reservoir, but also improve reliability and extend the service life of the Calero Dam facilities for another 50 to 100 years.

For planning purposes, it was concluded that Calero Reservoir would be fully lowered (drained) to facilitate retrofit construction, with the reservoir lowered for approximately two years. The total estimated construction duration is approximately 2-1/2 to 3 years.

The estimated project cost is approximately \$70 million in 2015 dollars. This cost estimate is an Association for Advancement of Cost Engineering (AACE) Classification Class 3 cost estimate, which is assumed to represent the actual total installed cost within the range of -20 percent to +30 percent of the cost indicated. The cost estimate does not include District administrative and legal costs, right of way costs, replacement water supply, planning/environmental studies and permitting, habitat restoration and mitigation, and removal or demolition of historical structures.

The estimated schedule for the project is as follows:

- Completion of design – March 2017
- Completion of California Environmental Quality Act (CEQA) studies – Dec 2016
- Acquisition of Permits – February 2018
- Start of Construction – March 2018
- End of Construction – October 2020

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1.0 Introduction and Project Background

1.1 Project Overview

A seismic stability evaluation of Calero Dams completed in 2012 (URS, 2012a), determined that significant deformation of the Calero Main Dam could occur from postulated design earthquake events. Deformations of the crest were estimated to be up to 27 feet horizontal and 6 feet vertical under the anticipated Maximum Credible Earthquake (MCE) of M_w 6.7 on the local Shannon fault (1.7 km away). Deformations of the crest were estimated to be up to 18 feet horizontal and 5 feet vertical for a MCE of M_w 7.9 on the San Andreas fault (approximately 13 km away). The deformations estimated at Calero Auxiliary Dam were less than 1.5 feet and were not expected to compromise the integrity of the auxiliary dam.

Based on the findings, Calero Reservoir was and remains restricted to elevation 467.4 feet, approximately 19 feet below spillway level that limits storage to approximately 4,585 acre-feet or 46 percent of the normal 9,934 acre-foot storage volume. The restriction was approved by the California Division of Safety of Dams (DSOD) (DSOD, 2012; URS, 2012b). Lesser restrictions had been in place since 2006 due to concerns on the adequacy of Fellows Dike at the upstream end of the reservoir. These interim risk reduction measures will remain in place until the seismic deficiencies are remediated.

Retrofit of the 80-year-old Calero Dam and associated facilities is necessary to address seismic safety concerns and identified dam safety issues; to meet current DSOD regulatory requirements; to satisfy District operational requirements; and to remove the reservoir operating restriction. Implementation of the Staff-Recommended Alternative to address these problems will not only remove the DSOD storage restrictions allowing full operational use of the reservoir, but also improve reliability and extend the service life of the facilities for another 50 to 100 years.

1.2 Project Objectives

The District's objectives for the Project are to make improvements necessary to:

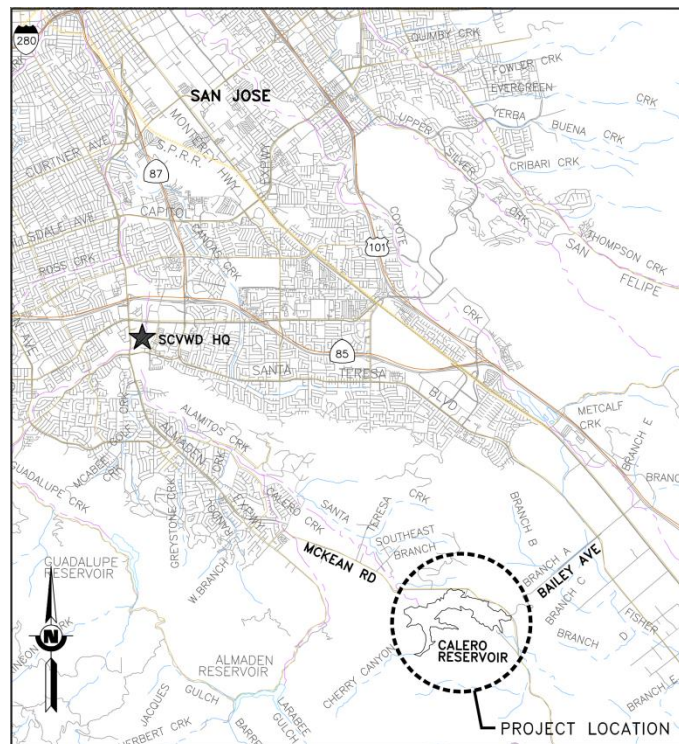
- 1) Stabilize the Calero Dam embankments for the Maximum Credible Earthquake;
- 2) Modify or replace the outlet works if determined to be inadequate;
- 3) Modify the spillway or increase the freeboard of the Calero dams for safe passage of the Probable Maximum Flood (PMF);
- 4) Provide modifications that do not preclude potential future expansion of Calero Dam and reservoir to provide additional reservoir storage;
- 5) Remove or relocate the Bailey Ranch structures and breach Fellow's Dike, and;
- 6) Incorporate other measures to address seismic and other deficiencies that are identified through the Project planning process.

The District also developed project requirements for addressing issues associated with the planning and design of the Calero Dam Retrofit. The project requirements are provided in **Appendix B** for reference.

1.3 Calero Facilities Location and Overview

The Calero Dam and Reservoir are located in south Santa Clara County, approximately 6.3 miles southeast of the District headquarters on Almaden Expressway, and approximately 5 miles west of US 101 as shown in **Figure 1-1**. The District uses Calero Reservoir to store natural watershed runoff, replenish downstream wells by ground water recharge, provide flood control, and provide recreation and environmental flows. Controlled releases from Calero Reservoir provide water to recharge the groundwater basin and raw water for treatment at the District's Rinconada or Santa Teresa water treatment plants. Storage in Calero Reservoir also serves as the emergency backup to the District's imported water supplies.

Figure 1-1: Project Vicinity Map



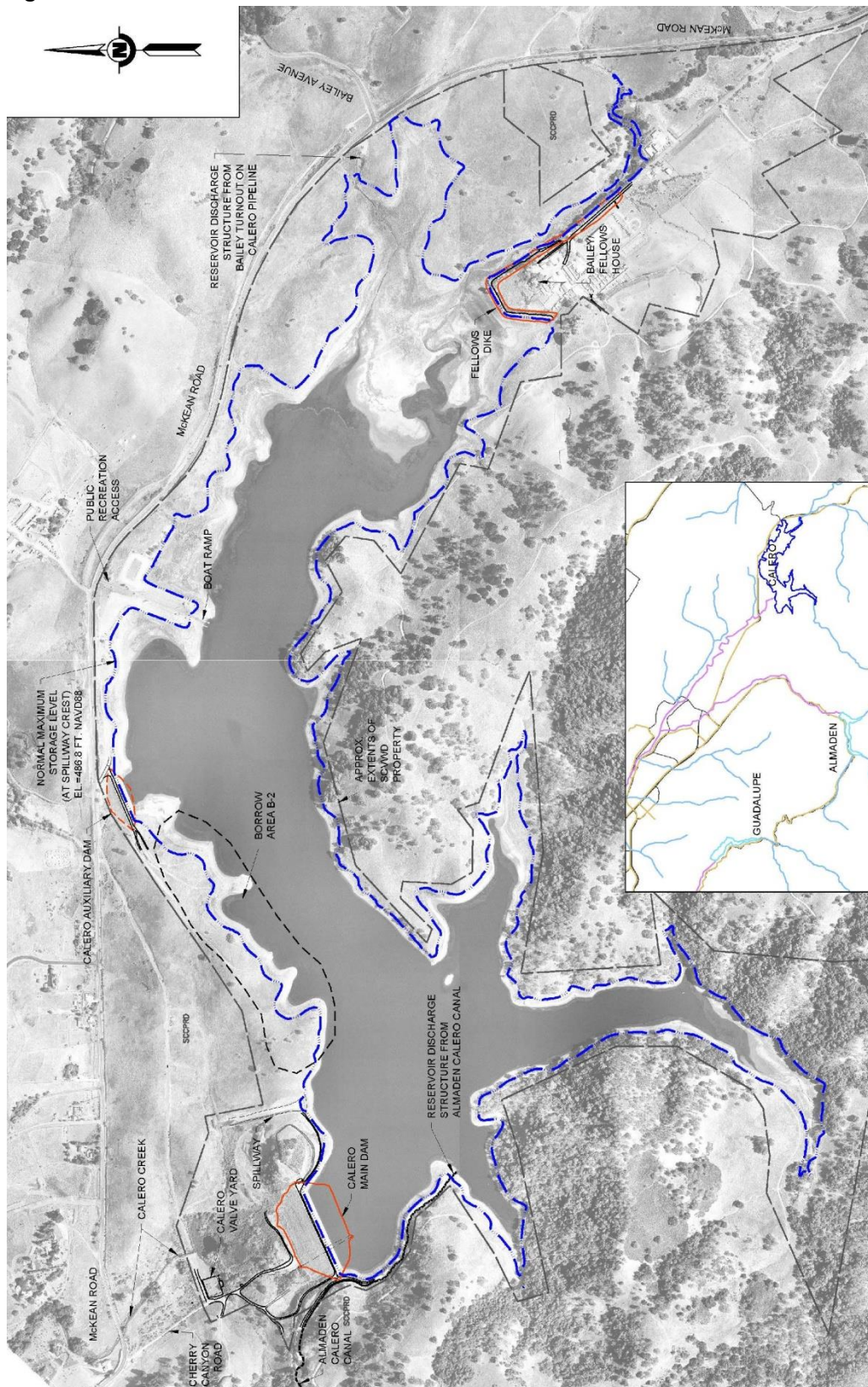
Typically, the reservoir is filled during the winter and early spring and drawn down from late spring to early fall. The reservoir is filled with local watershed runoff, transfers from Almaden Reservoir via the Almaden-Calero Canal, and imported water from the federal Central Valley Project via the Calero Pipeline at the Bailey Turnout or through bidirectional pumping through the outlet conduit.

Calero Reservoir is impounded by three embankments: the Calero Main Dam across Calero Creek; the Calero Auxiliary Dam; and Fellows Dike as shown in **Figure 1-2**. Access to Calero Dam is from McKean Road, a county road that skirts the northern and eastern perimeter of Calero Reservoir. A gravel single-lane road referred to as Cherry Canyon Road extends south from McKean Road near the overcrossing of Calero Creek, south approximately 0.3 miles to the toe of Calero Dam. The access road is gated at McKean Road.

Calero Auxiliary Dam is approximately 0.7 miles east of the Calero Main dam adjacent to McKean Road. Record drawings indicate that McKean Road was relocated to higher ground during construction of the Calero Auxiliary Dam. The auxiliary dam can be accessed via a locked gate at McKean Road or from a gravel roadway extending west from the Santa Clara County Parks boat launch area near McKean Road and Fortini Road.

Fellows Dike is approximately 1.4 miles southeast of the Calero Main dam. Access to the Fellows Dike area is via an unnamed, paved roadway extending from McKean Road (across from the Cinnabar Hills Golf Club) northwest approximately 0.6 miles.

Figure 1-2: Calero Site Plan



1.4 Calero Facilities Description

1.4.1 Embankments

Calero Main Dam is a 90-foot-high, 840-foot-long rolled earth embankment and the Calero Auxiliary Dam is a 40-foot-high, 510-foot-long rolled earth embankment. Fellows Dike is an earth embankment at the upstream end of Calero Reservoir that was constructed at the time of the Calero Dam construction to protect the Bailey Fellows Ranch complex from inundation by reservoir water. The dike is approximately 2,000 feet long, and wraps the Bailey Fellows Ranch complex in a general “U” shape. The dike heights range from zero feet at its south end where it transitions into the natural topography to a maximum height of about 12 feet at its north end. The embankments impound Calero Reservoir with a capacity of approximately 10,000 acre-feet at full storage (Elevation 486.7 feet NAVD88).

Construction of the Calero facilities occurred in the mid 1930’s with completion in 1935. Calero Dam has a Total Class Weight of 30 and falls in the “High Consequence” category according to the DSOD Consequence-Hazard Matrix for seismic hazard analysis (DSOD, 2002). Additional pertinent data for Calero Main Dam and Auxiliary Dam are provided in **Appendix A**.

1.4.2 Spillway

The Calero Reservoir spillway is located in a natural saddle 880 feet east of the Main Dam, and consists of a concrete overflow weir and concrete-lined chute with downstream unlined plunge pool. The weir crest is 84.4 feet long and was originally constructed in 1935 as a concrete ogee at elevation 485.4 feet NAVD88 (484.0 NGVD29); however it was raised in 1962 to elevation 486.8 feet NAVD88 (482.6 NGVD29).

The concrete-lined spillway chute is 640 feet long, 20 feet wide, and has side slopes of 1H:1V. The concrete-lined spillway chute directs spills north into an excavated, unlined open area, approximately 100 feet long, where the flow is redirected about 90 degrees west into a gully then back toward Calero Creek.

The reservoir level had significant fluctuations in years prior to 1988 (URS 2012b) with numerous spills. The last reported spill was in 1989. Since 2006 when the operating restriction was implemented due to the Fellows Dike inadequacies, (restriction to elevation 480.4 feet NAVD88), the spillway has not spilled.

1.4.3 Outlet Works

The original Calero Dam outlet works, constructed in 1935, consisted of a concrete intake structure and a straight, 481-foot-long, 36-inch-diameter, concrete-encased steel pipe under the Main dam which discharged to a stilling basin at Calero Creek, located at the downstream left toe of the dam. Flow control was provided at both the inlet structure (hydraulically actuated, 42-inch slide guard gate) with the hydraulic controls on the dam crest, and at the discharge structure (electrically actuated 30-inch butterfly valve).

In 1982 the outlet works were modified as part of the Almaden Valley Pipeline Project, and the existing outlet was connected directly to the Almaden Valley Pipeline with a turnout extending to Calero Creek. At that time, a modified trash rack was constructed for the inlet structure. The modifications included extending the outlet pipe from the original 30-inch

butterfly valve with a 48-inch-diameter pipe that connects to the District's raw water transmission system at the Calero valve yard, situated approximately 700 feet downstream from the toe of the dam, and filling a limited length of Calero Creek. A new stream release facility was also constructed approximately 650 feet downstream of the original outlet adjacent to the valve yard, consisting of an impact-type stilling basin. In total, the outlet works from the inlet structure to the creek outlet currently consists of approximately 481 feet of 36-inch-diameter steel pipe (circa 1935) and approximately 787 feet of 48-inch-diameter steel pipe (circa 1982).

In 1989, the Calero Pipeline was constructed and tied into the Almaden Valley Pipeline at the Calero valve yard. The Calero Pipeline project included construction of the Bailey Turnout structure (near Bailey Road and McKean Road) allowing water from Calero Pipeline to discharge into Calero Reservoir. With the Calero Pipeline, Calero Reservoir is able to receive imported water from the federal Central Valley Project via the Bailey Turnout or by pumping water back into the Calero Reservoir through the outlet conduit.

1.5 Project Studies

This Calero Dam Planning Study Report builds upon numerous previous studies performed for the Calero facilities including problem definition studies, alternatives evaluations, stability analyses, and borrow studies. Key studies are listed in Section 6, References.

1.6 Datum and Topographic Information

The District and future designers will prepare the design documents for the Project using elevations based on NAVD88. Unless noted, elevations listed in this report are shown as NAVD88 and as appropriate, the NGVD29 elevation in parenthesis. Many existing reports refer to elevations in NGVD29. DSOD correspondence and the District's ALERT system use NGVD29 elevations. The National Geodetic Survey (NGS) datum conversion indicates NAVD88 is 2.8 feet higher in elevation than NGVD29 at the location of Calero Dam.

1.7 Report Organization

The Planning Study Report is organized into the following sections:

- **Section 1** provides an introduction to the purpose, scope, and organization of this Planning Study Report. It also provides an overview and location of the Calero Facilities.
- **Section 2** provides a summary of the project's problem definition as the basis for the development and evaluation of project alternatives.
- **Section 3** describes the alternatives analysis planning process, including the Conceptual-level Alternatives Evaluation for 15 conceptual alternatives, Feasibility-level Alternatives Evaluation for 5 feasible alternatives, and identifies the Staff-Recommended Alternative.
- **Section 4** introduces and describes the recommended project, including the preliminary design of embankment, outlet works, and spillway components. It also discusses the breach of Fellows Dike, real estate needs for the Project, environmental considerations, and issues to be considered for final design.

- **Section 5** presents preliminary construction cost estimates and schedule based on the preliminary design of the Staff-Recommended Alternative.
- **Section 6** lists references utilized in preparing this Planning Study Report.
- **Appendix A** is a table of pertinent data for Calero Main Dam and Calero Auxiliary Dam.
- **Appendix B** is a table of the District's project requirements for the Calero Dam retrofit.
- **Appendix C** includes the set of drawings describing the Calero Dam Staff-Recommended Alternative.

2.0 Problem Definition

2.1 Overview

For the current planning study, existing data review, field investigations and analyses were performed to define the problems, identify dam safety issues, and develop feasible alternatives to remediate the seismic and other identified dam safety deficiencies. The results of the investigations and analyses were summarized in the Calero Dam Problem Definition Report (GEI, 2014b). The following problems have been identified at Calero Dam:

1. Seismic Stability: The main dam embankment will experience excessive and unacceptable deformations under the MCE. Consequently, DSOD accepted reservoir operating restrictions that limit the storage at Calero to less than 50% of its design capacity.
2. Spillway Capacity: An updated PMF study identified that the PMF (HMR 59) exceeds the existing spillway capacity and will potentially overtop the Main Dam and Auxiliary Dam during this maximum flood event.
3. Outlet Works Capacity and Condition: The existing low-level outlet works provides only marginal capacity for emergency drawdown in accordance with DSOD guidelines, and its current condition will not provide 50 years of additional service without modifications, nor provide the hydraulic capacity for a potential 30-foot crest raise and reservoir capacity increase.
4. Seepage: Although not considered a significant dam safety problem, seepage through the main dam embankment and right abutment occurs as the reservoir level increases above key levels, and;
5. Fellow Dike Inadequacies: The dike is in poor physical condition, susceptible to erosion, and not stable under seismic loading,

A synopsis of the investigations and analyses leading to the identification of these deficiencies is provided below.

2.2 Embankments

The District completed a Seismic Stability Evaluation of the Calero Main Dam and Auxiliary Dam in 2012 (SSE1B) (URS, 2012a) following earlier DSOD studies that indicated seismic concerns for Calero Dam. The analyses included seismic source evaluation, liquefaction evaluation of the embankment and underlying foundation materials (alluvium) and post-earthquake stability and deformation estimates of the embankment under potential seismic ground motions. Two events were identified as the controlling Maximum Credible Earthquakes (MCE); a local M_w 6.7 event on the Shannon fault (designated as the Calero Local Fault Event, (CLFE)) with a closest distance of 1.7 km, and a M_w 7.9 event on the San Andreas fault (designated as the Calero San Andreas Fault Event, (CSFE)) with a closest distance of approximately 13 km. Potential ground motions from these MCE events were used for the seismic stability analyses.

The Calero Main Dam seismic stability analyses indicated that during the controlling MCE events, the downstream slope would become unstable as a result of liquefaction of the underlying alluvial soils in the foundation of the dam causing downstream movement.

Deformations of the crest were estimated to be up to 27 feet horizontal and 6 feet vertical under the CLFE. Deformations of the crest were estimated to be up to 18 feet horizontal and 5 feet vertical for the CSFE. The downstream toe displacements were estimated to be over 30 feet horizontal and 10 feet upward for the CLFE, and over 18 feet horizontal and 8 feet upward for the CSFE. Such large deformations and the expected embankment cracking would compromise the integrity of the dam and are considered unacceptable for dam safety.

The SSE1B work determined that the post-earthquake stability of the upstream slope is acceptable. No remedial measures are necessary for the upstream slope because it is judged that if the downstream slope is stabilized, estimated deformations of the upstream slope under the controlling MCE event are tolerable from a dam safety perspective.

The Calero Auxiliary Dam was also analyzed as part of the SSE1B study (URS, 2012a). The deformations estimated at Calero Auxiliary Dam were less than 1.5 feet and were not expected to compromise the integrity of the auxiliary dam.

2.3 Spillway / PMF Passage

The standard hydraulic requirement for public safety on high-hazard potential dams is to provide spillway capacity capable of passing the probable maximum flood (PMF). When significant changes to the dam are proposed or made (such as a seismic retrofit project), DSOD requires confirmation of the PMF spillway capacity using updated methods. The previous PMF study for Calero Dam was completed in 1981 using Hydrometeorological Report (HMR) 36 whereas current studies use HMR 59. The updated PMF inflow to Calero Reservoir following the HMR 59 protocols produces a maximum still water surface elevation of 493.6 feet NAVD88 (490.8 feet NGVD29), which results in approximately 0.8 feet of potential overtopping over the entire length of both the main and auxiliary dams. DSOD requires passage of the PMF with no less than 1.5 feet of residual freeboard (DSOD, 2012). Under existing conditions, this requirement is not met.

2.4 Outlet Works

The original Calero Dam outlet works, constructed in 1935, consisted of a concrete intake structure and a straight, 481-foot-long, 36-inch-diameter, concrete-encased steel pipe under the Main dam which discharged to a stilling basin at Calero Creek, located at the downstream left toe of the dam. In 1982 the outlet works were modified and connected directly to the Almaden Valley Pipeline with a new turnout extending to Calero Creek, approximately 650 feet downstream of the dam. Key findings from the recent assessment of the Calero outlet works are summarized below:

1. No conditions were observed during the inspections that would require immediate repair for continued operational service over the next few years while the seismic retrofit project is being planned and implemented.
2. The hydraulic capacity of the existing outlet is judged satisfactory to meet DSOD emergency release criteria. Additional capacity would be required under a future 30-foot embankment raise.
3. Visual dive and ROV inspection and limited non-destructive (UT) testing of the conduit interior show the existing outlet conduit is unlined and has experienced

moderate to severe corrosion over the last 79 years that has reduced the computed hydraulic capacity and is causing significant wall thinning of the steel outlet pipe and appurtenances. No out-of-round deformation or other visual structural distress was observed during the inspections. Two small pinhole leaks near the upstream intake may be indicative of exterior corrosion that could have resulted from cracking of the exterior concrete encasement.

4. Inlet and outlet control facilities, while currently serviceable, will require full replacement if the existing outlet conduit is rehabilitated or replaced.

2.5 Calero Main Dam Seepage

Seepage has occurred at Calero Main Dam since shortly after construction and first reservoir filling in 1937 (Nelson, 2007). Seepage has been observed on the downstream right abutment, the downstream right groin, and the downstream face of the dam when the reservoir level is high. Remedial measures to reduce the seepage, including multiple grouting programs have been attempted with little success.

2.6 Fellows Dike

A geotechnical investigation conducted on Fellows Dike in 2001 (GEI, 2001) found that the dike would require extensive improvement to bring the facility up to DSOD minimum standards before it could be certified to impound water. Specifically, dike rehabilitation was required for the following reasons:

1. Potentially Liquefiable Soils: The dike foundation adjacent to Calero Creek contains several pockets of potentially liquefiable soils that may liquefy under heavy earthquake shaking.
2. Slope Erosion and Stability: The dike's water-side slope facing the reservoir and the creek has severely eroded in many areas presumably due to wave action and creek flows. Several areas of dike's side slopes are steeper than 2 horizontal to 1 vertical (2.0H:1.0V) and do not meet current safety standard.
3. Vegetation: The dike is covered with dense vegetation consisting of brush, shrubs, and mature trees preventing proper inspection and maintenance.

2.7 Potential Changes to Project Objectives

New investigations as documented in the Problem Definition Report (GEI, 2014a) confirmed the adequacy of project objectives. No changes to the project objectives were recommended in the report.

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3.0 Alternatives Analysis

3.1 Overview

Based on the issues identified and documented in the Problem Definition Report, and District and DSOD requirements, the seismic retrofit of Calero Dam included development and evaluation of alternatives for the following three primary project components:

- 1) Embankment seismic stabilization;
- 2) Safe passage of the PMF, and;
- 3) Outlet works replacement.

Each of these three primary components could be achieved with multiple options which in turn are strongly influenced by the water level in the reservoir during construction. In addition to these primary components, the project also includes consideration of improvements for handling the seepage at the main dam, and mitigation of the Fellows Dike safety issues.

The District requirements include the potential for a future Calero Reservoir enlargement with a raise of the main dam by up to 30 feet. For such an enlargement, it is noted that the auxiliary dam will require modification and new saddle dams constructed. The main dam stabilization, PMF passage and outlet works replacement options should accommodate, or avoid precluding, a potential future enlargement without major removal/reconstruction of the planned work.

Additional discussion of the technical considerations for formulation of the components and alternatives is presented in the Alternatives Report (GEI, 2015a).

3.2 Conceptual Alternatives Formulation

3.2.1 Primary Project Component Options

The options for the embankment seismic stabilization component were combined with required PMF passage and outlet works replacement components into overall project conceptual alternatives for conceptual-level screening. The following options (for each component) were considered in the initial formulation of alternatives.

Embankment stabilization - As identified in the SSE1B report (URS 2012b) the options for seismic stabilization of the main dam included the following:

- 1) Remove and replace downstream foundation and embankment.
- 2) Partial downstream foundation and embankment removal and full height buttress.
- 3) Partial height downstream rockfill buttress.
- 4) Insitu embankment and foundation treatment with Deep Soil Mixing (DSM).
- 5) Insitu foundation treatment with jet grout and downstream berm.

Safe PMF passage of the PMF with adequate freeboard – The options included the following:

- 1) Raising main and auxiliary dam by 7 feet to provide adequate containment and sufficient freeboard without modifying the spillway crest.

- 2) Raising main and auxiliary dam by 5 feet and widening the spillway crest to approximately 127 feet (150% of current width).
- 3) Lower the spillway crest by approximately 7 feet to provide adequate flood containment, and install an operable spillway crest gate that would be seasonally operated to maintain existing storage.

Outlet works modifications - Based on the outlet works condition assessment and the need to modify Calero Main Dam for seismic stability, the outlet works improvement alternatives judged most practical included a new replacement outlet works and abandonment of the existing outlet works. The replacement outlet works were configured to accommodate the planned seismic retrofit and current District operational and maintenance requirements, and the potential for a future enlargement of Calero Reservoir. The new replacement outlet works facilities should be located outside the footprint of the modified dam embankment, and incorporate appropriate air venting, man-ways and other operational improvements (e.g. multi-level intake, alternate actuators) deemed necessary by the District for improved reliability, operations and maintenance.

The options included three outlet works locations and alignments including:

- 1) A new tunneled outlet through the right abutment.
- 2) A new tunneled outlet through the left abutment.
- 3) A new tunneled outlet through the right ridge near spillway.

The two intake structure types including:

- 1) A sloping intake situated on the reservoir slope.
- 2) A vertical shaft situated on the rim of the reservoir with horizontal micro-tunneled intakes allowing construction into an active reservoir (i.e. wet-tap).

3.2.2 Reservoir Drawdown Considerations

Three reservoir drawdown levels during construction are summarized as follows:

- 1) Limited Drawdown – Temporary construction water level maintained no higher than the current DSOD restricted elevation (467.4 feet NAVD88), for a construction water depth of approximately 71 feet above the intake (invert elevation 395.7 feet NAVD88).
- 2) Major Drawdown – Temporary construction water level maintained no higher than elevation 440 feet NAVD88, for a construction water depth of approximately 44 feet above the intake invert. This provides up to approximately 1,000 acre-feet of water storage. (~10% of capacity and the minimum fish pool specified in the District's Board Policy. A tall cofferdam (e.g. cellular sheet pile) is likely feasible for marine construction which would allow a sloping intake and outlet tunnel to be constructed "in the dry". A micro-tunneled wet tap into an active reservoir may also be feasible without a cofferdam.
- 3) Full Drawdown – Temporary construction water level maintained no higher than elevation 410 feet NAVD88, for a construction water depth of approximately 14 feet above the intake invert. This provides no water storage in the reservoir during construction. A short cofferdam (e.g. earth or braced sheet pile) would be required for temporary diversion to provide limited protection of the sloping intake and outlet tunnel construction. The sloping intake and outlet tunnel would be constructed in the dry, using conventional methods.

3.2.3 Other Required Components

Calero Dam seepage improvements - The 2011 Potential Failure Mode Analysis (PFMA) Workshop, did not identify seepage as a postulated potential failure mode (Geosyntec, 2012a) for Calero Main Dam. It was recommended that an improved seepage collection and monitoring system be installed. Preliminary design considerations for an improved seepage collection and monitoring system are included in the Staff-Recommended Alternatives.

Fellows Dike rehabilitation The District's staff-recommended project (SCVWD, 2010) is to breach the dike, and remove the dike from DSOD jurisdiction. Prior to breaching the dike, the Bailey Ranch historic structures would be removed.

3.2.4 Conceptual Alternatives Considered

The initial formulation of alternatives resulted in over 100 possible pre-conceptual component combinations that could be considered. To focus on a realistic subset of conceptual alternatives (approximately 15), pre-conceptual screening was completed through consideration of the component feasibility given expected project needs and constraints, and also the compatibility/feasibility of one component with another component, or with the assumed amount of temporary reservoir drawdown during construction.

Key conclusions from the pre-conceptual screening included:

- 1) Limited temporary reservoir drawdown during construction (maintaining the reservoir at the DSOD restricted level of elevation 467.4 feet) is infeasible as a significant cofferdam (over 80 feet high) would be required if the preferred sloping intake is to be considered, and any excavation of the dam foundation and toe necessary for a number of the embankment stabilization options would not be possible due to assurance of dam safety risks during construction.
- 2) Major temporary reservoir drawdown during construction is possible (elevation 440 feet or lower), but with tradeoffs on the type of intake constructed.
- 3) Full temporary reservoir drawdown during construction provides the most flexibility for retrofit options.
- 4) High quality rockfill for use in a downstream rockfill buttress is likely not readily available on site, based on the preliminary Borrow Screening Study (GEI, 2014a), and would require import from offsite commercial sources.

Based on the prescreening, 15 conceptual alternatives were identified for evaluation and are listed in **Table 3-1** below.

Table 3-1: Calero Dam Conceptual Alternatives

No.	Embankment Retrofit	PMF Passage ¹	Outlet Location and Type	Construction Drawdown ²
1-1	Downstream Removal/Replacement	Dam Crest Raise	Left Abutment Sloping Intake	Full
1-2	Downstream Removal/Replacement	Dam Crest Raise	Right Abutment Sloping Intake	Full
1-3	Downstream Removal/Replacement	Dam Crest Raise	Right Ridge Sloping Intake	Full
1-4	Downstream Removal/Replacement,	Dam Crest Raise Spillway Widening	Right Ridge Sloping Intake	Full
2-1	Partial Downstream Removal/Replacement with Buttress	Crest Gate Spillway	Left Abutment Sloping Intake	Major
2-2	Partial Downstream Removal/Replacement with Buttress	Crest Gate Spillway	Right Abutment Sloping Intake	Major
2-3	Partial Downstream Removal/Replacement with Buttress	Crest Gate Spillway	Right Ridge Microtunneled	Major
2-4	Partial Downstream Removal/Replacement with Buttress	Dam Crest Raise	Right Ridge Sloping Intake	Major
2a-1	Partial Downstream Removal/Replacement with Buttress	Dam Crest Raise	Left Abutment Sloping Intake	Full
2a-2	Partial Downstream Removal/Replacement with Buttress	Dam Crest Raise Spillway Widening	Left Abutment Sloping Intake	Full
2a-3	Partial Downstream Removal/Replacement with Buttress	Crest Gate Spillway	Left Abutment Sloping Intake	Full
3a-1	Partial Height Buttress with Rockfill	Crest Gate Spillway	Left Abutment Microtunneled	Major
4a-1	Insitu Treatment with DSM	Crest Gate Spillway	Left Abutment Microtunneled	Major
4a-2	Insitu Treatment with DSM	Dam Crest Raise	Left Abutment Sloping Intake	Major
5a-1	Insitu Treatment with Jet Grout and Buttress	Crest Gate Spillway	Left Abutment Sloping Intake	Major

- 1) PMF Passage: Dam crest raise - 7 foot raise of main and auxiliary dams
Dam crest raise with spillway widening – 5 foot raise of main and auxiliary dams
- 2) Construction Drawdown: Full - elev. 410, 0 acre-feet storage;
Major, elev. 440, 1,000 acre-feet storage

All 15 conceptual alternatives included common components: seepage collection and monitoring improvements at the main dam; provisions to accommodate the potential Calero Dam enlargement; and breaching of Fellows Dike. All alternatives also assume the existing outlet works is abandoned by grouting.

3.2.5 Evaluation and Scoring Criteria

The screening framework for evaluation of conceptual alternatives was formulated as a simple decision tree matrix with four major goals and with each goal having two to four key objectives. Relative weights were assigned to each goal and to each objective. The individual goal weights sum to 100%. The four major goals (with relative weights) for the Calero Dam alternatives included:

- Minimize Adverse Environmental Impacts (20%)

- Maximize Operational Effectiveness (20%)
- Minimize Overall Project Costs (30%)
- Maximize Project Implementability (30%)

Within each goal are a number of identified objectives that would be attained to varying degrees, depending on the configuration and performance of each alternative. Within each goal, the assigned objective weights must also sum to 100%. District staff were consulted and provided input to the relative weights for both the goals and objectives. The decision matrix with goals and objectives, and relative weighting percentages is shown in **Table 3-2**. The goals and objectives were measured based on the specific considerations noted.

Table 3-2: Calero Dam Screening Framework

GOALS	Goal WT %	OBJECTIVES	Objective WT%	CONSIDERATIONS
Minimize Adverse Environmental Impacts	20%	Minimize Adverse Impacts to Sensitive Biological Resources	35%	Habitat Sensitivity (HCP)
				Work Windows - Migratory Species
				Other T&E Species
		Minimize Adverse Water Resource Impacts	30%	Instream Flows
				Water Quality
		Minimize Community Impacts	35%	Construction Traffic
				Fugitive Dust
				Noise Impacts
				Visual Impacts
				Recreation
				Cultural and Archaeological Resources
Maximize Operational Effectiveness	20%	Safety & Security	40%	Operational Reliability/Dam Safety
				Security
		Water System Operations	35%	Water Supply Reliability
				Ease of Operations
				Flexibility for Enlargement
		Sustainability	25%	Long Service Life
				Ease of Maintenance
Minimize Overall Project Costs	30%	Implementation Costs	70%	Construction Cost
				Indirect Costs
		Life Cycle (O&M) Costs	30%	O&M & Replacement Costs
				Lost Benefits
Maximize Project Implementability	30%	Regulatory Approvals	30%	DSOD Approvals
				Environmental Permits
				Land Acquisition
		Risk Management/Claims Potential	20%	Environmental Risks
				Delay Potential
				Supply Interruption Risks
		Completion Schedule	20%	Construction Claims Potential
				Construction Duration
		Constructability	30%	Completion Date
				Borrow, Staging and Spoil Areas
				Construction QA Verification
				Temporary Facility Requirements
				Difficulty of Construction

3.2.6 Conceptual Alternatives Evaluation and Scoring Results

Each of the 15 conceptual alternatives were evaluated by assessing the key components and features, key assumptions needed for project implementation, design and construction feasibility considerations, and the advantages and disadvantages of the alternative. Drawings were developed at a conceptual level to identify key work items and quantities and identify approximate project footprint. Expected construction duration was estimated to the nearest 6-months based on a conceptual-level understanding of the work required, key construction constraints, and using professional judgment from similar projects. Construction costs (AACE Class 5) were estimated based on the conceptual-level layouts of key features and estimated quantities for major work items where there were differences among alternatives (earthwork, tunnel/pipe lengths, etc.), with unit prices and lump sum allowances based on similar projects and judgment.

The conceptual alternative were then screened and comparatively evaluated in a workshop using a discussion/consensus process, with the workshop participants comprised of District subject-matter experts with appropriate perspectives to cover the relevant goals and objectives. Key conclusions from conceptual-level screening are summarized in the following points:

- 1) Embankment Retrofit should focus on Alternative 1 (remove/replace), Alternative 2 (partial remove/replace plus buttress), and Alternative 4 (deep soil mixing). Alternative 3 (rockfill buttress) and Alternative 5 (jet grout soil improvement with buttress) should be eliminated because rockfill (Alternative 3) is not available on site and jet grout (Alternative 5) is not considered practical due to low performance reliability (implementation and verification challenges) and difficulty in dam safety permitting (approval) by DSOD.
- 2) Outlet Works Replacement should focus on locating the features in the left abutment and providing a sloping intake type structure. The left abutment proves a simpler tie-in with the existing Almaden Valley Pipeline and the Calero valve yard and avoids construction in an identified wetlands area downstream of the dam.
- 3) An accessible sloping intake structure based on District requirements is preferred. A microtunneled wet-tap should be eliminated unless the District requires maintaining over 1,000 acre-feet of storage during construction.
- 4) PMF Passage should further consider both a dam crest raise (Main and Auxiliary Dams) and an operable spillway crest gate. For the dam crest raise alternatives, a slightly longer spillway crest may be feasible and could reduce the height of the crest raise; this could be evaluated as a refinement during final design and after DSOD has approved the PMF study and final freeboard requirement, but does not need to be further evaluated at the feasibility stage.
- 5) Reservoir Lowering for Construction should be further evaluated (full lowering versus major lowering) due to the higher costs and complexities of construction in an active reservoir. Full lowering provides the most options and lowest risk for construction.

Based on the results of the conceptual alternatives screening, five conceptual alternatives were recommended for further consideration as feasible alternatives.

3.3 Feasible Alternatives Evaluation

3.3.1 Alternatives Carried Forward

The Calero Dam recommended feasible alternatives are summarized in **Table 3-3**. These five alternatives provide flexibility for different embankment retrofit approaches (three options), focus on the preferred left abutment location for the replacement intake, allow for two options for increased spillway capacity, and provide an accessible sloping intake structure that fully meets District operational requirements. As noted in the **Table 3-3**, two of the alternatives would require a large cellular cofferdam to preserve 1,000 acre-feet of reservoir storage during construction, while three of the alternatives require full draining of the reservoir with a small earthen cofferdam to protect the in-reservoir work areas during the construction season.

Table 3-3: Calero Dam Recommended Feasible Alternatives

No.	Embankment Retrofit	PMF Passage	Outlet Location and Type	Construction Drawdown
1-1	Downstream Removal/Replacement	Dam Crest Raise	Left Abutment Sloping Intake	Full
2-1	Partial Downstream Removal/Replacement with Buttress	Crest Gate Spillway	Left Abutment Sloping Intake	Major
2a-1	Partial Downstream Removal/Replacement with Buttress	Dam Crest Raise	Left Abutment Sloping Intake	Full
2a-3	Partial Downstream Removal/Replacement with Buttress	Crest Gate Spillway	Left Abutment Sloping Intake	Full
4a-2	Insitu Treatment with DSM	Dam Crest Raise	Left Abutment Sloping Intake	Major

3.3.2 Design Refinements, Baseline Cost and Schedule Estimates

The five feasible alternatives were further developed from the conceptual level to an approximate 10-percent level of project definition to better define project configuration and footprint, construction considerations including sequence and schedule, and further refine costs. The key feasibility level design refinements are summarized below:

- 1) Embankment Modification Configurations: More refined cross sections and layout of embankment modifications were developed to understand required limits, quantities, and construction sequence for foundation excavation/partial dam degrade, construction of filter drains, embankment placement, Deep Soil Mixing (DSM), and extension/restoration of concrete panels at the upstream face of the Main and Auxiliary Dams.
- 2) Sloping Intake: The design of the intake was revised from the sloping intake type used at the District's Lenihan Reservoir (hydraulically actuated sluice gates with non-submerged access) to the concept used at the San Francisco Public Utilities Commission's (SFPUC) San Antonio Reservoir (electrically actuated valves inside a sloping intake structure that provides dry access for maintenance). Also, the required excavation for placement of the intake structure and connection with the new tunneled outlet conduit was better defined.
- 3) Tunnel Alignment and Profile: The preliminary tunnel alignment through the left abutment was refined to include straight tangents rather than long bends, and tunnel portal location and excavation requirements were also identified.

- 4) Downstream Pipe Connections: The location of the downstream access structure and the general layout of downstream piping connections to the existing AVP were better refined.
- 5) Dam Crest Raise: The footprint and section for raising the crest of the Main and Auxiliary Dams for alternatives that include a dam crest raise to contain the PMF were better refined. The likely need for a backwater control gate to be installed on the Almaden-Calero Canal near the crest of the Main Dam was identified; the gate would be required to prevent unintended spills through the canal during extreme flood events.
- 6) Spillway Modifications: The configuration and estimated quantities for either replacement of the existing ogee crest, or installation of an operable crest gate were more accurately defined. Crest gates were recognized to be unfavorable to DSOD. Options were researched for use of a hydraulically actuated crest gate rather than a pneumatically actuated as the hydraulically actuated gate would more likely be accepted by DSOD,
- 7) Borrow, Stockpile, and Disposal: Initial findings of Borrow Screening study were incorporated in layout of potential borrow and disposal sites, and nature and volume of borrow materials available for embankment construction.
- 8) Haul Routes and Staging: Potential haul routes and staging areas were preliminarily identified for construction considering location and layout of key facility construction areas, reservoir drawdown, and borrow/stockpile/disposal locations.
- 9) Quantities: The expected quantities for construction were refined based on the refined facility layouts, including conservative estimates of the “use percentage” of identified borrow/stockpile/disposal areas to estimate the likely environmental impact footprint for construction. These use percentages conservatively assume removing all the dam and foundation soils in the Alternative 1 and 2 options, stockpiling of material, and then reusing the material once the entire footprint is excavated to a suitable foundation. This amounts to “double handling” of all excavated material to be removed and replaced in the dam embankment; whereas a contractor’s construction sequence might “roll-over” this material to reduce the amount and footprint of required stockpiles for excavated or imported material.
- 10) Construction Sequence, Schedule, and Other Considerations: A potential sequence and preliminary schedule for construction were developed and special considerations were identified that could increase construction risk, constrain acceptance, or extend the project schedule.
- 11) Construction Cost Estimate: The cost estimates were refined to AACE Cost Class 4 to reflect an approximate 10% level of project definition based on the updated configuration and quantities of each alternative. It is noted that these cost opinions are for alternative comparison and not for project budgeting or approval as they do not include all project implementation costs.

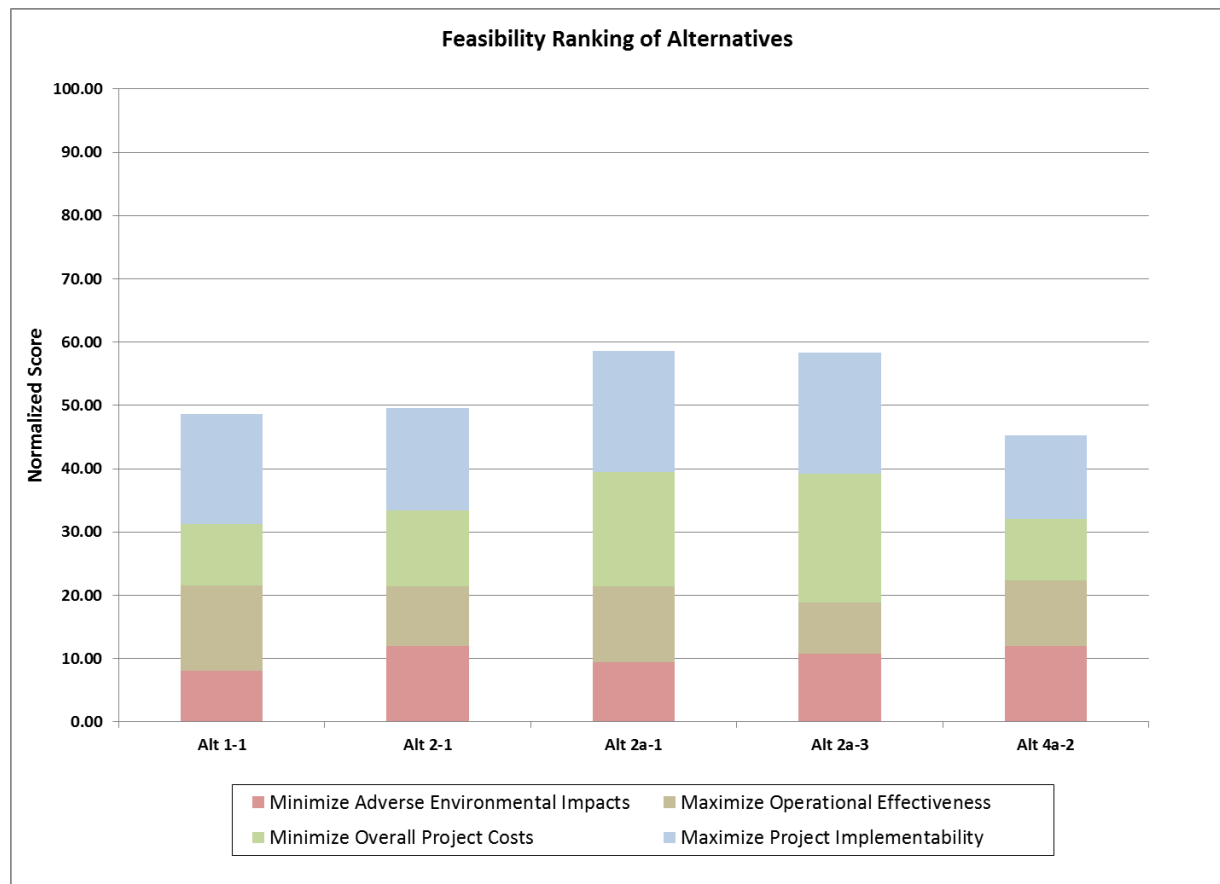
3.3.3 Feasible Alternatives Evaluation

The five feasible alternatives were screened using the same screening framework and workshop scoring process used in prior conceptual-level screening (see Section 3.2). **Table 3-4** presents a summary of the scores for each alternative, with results shown graphically in **Figure 3-1**. It is noted that these scores are relative, and for comparison purposes only.

Table 3-4: Summary Scores for Calero Dam Feasible Alternatives

NORMALIZED SCORES	Alt 1-1	Alt 2-1	Alt 2a-1	Alt 2a-3	Alt 4a-2
Minimize Adverse Environmental Impacts	8.00	12.00	9.40	10.80	12.00
Maximize Operational Effectiveness	13.60	9.40	12.00	8.00	10.40
Minimize Overall Project Costs	9.60	12.00	18.00	20.40	9.60
Maximize Project Implementability	17.40	16.20	19.20	19.20	13.20
Total	48.60	49.60	58.60	58.40	45.20

Figure 3-1: Graphical Relative Scoring of Calero Dam Feasible Alternatives



Key conclusions from feasibility-level screening are summarized as follows:

- 1) Alternatives 2a-1 and 2a-3 are the top-ranked alternatives and score similarly. Both involve Partial Removal of the Downstream Embankment and Foundation Alluvium with a Full Height Buttress and a Sloping Intake on the Left Abutment constructed with Full Drawdown of the Reservoir. The difference between these alternatives is how the PMF Passage is implemented. Alternative 2a-1 utilizes a Dam Crest Raise while Alternative 2a-3 utilizes an operable Spillway Crest Gate.
- 2) Alternative 2a-3 provides a slightly better cost and environmental profile, but the negative operational tradeoffs associated with an operable Spillway Crest Gate offset the slightly larger embankment (i.e., more Main Dam and Auxiliary Dam

- embankment fill) and the need to modify the Auxiliary Dam in Alternative 2a-1 to incorporate the Dam Crest Raise.
- 3) Alternative 2a-1 is preferred assuming the District can obtain right of way at the toe of the Auxiliary Dam as needed for a Dam Crest Raise.
 - 4) The reservoir should be completely dewatered to reduce the risk and complexities of the intake/outlet and seismic retrofit construction.

Based on the feasibility-level screening, Alternative 2a-1 is the Staff-Recommended Alternative for further design refinement and future consideration by the District Board. This alternative is discussed in further detail in Section 4.

4.0 Recommended Project

4.1 Staff-Recommended Alternative Description Overview

The Staff-Recommended Alternative 2a-1 includes the following elements:

- Partial removal of the downstream embankment of the main dam to remove liquefiable alluvium below the downstream shell;
- Rebuilding of the downstream portion of the dam with an internal filter and drain system and a downstream buttress;
- Raising the crests of the Main Dam and the Auxiliary Dam up to 7 feet to contain and pass the updated probable maximum flood (PMF) through the spillway;
- A new ogee crest at the existing spillway;
- A new sloping, multi-level intake on the left abutment;
- A new tunneled outlet works with fully accessible conduits that connect to the existing Almaden Valley Pipeline;
- Abandonment of the existing outlet works by backfilling/sealing with grout, and;
- Relocation and/or demolition of existing historical structures and subsequent breaching of Fellows Dike.

Figure 4-1 presents an overview of the Calero facilities that will be modified by construction of Alternative 2a-1, including callouts of key project features. Preliminary design drawings for the Staff-Recommended Alternative are included for reference in **Appendix C**. A more detailed description of the preliminary design considerations for Alternative 2a-1 is provided in the following sections.

4.2 Staff-Recommended Alternative Refinements

Further development of the Staff-Recommended Alternative includes:

- 1) **Borrow Material:** The results from recent subsurface explorations and lab testing were considered in refinement of borrow quality and processing requirements, and associated quantity and cost estimates. A summary of the borrow studies is included in Section 4.7.
- 2) **Construction Flood Hydrology:** The 2-yr, 10-yr and 100-yr floods were evaluated to support evaluation of diversion, cofferdam, and temporary embankment stability risks during construction, and to support refinement of the construction schedule and costs.
- 3) **Embankment Stability:** The temporary construction stability was analyzed for the partially excavated embankment, and preliminary analyses were also completed for the long term static (at normal pool) and seismic stability of the dam with the full-height buttress and crest raise.
- 4) **Embankment Details:** Additional cross sections and details of the embankment retrofit were developed, including filter, drain, and seepage collection and monitoring improvements.
- 5) **Almaden-Calero Canal:** Requirements for the re-route/bypass of the new proposed Calero intake structure were identified. Consideration was also given to the

configuration of a control gate at the Almaden-Calero Canal at the approximate dam centerline that may be needed to prevent uncontrolled reservoir outflow along the canal during an extreme flood event due to the dam crest raise.

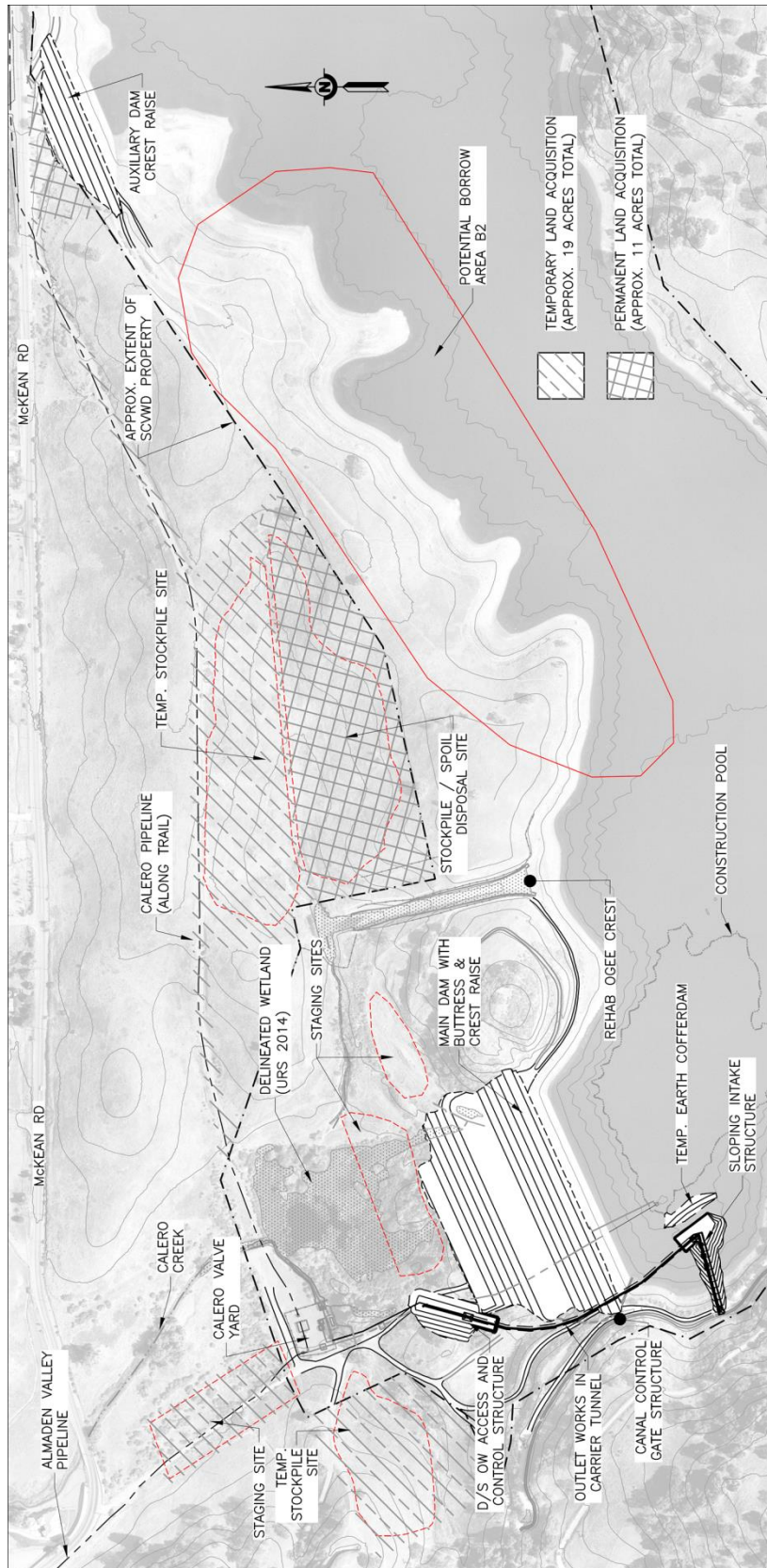
- 6) Outlet Works Downstream Vault and Connections: More detailed layouts were developed for the downstream control vault, valving and piping connections to the existing Almaden Valley Pipeline and Calero Valve Yard stream release piping.
- 7) Outlet Works Intake Structure: More detailed layouts were also developed for the control building and other operational features at the intake structure.
- 8) Preliminary Right of Way Requirements: Preliminary delineations were made of approximate limits for proposed land acquisition (either in fee or by easement) necessary for construction of the Auxiliary Dam Modifications, borrow/disposal areas, and temporary staging areas and haul routes.
- 9) Fellows Dike Breach: More detailed layout of the structure removal and breach at Fellows Dike was developed, including the disposal location of excavated material from the breach.

4.2.1 Potential Future Expansion of Calero Reservoir

Previous studies by the District have determined that up to a 30-foot high dam raise is feasible for future expansion of Calero Reservoir. The following considerations were made in refining the Staff-Recommended Alternative:

- Select buttress and drainage configurations within the main dam that can accommodate future extension or raising;
- Size the outlet conduit with adequate DSOD emergency release capacity for future reservoir capacity enlargement;
- Select an outlet works intake structure concept that can be raised in the future (e.g. ability to extend sloping intake uphill or raise shaft vertically);
- Locate the outlet works control valves beyond the downstream toe of a future larger dam;
- Consider a spillway crest structure that can be modified/raised in the future;
- Locate access roads or other key features away from future dam enlargement footprint, and;
- Consider a downstream raise of the Auxiliary Dam for the 7 foot crest raise. Future reservoir enlargement may require more extensive rebuilding of the entire Auxiliary Dam.

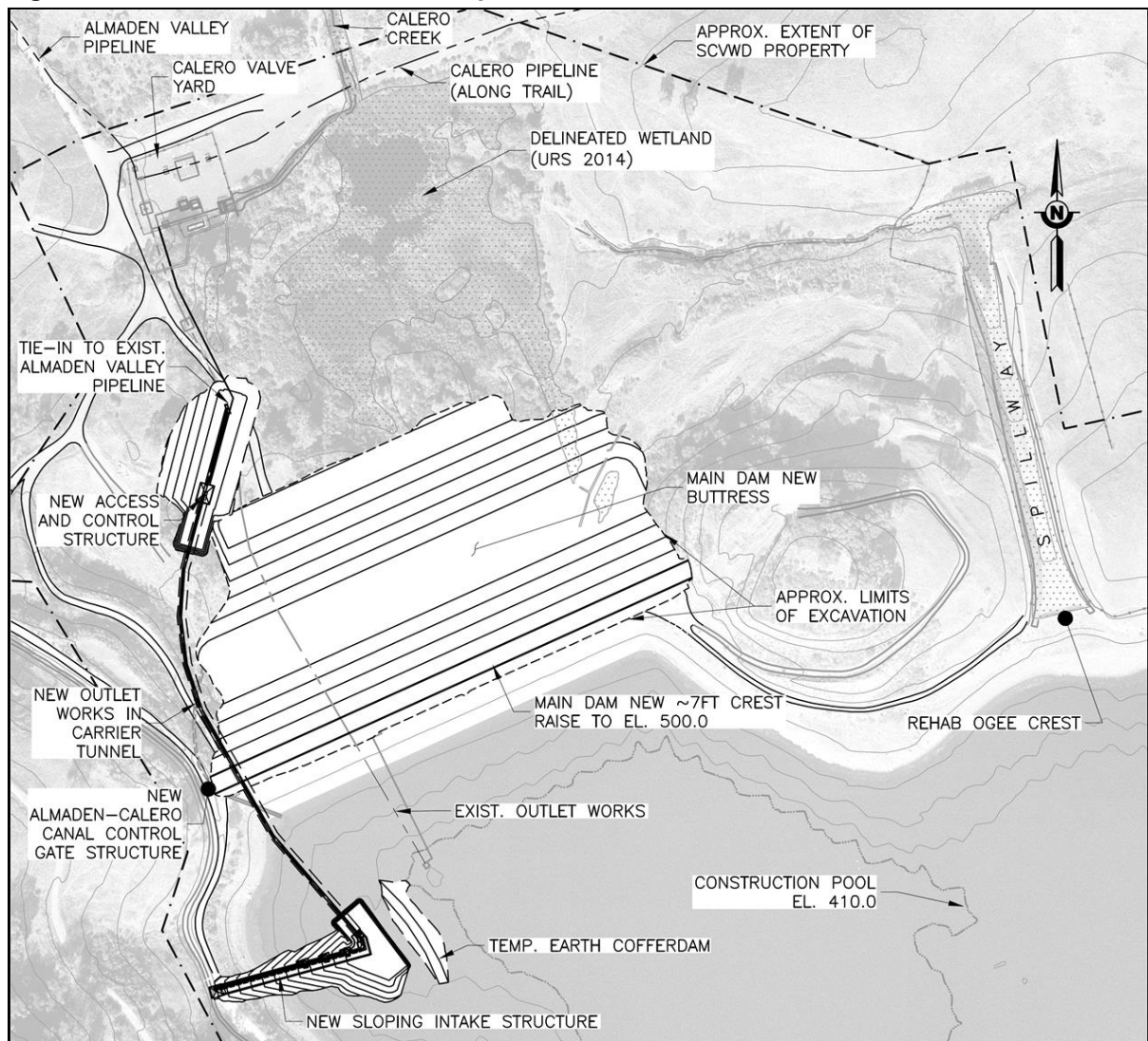
Figure 4-1: Overview of Calero Facilities with Alternative 2a-1 Modifications



4.3 Embankment Design

Alternative 2a-1 involves the removal of a portion of the downstream embankment; the excavation of alluvium beneath the removed embankment and in the valley downstream of the toe; the construction of a chimney and blanket drain; the reconstruction of the dam with a raised and widened crest; and an earth fill buttress to approximately 60% of the height of the dam, as shown in plan view in **Figure 4-2** and schematically in **Figure 4-3**. The intent of Alternative 2a-1 is to excavate and replace liquefaction-prone alluvium from underneath the downstream slope, reconstruct the dam, and construct a downstream compacted earthfill buttress that improves the overall seismic stability of the rebuilt embankment. The preliminary design of the outlet works access tunnel for the Calero Dam seismic retrofit was modeled after the outlet works at the District's Lenihan Dam.

Figure 4-2: Plan View of Main Dam Improvements

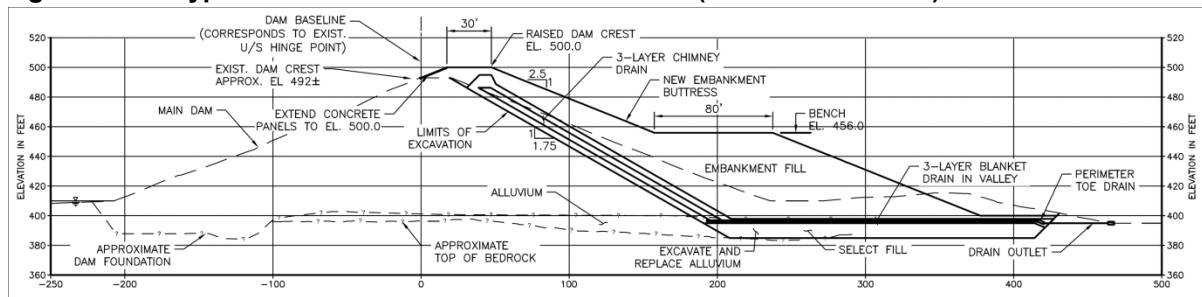


The downstream slope of the Main Dam would be excavated to bedrock for about 50 feet upstream from the current toe, and the excavation of alluvium would extend downstream about 160 feet beyond the existing toe. The inclination of the excavation would be about

1.75H:1.0V through the existing embankment, starting at about elevation 487 feet on the downstream face. The widened and raised dam and buttress would be constructed with well-compacted earth fill and would have a slope of 2.5H:1.0V, the same as the existing slope, with a bench at about El. 456. The new buttress would extend about 130 feet beyond the existing downstream toe.

The Staff-Recommended Alternative also includes the construction of a full-height filter and chimney drain for controlling the phreatic surface within the embankment and providing a seepage drainage path for reducing the potential for through-seepage. The full height chimney drain would be located between the existing embankment material and the new buttress materials (see **Figure 4-3**) and a blanket drain would be located along the buttress foundation. The chimney drain would extend up to the spillway crest elevation and be zoned with graded filter and drain material. Seepage from the chimney and blanket drains would be collected at a toe drain. The blanket drain would extend up the abutments beneath the footprint of the new buttress zone to collect seepage.

Figure 4-3: Typical Cross Section of Alternative 2a-1 (Maximum Section)



The reservoir would be fully dewatered during construction to approximately elevation 410. Excavation of the downstream foundation soils may require temporarily lowering of the groundwater table through localized dewatering measures. The earth fill material would be sourced from the existing embankment excavation and augmented by on-site borrow areas. The filter and drain materials would need to be imported from offsite sources.

The Borrow and Spoil Siting Suitability Screening Study (GEI, 2014a) indicated that suitable material similar in engineering properties to the existing embankment can be found in adequate quantities on site along the north rim of the reservoir between the spillway and the auxiliary dam (see **Figure 1-2**).

The concerns regarding embankment and abutment seepage, as mentioned in Section 2.5, will be largely addressed through the incorporation of the filter and drain system mentioned above. The buttress embankment footprint is expected to encompass historically observed and mapped seepage expressions, and therefore seepage will be directed into the internal drainage system rather than exiting on the downstream face or abutment slope. The limits of excavation, foundation preparation, and filter and drain placement would have to be confirmed during final design and construction.

Initial considerations for separation and measurement of seepage through the right abutment include an interceptor drain along the right abutment and a separate outfall and measurement location. If the dam were raised in the future, it is possible that seepage through the right abutment could increase. As a contingency, the District may consider an

upstream seepage reduction blanket to help control flow into the seepage collection system as part of the retrofit design project.

4.4 Preliminary Design for Containment and Passage of the PMF

For the Staff-Recommended Alternative, passage of PMF would be accomplished by means of a 7-foot dam crest raise at both the main and auxiliary dam. This would require some temporary crest degrading during construction for adequate incorporation of new embankment fill. The main dam raise is shown in **Figures 4-2 and 4-3**. The auxiliary dam modifications are shown in **Figures 4-4 and 4-5**. The 7-foot raise is based on conservative assumptions of a minimum 1.5 feet of freeboard required by DSOD plus 3.7 feet for wind-wave setup and runup for a total of 5.2 feet of freeboard above the PMF level. The total amount of freeboard above the spillway crest would be approximately 13 feet. The freeboard requirement would have to be approved by DSOD prior to final design.

Figure 4-4: Plan View of Auxiliary Dam Improvements

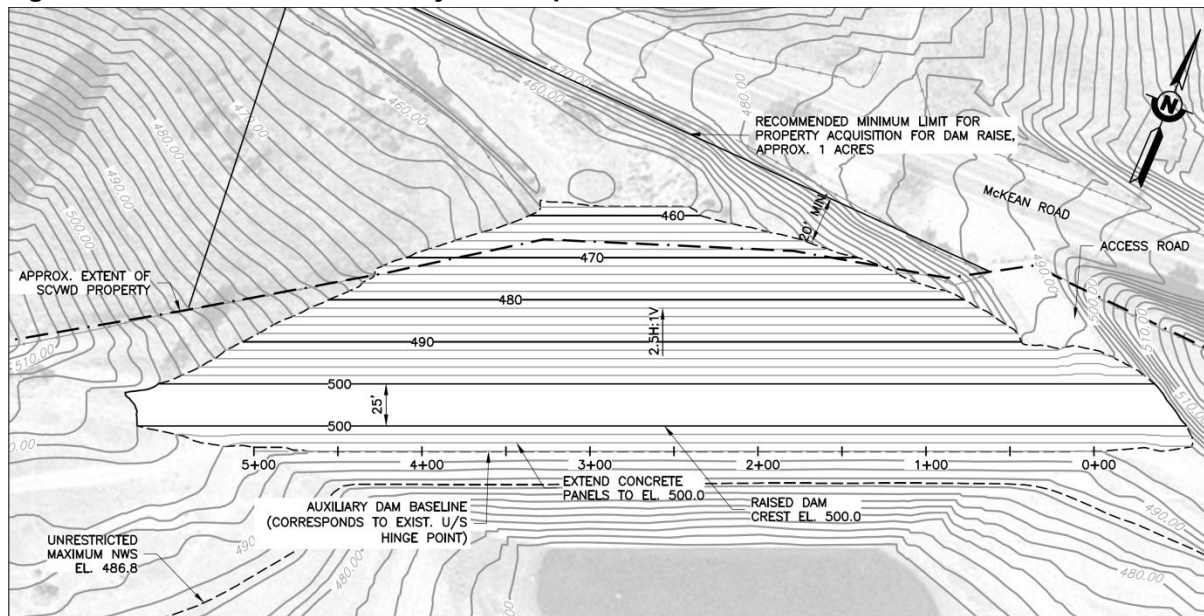
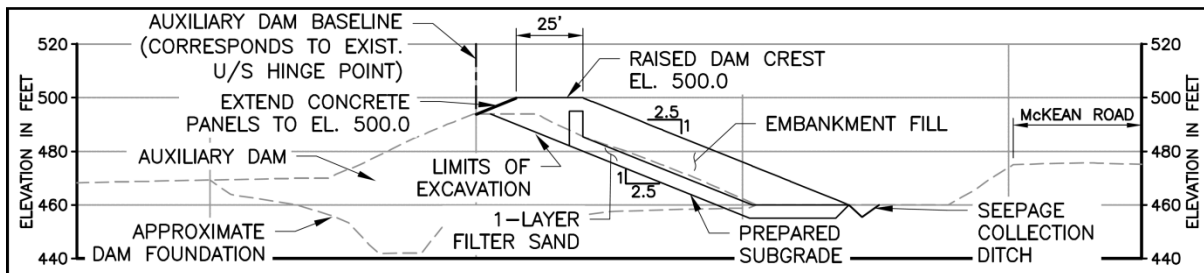


Figure 4-5: Typical Cross Section of Raised Auxiliary Dam (Maximum Section)

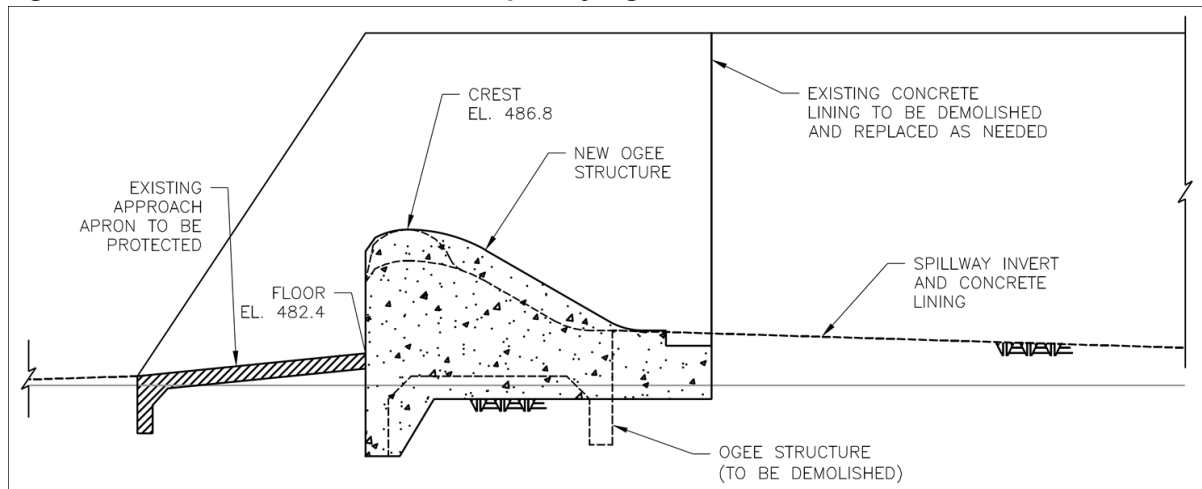


In addition to the dam crest raise at both dams, the existing spillway concrete control section would be demolished and rebuilt with a new ogee structure as shown in **Figure 4-6**.

Other final design considerations for containment and passage of the PMF should include hydraulic analysis of the spillway chute based on the new or rebuilt spillway ogee crest,

containment of the flow within the chute, as well as evaluation of drainage/erosion concerns in the channel that conveys spillway discharges back to Calero Creek.

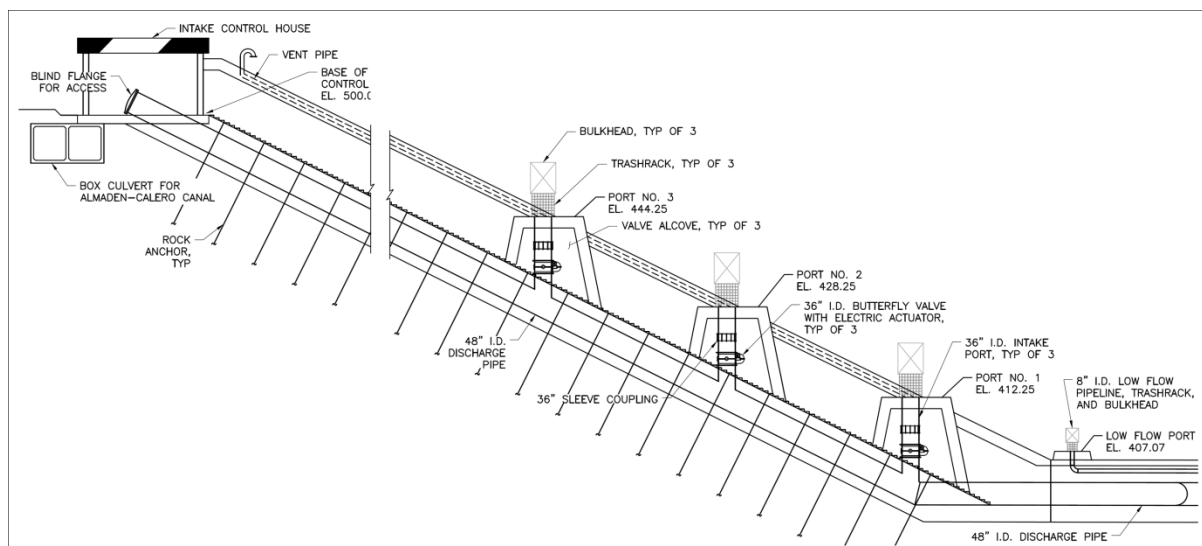
Figure 4-6: Cross Section of Rebuilt Spillway Ogee Crest



4.5 Outlet Works Design for Operations and Emergency Drawdown

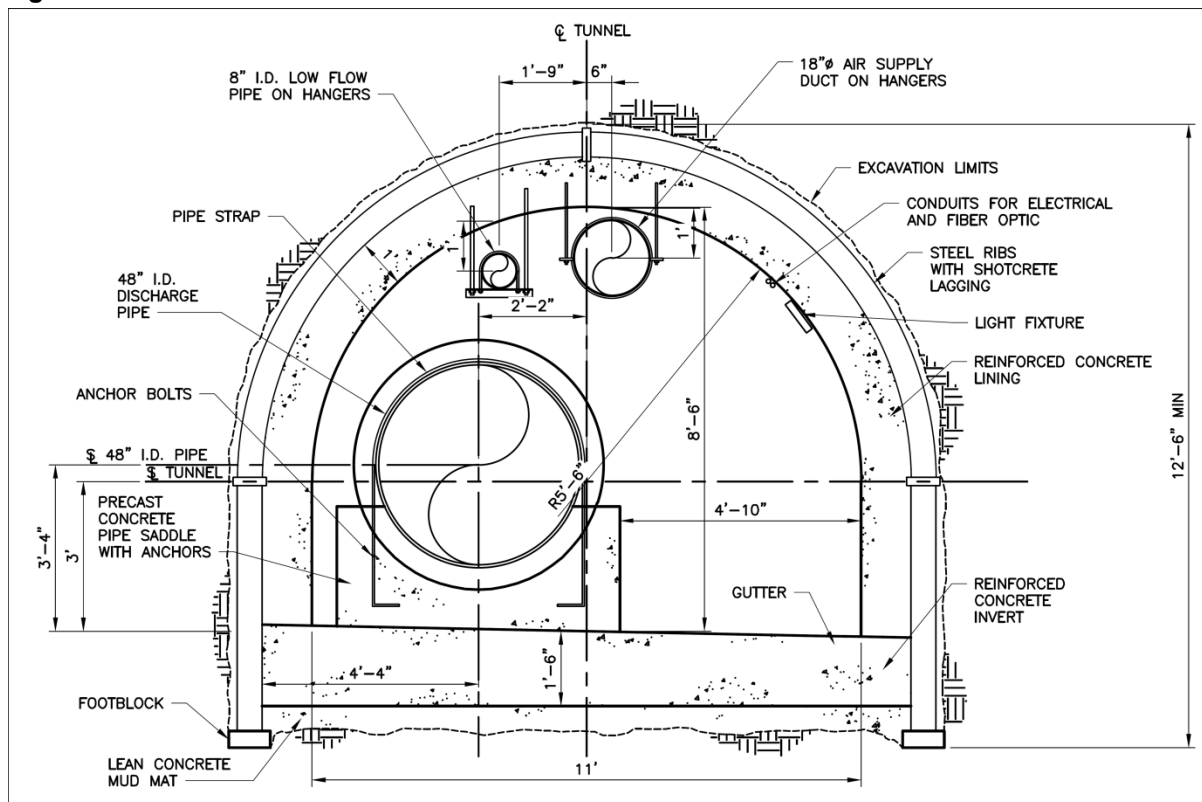
The Staff-Recommended Alternative includes a new outlet works constructed through the left abutment consisting of a sloping intake structure, an access tunnel with the main and low-flow outlet conduits, and an access and control structure at the downstream connection to the Almaden Valley Pipeline. **Figure 4-7** shows a profile view along the new sloping intake along the left abutment. **Figure 4-8** shows a cross-section view of the new access tunnel, including the 8-inch low flow conduit and 48-inch discharge pipe. Geotechnical investigations during final design will be necessary to confirm the location and alignment of the new outlet works access tunnel. In addition, the hillside stability in the vicinity of the sloping intake structure must also be confirmed during final design.

Figure 4-7: Profile of Sloping Intake Structure



An earthen cofferdam would be required to isolate the construction area for the sloping intake and left abutment tunnel. For planning purposes, it has been assumed that the cofferdam will be an earthfill structure with a sheet pile cutoff wall and crest elevation at El. 420 feet. It should be noted that this configuration assumes full reservoir drawdown (See Appendix D in Calero Alternatives Report for SCVWD Memo). The preliminary construction schedule assumes that this site would be winterized each year, due to potential expected inflows exceeding the capacity of any reasonably sized cofferdam. It is assumed that minimum streamflow releases would be made by the District using the Calero bypass pipeline, and that the existing outlet works would be available for use by the construction contractor for diversion of natural streamflow/runoff through the worksite. Once the new outlet works are completed, tested, and accepted by DSOD, the existing outlet works would be properly abandoned by grouting.

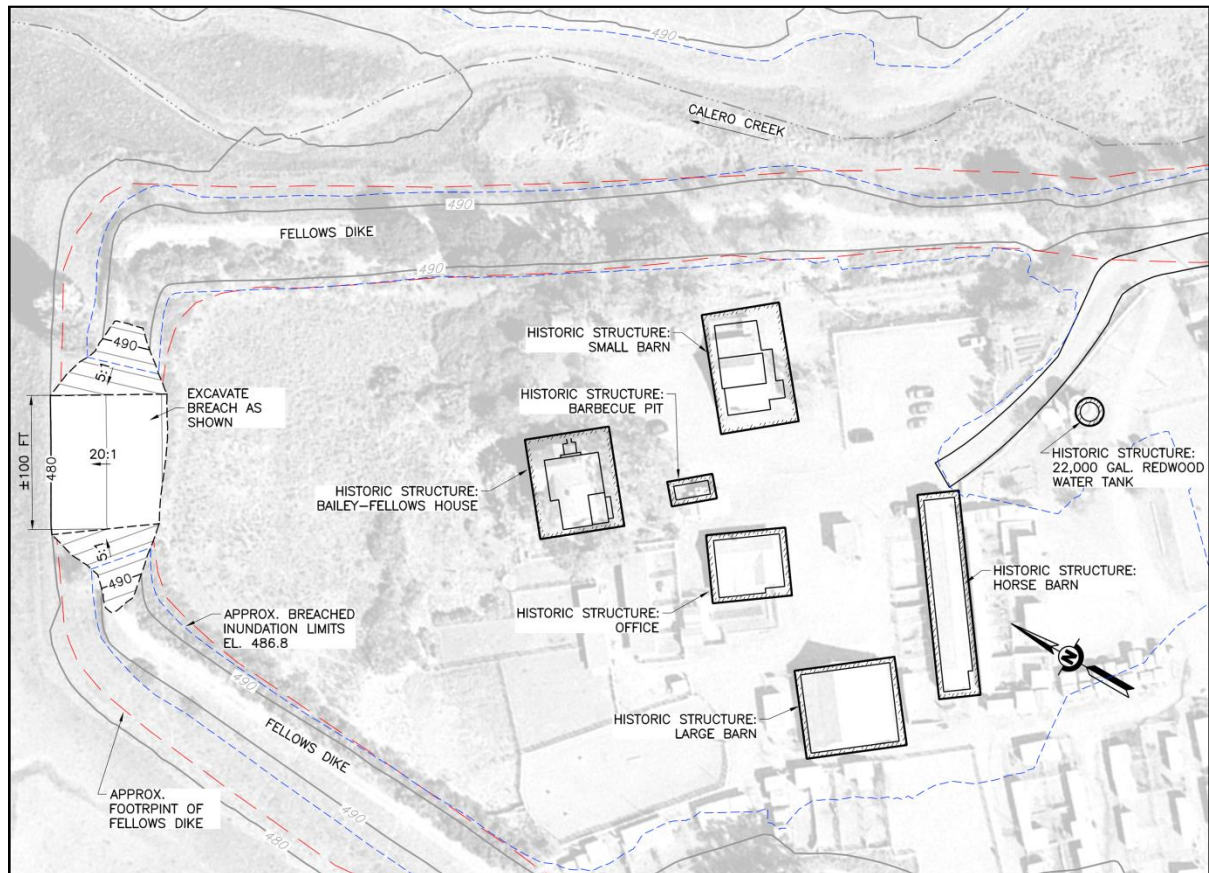
Figure 4-8: Access Tunnel and Outlet Conduit Cross Section



4.6 Preliminary Design for Fellows Dike Breach

Geotechnical investigation on Fellows Dike in 2001 (GEI, 2001) determined that the dike would require extensive improvement to bring the facility up to DSOD minimum standards before it could be certified to impound water. In 2010 the District determined that the relocation of the Bailey Ranch historic structures and breaching of Fellows Dike is the preferred course of action. **Figure 4-9** provides a preliminary design overview of the anticipated breach of Fellows Dike. Existing historic structures at this location would either be relocated outside the reservoir limits, or alternatively documented and demolished, as determined by the District during final design and permitting.

Figure 4-9: Plan View of Fellows Dike Breach and Remaining Historical Structures (to be demolished or relocated)



As indicated in **Figure 4-9**, Fellows Dike would be breached along its northern-most edge. For planning purposes, it has been assumed that the breach would be excavated from the Fellows Dike crest (approximately El. 498 feet) down to El. 480 feet for a width of roughly 100 feet, with excavation surfaces being sloped back at 5.0H:1.0V. The breach would result in approximately 2,600 CY of excavated material which would be placed along the interior of the western dike embankment. Alternatively, the breach spoil materials could be placed on the exterior of the dike to stem erosion. Also depicted are the projected inundation limits following the breach of Fellows Dike. These inundation limits are based on the unrestricted normal maximum water surface of El. 486.8 feet.

4.7 Earthwork and On Site Borrow Evaluation

The Staff-Recommended Alternative would result in a retrofitted embankment volume of approximately 390,000 cubic yards (CY). Earthwork quantities associated with this alternative would include approximately 230,000 CY of material from the excavation of the existing embankment and foundation, 75,000 CY of imported filter and drain material, 200,000 CY of material reused from the embankment and foundation excavation, and approximately 90,000 CY of material from on-site borrow sources. The assumption is that about 85 to 90% of the embankment and foundation excavation would be reused as embankment fill (i.e. unsuitable material is about 10 to 15% of the excavation volume).

There are no on-site sources of suitable filter and drain materials available from on-site borrow areas; this material will need to be imported. Approximately 50,000 CY of spoil material would be generated from embankment foundation excavation and outlet tunneling operations that would require disposal in approved spoil areas.

A screening study of preferred borrow, spoils disposal, and stockpile sites (areas) was conducted during the planning study. The following is a summary of the studies and selected sites.

- Based on field and laboratory data, Borrow Area B-2 (shown in **Figure 4-1**) appears to have suitable buttress materials for the Staff-Recommended Alternative. The Franciscan rock materials in Borrow Area B-2 (greywacke sandstone, mélange, and silicified mudstone) could be ripped and processed and would meet the strength requirements for buttress fill. However, there is a large degree of variability in block sizes, strength, and hardness in the Franciscan materials that would require further field investigation and evaluation during final design.
- Borrow Area B-2 is located adjacent to and within the rim of the reservoir, which would result in less disturbance of surrounding lands and grassland habitat. There would also be less visual impacts to surrounding areas.
- Borrow Area B-2 meets the volumetric yield requirements for embankment fill that would be required for the Staff-Recommended Alternative buttress configuration.
- Borrow Area B-2 is within close proximity to the dam site, and allows for development of reasonable ingress and egress haul routes around the perimeter of the site.
- Borrow Area B-2 is located far enough outside of the main work area for Staff-Recommended Alternative where potential impacts to work activities along the right abutment could be minimized. Excavations from Borrow Site B-2 would yield more suitable material, and have fewer disturbances to the right abutment area of the existing dam than Borrow Site B-1.
- Spoils Disposal Site SD-2 was selected for the Staff-Recommended Alternative, because it is located much closer to the dam than Site SD-4, despite the fact that it is located on County Parkland property downstream of the reservoir.
- Spoils Disposal Site SD-4 was screened for additional exploration under an original assumption that spoils material could be disposed behind the existing Fellow Dike embankment. However, the original dike breach option was retained as part of the Staff-Recommended Alternative precluding SD-4 as a viable spoils disposal site.
- Stockpile Site SS-1 was selected for consideration due to sensitive environmental habitat in close proximity of the dam, including wetland habitat associated with Calero Pond. Stockpile Site SS-1 shares a contiguous footprint with Spoils Disposal Site SD-2. Stockpile Site SS-2 was added as an alternative site, given the close proximity of this site to the toe of the existing dam and site access routes, and its hillside location outside of sensitive drainage areas.

4.8 Right of Way Needs

Construction work is anticipated to extend outside District property limits in some areas. **Figure 4-1** illustrates the areas identified for temporary and permanent land acquisition to complete the Staff-Recommended Alternative. Also delineated are areas identified for temporary borrow, stockpile, and staging, as well as permanent spoils disposal sites,

potential haul routes, and key temporary facilities such as an earth cofferdam and temporary bridge over Calero Creek.

For planning purposes, it has been estimated that approximately 19 acres of temporary land acquisition and 11 acres of permanent land acquisition (30 acres total) would be required to complete the retrofit. This estimate includes approximately one acre of permanent land acquisition for the Calero Auxiliary Dam where the retrofitted footprint associated with the 7-foot downstream crest raise would extend slightly outside District property along McKean Road. Right of way acquisition costs were excluded from the project cost estimates for the Staff-Recommended Alternative.

4.9 Environmental Impacts

Environmental impacts will be assessed in future studies and covered under the California Environmental Quality Act (CEQA). The District would serve as lead agency for CEQA compliance and the project would be evaluated in an Environmental Impact Report (EIR). The EIR would address the environmental impact of the Staff-Recommended-Alternative. A key feature of the CEQA process is the opportunity for the public to review and provide input on the project.

Environmental studies and permitting to support the CEQA process will take place concurrently with final design. Key environmental impacts to be considered during the process include, but are not limited to, protection of cultural resources, protection of biological resources, mitigation of hazardous materials, and protection of recreational usage. The CEQA process would also incorporate proactive community outreach to manage public expectations regarding changes in recreational uses as well as temporary impacts such as traffic, dust, and noise during the dam retrofit project construction.

4.10 Environmental Mitigation

Compliance with the Federal and State Endangered Species Acts would be conducted through the 2013 Santa Clara Valley Habitat Plan (VHP) process. The United States Fish and Wildlife Service and California Department of Fish and Wildlife have ceded regulatory authority under these laws to the VHP Implementing Agency in the expectation that the VHP will both simplify and shorten the regulatory process and provide for improved resource protection. The VHP covers the “take” of 18 federal and state listed species, and imposes a fee menu for mitigation of impacts to those species and to sensitive natural communities. The VHP provides coverage for special-status wildlife and plants impacted by dam seismic retrofit projects, including the Calero and Guadalupe Dams Seismic Retrofits Project. The VHP also provides coverage for borrow sites and dewatering associated with project construction.

4.11 Public Outreach

The results of the planning study will be disseminated into the community through the Calero-Guadalupe Dams Seismic Retrofits Project Community Engagement Action Plan. This living document has been created and maintained by the District, and included plans to inform the community through various media including a web-page, public meetings,

mailers, and display materials at community venues. Efforts to inform the public are ongoing and expected to continue through project completion.

4.12 Design and Permitting Issues

In preparation of the Planning Study Report, the configuration, schedule, and cost estimate for the Staff-Recommended Alternative have been refined to approximately the 15-20% level of design development. The Staff-Recommended Alternative is provided in the Preliminary Design Drawings included in **Appendix B**.

During the alternatives evaluation, several project components have been identified as either: a) areas for future design refinement, or b) additional project improvements that may be included as part of the project, but are not covered in the currently defined project requirements:

- 1) Borrow Material: The engineering properties and compaction requirements for borrow from the identified site(s) must be confirmed during final design with additional geotechnical investigation and laboratory testing. The extent of borrow development, quantities necessary to complete the retrofit, and construction considerations (i.e. rippability, material processing requirements, etc.) of selected borrow sources must also be further developed and confirmed during final design and permitting.
- 2) Freeboard, Spillway Crest Length and Dam Crest Refinement: The 7-foot dam crest raise may be decreased by 2 to 3 feet assuming a) reduction in current 5.2 feet flood freeboard requirement (3.7 feet waves plus 1.5 feet DSOD minimum) to 3.7 feet, and b) combined with some nominal lengthening of the spillway crest length. Based on recent feedback in a meeting on October 22, 2014, DSOD indicated they would be receptive to such refinement provided the total freeboard over the spillway crest was at least 10 feet, and the lengthen spillway crest did not show hydraulic convergence/wave issues in the chute.
- 3) Almaden-Calero Canal Control Gate: Final design can more fully consider the need for a canal control gate to prevent uncontrolled reservoir outflow based on: a) possible reductions in PMF water surface if the spillway crest length is widened nominally under item 2 above; b) more detailed evaluation of canal operations and spill potential near the canal during storm events, and c) further discussion with DSOD.
- 4) Fellows Dike Historic Structures Removal: The project definition will be modified to explore documentation/demolition of historic structures as an alternative to relocation.
- 5) Upstream Seepage Blanket: Because the reservoir would be fully lowered for construction, District staff has suggested that it may be beneficial to construct an upstream blanket on the right abutment slope to reduce seepage. The type and extent, costs, O&M requirements and potential benefits of such a blanket require additional consideration during final design.
- 6) Downstream Pond and Channel Improvements: The origins of the pond adjacent to the Calero Valve Yard and the linkage to water sources including dam seepage, natural groundwater, dam outlet and spillway discharges are currently being studied. The District has also identified some drainage/flooding concerns of its facilities at the toe of the dam and drainage/erosion concerns in the channel that conveys spillway discharges back to Calero Creek. Once the District determines if and how they want

to address these items, they could be addressed as part of final design and permitting of the Calero Dam Retrofit Project.

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5.0 Construction Costs and Schedule

5.1 Preliminary Cost Estimates

A comparative (construction) cost for the Staff-Recommended Alternative has been estimated at approximately \$56.2 million in 2015 dollars (1st quarter 2015). The comparative cost estimate was generated in accordance with guidelines established by the Association for Advancement of Cost Engineering (AACE) as a Class 3 estimate which is assumed to include the actual installed cost within the range of -20 to +30 percent. Assumptions made in developing the construction costs included a 20% cost for unlisted items and a 20% Class 3 contingency.

Table 5-1 summarizes the estimated project costs.

Table 5-1: Estimated Project Costs

Project Element	Amount
Main Dam Seismic Retrofit and Crest Raise	\$14,300,000
Spillway Improvements for PMF and Auxiliary Dam Raise	\$2,300,000
Outlet Works Replacement and Abandonment of Existing Outlet Conduit	\$12,300,000
Other Site Work	\$5,000,000
Miscellaneous Uncosted Items @ 20%	\$6,800,000
General Conditions, Bonds & Insurance	\$6,100,000
Direct Construction Subtotal (DCS)	\$46,800,000
Class 3 Contingency (20%)	\$9,400,000
Estimated Construction Cost	\$56,200,000
Design Engineering and CM Allowance (25% of DCS + Contingency)	\$14,000,000
Total Estimate (2015 dollars)	\$70,200,000

This is not the overall actual estimated project cost. Costs for right of way acquisition, replacement water supply, District administration and legal fees, planning/environmental studies and permitting, habitat restoration/mitigation costs, and relocation of historic structures are not included in the \$70,200,000 estimate.

Assuming the midpoint of construction would be in 2019, estimated escalation from 2015 would be \$5,600,000 making a projected project cost in 2019 dollars of \$75,800,000.

5.2 Construction Schedule

Based on preliminary schedule estimates, and assuming the reservoir is fully drained for construction, the seismic and other retrofit improvements at Calero Dam could be constructed over approximately 32 to 36 months. Assuming construction begins in March 2018 as forecast by the District, construction would be completed by late 2020.

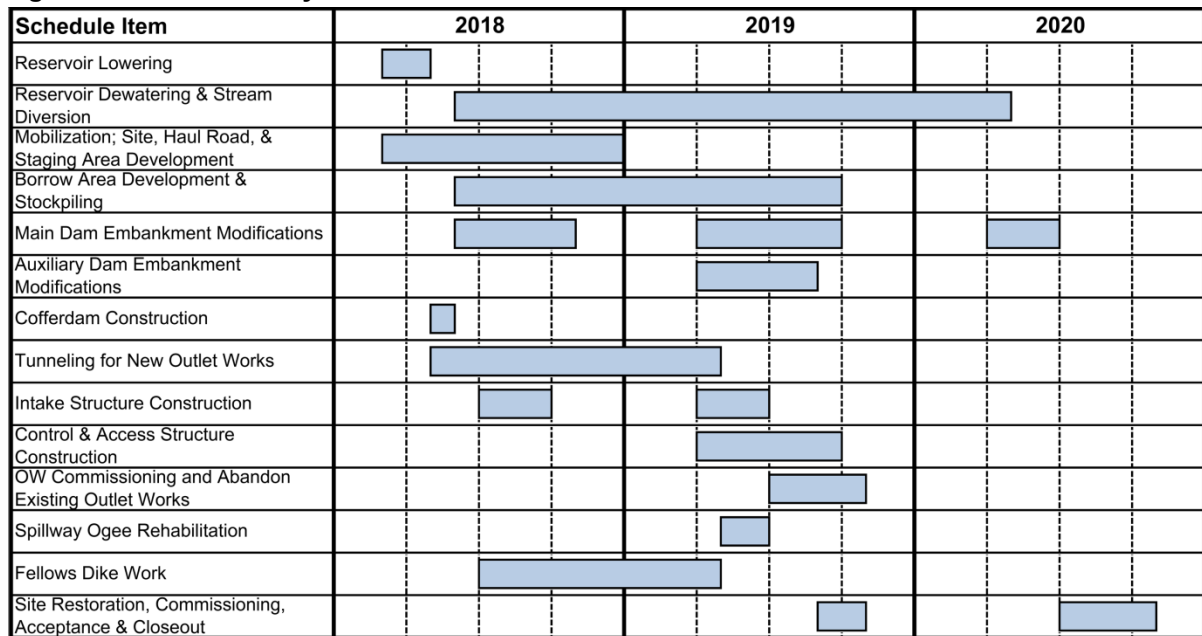
In general, construction of the Staff-Recommended Alternative would span at least two full construction seasons, with some work over the intervening winters, plus a portion of a third construction season. Key sequence assumptions made in preparing the construction schedule for the Staff-Recommended Alternative are as follows:

- As indicated by the District, the construction contract notice to proceed (NTP) would be issued by March 1, 2018 to allow a full construction season starting in April 2018.
- Reservoir lowering by the District would occur in March-April 2018 allowing access for the temporary cofferdam for sloping intake construction to occur by the end of May 2018.
- Dam earthwork would occur from April through October 2018 and 2019, with a shutdown of major earthwork during the winter rainy season. (Constructability review may indicate it is preferable to a contractor to delay start of major earthwork on the Main Dam until the second construction season, early 2019, without delaying the completion schedule.)
- The new outlet works would be constructed continuously from May 2018 through August 2019, with work occurring over the intervening winter, and completion required before abandoning the existing outlet works.
- The existing outlet works would be abandoned in late summer 2019, with completion required before completing downstream dam embankment work in fall 2019.
- Final dam crest work, upstream concrete panel construction, and instrumentation would occur in the 2020 construction season after substantial project completion.
- Fellows Dike structure removal and/or relocation and breach would occur in 2018 or 2019.

This schedule would allow refilling of Calero Reservoir beginning in September 2020 after substantial completion of the overall project. It may, however, be possible to begin a partial refilling in late 2019 after completion of the outlet works and major dam earthwork, subject to the approval of DSOD.

The generalized schedule discussed above is also presented graphically in **Figure 5-1**.

Figure 5-1: Preliminary Construction Schedule for SRA



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Appendix A

Table A-1: Calero Dam Pertinent Data (Modified from Calero Main and Auxiliary Dam Supporting Technical Information Document (STID), Appendix D, Pertinent Data Table; Geosyntec, 2012b)

Location	Santa Clara County, 12 miles south of downtown San Jose
Dam No.	CA 72-003, National ID. No. CA00288
Latitude/ Longitude	Calero Main Dam: 37°10'59.7"N, 121°47'32.4"W Calero Auxiliary Dam: 37°11'15.5"N, 121°46'49. 3"W
Stream/River	Calero Creek
Project Function	Storage for conservation, groundwater recharge and flood control. Backup storage of imported water supplies.
Datum	District has converted to NAVD 1988 which is 2.8 feet higher than NGVD 1929 at this location. Original construction documents were based on local datum that has been estimated to be 2.89 feet lower than NAVD 1988.
Drainage Area	7.1 sq. miles
Reservoir Capacity	9934 acre-feet (note 1)
Reservoir Area	337 acres at NHWL El. 483.9 ft (El. 486.8 ft NAVD88)(note 2)
Dam Type	Main Dam: Compacted earthfill with upstream concrete face Auxiliary Dam: Compacted earthfill with upstream concrete face
Height	Main Dam: 90 ft Auxiliary Dam: 40 ft
Dam Crest Length/Width	Main Dam: 840 ft long, 20 ft wide Auxiliary Dam: 510 ft long, 25 ft wide
Dam Crest Elev.	Main and Auxiliary Dams: Design El. 490 ft (El. 492.9 ft NAVD88); current surveyed minimum elevation El. 489.3 (El. 492.2 NAVD88)
Spillway Crest Elev.	El. 483.9 (El. 486.8 NAVD88) (note 3)
Reservoir Elev.	El. 483.9 (El. 486.8 NAVD88) (NHWL DSOD certificate); Restricted to El. 469.3 ft (El. 472.2 NAVD88), ~ 20 feet of freeboard As of October 13, 2011, restriction was changed to El. 464.5 ft (El. 467.4 NAVD88), ~ 25 feet freeboard

Outlet Type/Capacity	Low-level outlet: • Capacity 280 cfs • Inlet: 42-inch hydraulically operated slide gate valve • 36-inch steel outlet pipe in concrete jacket. Invert El. 392.1 (El. 394.9 NAVD88). 481 ft long • 30-inch butterfly valve located in valve vault at the dam toe, which is used solely for isolation of the pipeline downstream of outlet pipe. Invert 389.5 ft (392.4 NAVD88) • Typically operated with valve in the Calero valve yard.
Slopes	Main Dam: • Upstream and Downstream : 2.5 H:1 V Auxiliary Dam: • Upstream: 2.5 H:1 V • Downstream: 2.5 H:1 V, upper 7 ft 1.8H to 1V
Hazard Classification	DSOD Total Class Weight 30 High Consequence on DSOD Consequence-Hazard Matrix Treated as extreme consequence for SSE1B study
Original Construction	1935
Modifications	1962: Dam crest and spillway crest raised 1966: Piezometers installed 1972: Piezometers installed 1977: Piezometers installed 1981: Outlet works modified and connected to the Almaden Valley pipeline. 1991: Grout curtain installed 2006/07: 26 vibrating wire piezometers and 2 inclinometers installed as part of DIP 2010: 5 Vibrating wire piezometers installed

Notes:

- 1) There are different estimates of reservoir capacity, ranging from 9934 acre-feet (SCVWD website) to 10,410 acre-feet (DSP, 2005).
- 2) From DSOD Bulletin 17. 2005 DSP indicates reservoir surface area 347 acres at full pool.
- 3) From Bulletin 17. 2005 DSP indicates spillway crest at 483.5 ft. However, DSP may be in error. DSOD certificate indicate raised (sacked concrete) spillway weir at 483.9 (NGVD29)

Appendix B

Calero Dam Seismic Retrofit Project Requirements

FINAL DRAFT Project Requirements CALERO DAM

PROJECT # 91084020 - CALERO AND GUADALUPE DAMS SEISMIC RETROFIT PROJECT - CALERO DAM

District Project Manager: Bal Ganjoo

Planning Consultant: GEI Inc.

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			Planning	Design					
GENERAL									
1	All facilities associated with the Project, outlet works, spillway, and their appurtenances shall have a useful life of at least 50 years without requiring major repairs.	Project Requirements Workshop (Internal) on 9/11/13	X	X	A specific life line standard is not referenced. However, it is common engineering and planning practice to assume major infrastructure will remain in service 100-years or more. Specific materials and designs of specific major components (i.e. outlet pipes) should be designed to remain in service for at least 50 - years without major rehabilitation or replacement. Pertinent USACE design manuals and other industry standards are recommended for estimating major feature service life. Refer to USACE ER 1110-2-8159 for typical major infrastructure design life requirements.				
2	Comply with all DSOD safety requirements/guidelines, and use engineering judgment consistent with the state-of-the-practice.	Project Requirements Workshop (Internal) on 9/11/13	X	X					
3	Construction of the Project shall be substantially complete by June 2019.	Project Requirements Workshop (Internal) on 9/11/13	X	X	DSOD letter dated 3/23/2012				
4	Seismic Performance. The project shall be designed such that after MCE loading, the project will not suffer catastrophic failure (such as breach of the dam) and all features necessary to ensure dam safety will remain operational (such as the ability to quickly lower the reservoir).	Project Requirements Workshop (Internal) on 9/11/13	X	X	Seismic performance for ancillary facilities, access roads, and instrumentation and controls systems will be addressed as part of design. Consideration will be given to distinguishing performance for both an operating basis earthquake (OBE) and the MCE.				
5	The District has the following post-MCE service level requirements that shall be incorporated to the extent practical within the retrofit project area (a) Ancillary structures housing valves or other mechanical/electrical equipment shall not fail during the Maximum Credible Earthquake (MCE) and any resulting structural damage shall not prohibit access for inspection and/or operation of mechanical and electrical systems, (b) Access roads to the dam embankment and appurtenances shall remain accessible by standard passenger vehicles for inspection and readily repairable by dozer or grader to facilitate repairs following the MCE, (c) instrumentation and surveillance monitoring equipment for the dam embankment and appurtenances shall remain operational immediately following the MCE, including communication links to District headquarters, and (d) Power and SCADA controls required to operate the intake, outlet works, spillway gates (if applicable), and other appurtenances shall not be disrupted following the maximum credible earthquake.	Project Requirements Discussion February 18, 2014	X	X	There are portions of this requirement they may not be possible to guarantee. The planners and designers should identify specific issues, as they are encountered to agree upon a path forward.				
6	An independent source of back-up power should be incorporated into the Project. This may be propane generators , UPS or other suitable power source.	Project Requirements Workshop (Internal) on 9/11/13		X	Provisions for back-up power to be addressed by the design consultant.				
7	For planning include cost estimates for replacement of all blockhouses. Design should include the evaluation and design of replacement blockhouses, as necessary.	Project Requirements Workshop (Internal) on 9/11/13	X	X					

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District Project Manager: Bal Ganjoo									
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8	Storage of boring log (geotechnical investigation) sample for geotechnical investigation; obtain District's warehouse's confirmation for approximately one year storage after construction is complete.	Project Requirements Workshop (Internal) on 9/11/13	X	X					
TECHNICAL - EMBANKMENT									
1A	The embankment requirements for the project will require discussion and agreement with DSOD. Requirements noted below may require modification as the project continues.	Project Requirements discussion 2.18.14	X	X	Black & Veatch: Suggest keeping samples throughout construction + some amount of time				
1	The dam embankment shall have sufficient freeboard to safely pass the PMF without overtopping, and to meet DSOD freeboard requirements.	PMC - per PC comments on previous revisions	X	X	Parapet walls to meet freeboard are not anticipated to meet DSOD requirements				
2	Embankment shall have adequate stability, and any deformation post MCE shall not pose a dam safety risk and shall be readily repairable.	PMC - per PC comments on Revision 2	X	X					
3	Embankment seepage shall be safely controlled using filters, drains, cutoffs and/or other methods. USBR and/or other industry standards should be used in design.	PMC - per PC comments on Revision 2	X	X					
4	If borrow is required by the project alternative, designs should make use of on-site borrow sources if possible.	PMC - per PC comments on Revision 2	X	X					
5	Modifications to the project shall consider the possibility of future raising of the dam by about 30 feet, and planning shall incorporate this consideration in the design of new features.	PMC - per H.Desai comments on Revision 2	X	X	Specific design considerations for a future dam raise include: locating outlet works, intake structures, and other major features outside of an enlarged embankment foot print, specifying strengths and compaction requirements of new fill such that the new fills could likely be incorporated in new raises, and consideration of potential earth loads of a new dam on new underground features, and sizing outlet pipes to handle additional reservoir head.				
TECHNICAL - OUTLET WORKS									
1	The new outlet works shall meet the DSOD emergency drawdown criteria. For reservoirs that impound over 5,000 acre-feet of water, the outlet system should be capable of lowering the maximum storage depth by 10 percent within 7 days and draining its full contents within 90 days.	Project Requirements Workshop (Internal) on 9/11/13	X	X					
2	The new outlet intake shall be compatible with a potential future dam raise of 30 feet, as well as the existing dam height.	Project Requirements Workshop (Internal) on 9/11/13	X	X					

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			Planning	Design					
3	The new outlet works shall be capable of providing flow releases to Calero Creek in accordance with current operations.	Project Requirements Workshop (Internal) on 9/11/13	X	X					
4	The outlet works shall remain fully operable and accessible following the Maximum Credible Earthquake (MCE). For the outlet works damage to the existing conduit is acceptable only to the point where it does not compromise flow carrying capacity of the system commensurate with DSOD emergency drawdown criteria or normal operations that provide for flows to Calero Creek. Further, the outlet works must remain accessible for repairs that allow the system to remain fully operational.	Project Requirements Workshop (Internal) on 9/11/13	X	X					
5	Any modifications to the intake structure shall consider sedimentation and operations and maintenance in selection of the intake port elevation(s).	Project Requirements Workshop (Internal) on 9/11/13		X	Verify with Jae Abel in regards to reservoir temperature requirements, if any. Design consultant will be responsible for refining intake elevations based on sedimentation, temperature, or other factors.				
6	If necessary, the existing outlet conduit, intake, and the outlet structures should be abandoned as per DSOD requirements	Project Requirements Workshop (Internal) on 9/11/13		X					
7	If a new outlet is planned, it is preferred by the district to be a carrier pipe in an oversized tunnel, to facilitate inspection and maintenance	Project Requirements Discussion 2/18/14	X	X					
8	Evaluate the replacement of the hydraulic lines, such that they are not in contact with water.	Project Requirements Workshop (Internal) on 9/11/13		X					
9	Perform inspection of outlet pipe. This will assist in determining to construct a new outlet or to continue to use existing outlet and connect to new intake.	Project Requirements Workshop (Internal) on 9/11/13	X						
10	If new outlet tunnel option is selected, it shall be constructed in such a way as to absolutely minimize leakage into tunnel.	Project Requirements Workshop (Internal) on 9/11/13	X	X					
11	If new outlet tunnel option is selected, all lighting and emergency lighting should be water tight design and installed according to manufacturer specifications in order to ensure effective and long lasting performance.	Project Requirements Workshop (Internal) on 9/11/13		X	Valve travel time to match the existing valves (but not less than 15 minutes full travel) and is to move continuously (not pulsed).				
12	If new outlet tunnel option is selected, it shall accommodate trench grates to efficiently eliminate any water that collects in the tunnel in order to avoid any slip hazards.	Project Requirements Workshop (Internal) on 9/11/13		X					
13	If new outlet tunnel option is selected, a paging system (such as Gaitronics or similar) shall be installed with necessary receivers/transmitters to effectively communicate.	Project Requirements Workshop (Internal) on 9/11/13		X					

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15	Replace 30" outlet valve. Current pipe through dam is 36" and downstream pipe is 48". Valve limits flow capacity.	M. Devore, Project Requirements Workshop (Internal) on 9/11/13	X	X					
16	Remove old siphon pipes.	M. Devore, Project Requirements Workshop (Internal) on 9/11/13	X	X					
17	Evaluate the feasibility of installing bi-directional pump station to increase outflow and allow for pumping into reservoir when needed.	M. Devore, Project Requirements Workshop (Internal) on 9/11/13	X	X	The pipes and valves should be sized to facilitate bi-directional flow. A pump station itself is considered outside of the project scope.				
18	New intakes will require inspection gallery. Required by Dam Safety Unit	M. MooersProject Requirements Workshop (Internal) on 9/11/13	X	X					
19	If a new outlet is planned as part of the project, the new outlet shall include a low-flow system such that the downstream environmental creek flows can be continually maintained.	PMC per H. Desai comments	X	X					
TECHNICAL - SPILLWAY									
1	The spillway shall be capable of safely routing past the downstream toe of the dam, storm flows in accordance with HMR 58/59.	DSOD	X	X					
2	The spillway for the Project shall remain fully operable and accessible following the MCE.	Project Requirements Workshop (Internal) on 9/11/13	X	X					
3	Install screening at weep holes in spillway to keep amphibians and other animals from nesting there.	T. Neudorf, Project Requirements Workshop (Internal) on 9/11/13		X					
4	Need system to maintain vegetation at upper edges of spillway. Access and safety must be addressed in whatever is chosen. Spillway should included fall harness anchor points	M. Devore, Project Requirements Workshop (Internal) on 9/11/13		X					
5	Replace weir if the spillway needs to be changed.	M. Mooers, Project Requirements Workshop (Internal) on 9/11/13	X	X					

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6	To the extent practical, any spillway modifications shall consider the potential for a future dam raise, and the robustness of the spillway for future modification associated with dam raising.	PMC	X	X					
MAINTENANCE									
1	Guard valves shall be provided upstream of the main control valves to facilitate ease of maintenance and inspection of the outlet pipe(s).	Project Requirements Workshop (Internal) on 9/11/13	X	X	Black & Veatch: Modified from previous comment, however GEI should confirm this is consistent with their scope of work The practicality of work requirement that to the extent conduits required for drawdown, and distribution at they can be visually inspected and maintained by District staff. The Planning Consultant is advised to refer to the intake and outlet works at Austrian Dam (Lake Elzman) or San Antonio Reservoir for examples of where man access has been provided for inspection and maintenance.				
2	Outlet works shall be configured such that the intake and outlet pipe(s) can be inspected without lowering or dewatering the reservoir.	Project Requirements Workshop (Internal) on 9/11/13	X	X					
3	Main control valves and structure should be easy to access, inspect, and maintain. Meaning special equipment or training should not be needed for maintenance of valves.	Project Requirements Workshop (Internal) on 9/11/13	X	X					
4	Use of low maintenance valves such as stainless steel cone valves.	Project Requirements Workshop (Internal) on 9/11/13		X					
5	Intake structure sloped (as opposed to vertical) so that it can be inspected by walking through it.	Project Requirements Workshop (Internal) on 9/11/13	X	X	If difficult topography or geologic conditions make a sloping intake impractical, the district should be consulted regarding alternate approaches.				
6	Use of standard off the shelf (available/reliable) parts to the extent possible. Parts should be relatively common, such that special manufacturing and long lead ordering would not be required for replacement parts.	Project Requirements Workshop (Internal) on 9/11/13		X	Do not use butterfly valves, too many issues with cavitations, vibration, noise, and requires long dissipation. Prefer using smaller sized valves.				
7	Ability to replace oil during preventative maintenance (if oil is used), without requiring lowering of the reservoir.	Project Requirements Workshop (Internal) on 9/11/13		X					
8	Horizontal cylinders or lockout valves on underwater gates and valves.	Project Requirements Workshop (Internal) on 9/11/13		X					
9	Use of non-hazardous hydraulic fluid (no oil) for hydraulic systems for the upstream valves and gates.	Project Requirements Workshop (Internal) on 9/11/13		X					

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10	Ability to isolate hydraulic pumps and connect backups. Hydraulic piping should have a minimum of connections.	Project Requirements Workshop (Internal) on 9/11/13		X					
12	Stainless steel shall be used wherever and whenever possible and practical to prevent corrosion of metallic parts such as valves, hydraulic lines.	Project Requirements Workshop (Internal) on 9/11/13		X	larger metallic items such as trash racks, etc are not included in the requirement				
13	Metallic components shall have adequate corrosion protections. Cathodic protection should be utilized as required.	Project Requirements Workshop (Internal) on 9/11/13		X					
FELLOWS DIKE									
1	The staff-recommended alternative in the PSR(2010) for the Fellows Dike project produced by the District shall be incorporated into the Calero Dam PSR.	Project Requirements Workshop (Internal) on 9/11/13	X	X	All historical structures to be moved away from the area of inundation.				
OPERATIONS									
1	All upstream valves and gates should have position, as well as full-range indicators.	Project Requirements Workshop (Internal) on 9/11/13		X					
2	Valves associated with the outlet works shall be sized specific to their function (do not want one size fits all). Need to be able to control releases to within 20% or so many cfs. 1. Dam, Low Flow: 0 - 10 cfs. 2. Dam, Mid Flow: 0 - 200 cfs The high flow outlet shall be sized to meet emergency drawdown criteria, and may be a full port valve.	J. Sparkman, Project Requirements Workshop (Internal) on 9/11/13	X	X	Design Consultant to clarify requirement based on discussion with valve expert.				

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3	Valve / Gate Operations - Communication: Telephone communication (for communication w/ RWTP and for Dam Safety) - All valves should have a position indicator locally and remote (SCADA, etc.) - Power: Ability to disconnect power source and apply lock and tag and/or horizontal cylinders for underwater gates - Lighting: Inside/outside lighting with security covers; cage on lighting fixture - Security - Alarm when local control of valves are initiated - Flow Release Alarm for warning public of discharge	Project Requirements Workshop (Internal) on 9/11/13		X					
4	Security & Monitoring -Dam vaults/control structures will secured with District provided security locks. -PTZ w/ infrared CC cameras to monitor dam infrastructure.	Project Requirements Workshop (Internal) on 9/11/13		X					
5	Any large valves/gates that will not be automated will require manual operation shall incorporate means of attaching a portable electric motorized device for operation.	Project Requirements Workshop (Internal) on 9/11/13		X					
6		J. Sparkman, Project Requirements Workshop (Internal) on 9/11/13	X	X	Requirement removed per J. Sparkman. The previous intent was to modify the downstream channel capacity to safely pass the emergency release flows without flooding neighbors. This is still a desired goal, but it is realized it may not be in the scope of the project. New project features should be located outside of the flood elevation to the extent practical				
7	Install ability to release water to creek and pipeline at same time. Black & Veatch: The requirement was removed as noted.	J. Sparkman, Project Requirements Workshop (Internal) on 9/11/13	X	X					
8	Install better valve scenario allow for repairs.	J. Sparkman, Project Requirements Workshop (Internal) on 9/11/13	X	X	The intent of this requirement is to have all valves easily opera table by a single person without special training or equipment.				
9	Creek channel needs to be fixed to manage pond and related issues, including maintenance problems caused by pond grass and algae.	M. Mooers, Project Requirements Workshop (Internal) on 9/11/13 (See Environmental Section for additional related items)	X	X					

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10	Access to valve controls to be maintained throughout construction	M. Devore, Project Requirements Workshop (Internal) on 9/11/13		X					
11	Need to evaluate power needs and ensure adequate power is installed to dam and valve yard.	M. Devore, Project Requirements Workshop (Internal) on 9/11/13	X	X					
12	Valves to be electrically operated, and suitable for continuous operation. Motors to be rated for continuous duty.	E-mail received from Jerry Alexander (Control Systems) 9/11/13.		X					
13	The discharge valves should match the existing valve timing or at least have not less than 15 minutes for full stroke operation. For larger flow potential situations a full stroke duration should be 30 minutes.	E-mail received from Jerry Alexander (Control Systems) 9/11/13.		X					
14	Valves to have the following remote control interface signals: Position status, Position indication, and OPEN / CLOSE command signals (see Jerry Alexander's 9/11/13 e-mail for further circuit details).	E-mail received from Jerry Alexander (Control Systems) 9/11/13.		X					
15	Local manual operators and lights (to be used if remote controls are not available or not functioning properly)	E-mail received from Jerry Alexander (Control Systems) 9/11/13.		X					
16	Unit 545 electrical, I&C and SCADA personnel should review the valve and actuator submittals prior to installation.	E-mail received from Jerry Alexander (Control Systems) 9/11/13.		X					

INSTRUMENTATION									
1	Install new/improved instrumentation at dam. Planning shall consider conceptual instrumentation plans in cost estimating and transitioning to design phase of project.	James Nelson, Project Requirements Workshop (Internal) on 9/11/13	X	X					

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2	Instrumentation shall be designed and installed at the dam to measure seepage flows, seepage turbidity, embankment pore pressures, foundation pore pressures, settlement, tunnel deformations and ground movement, and outlet flows and temperatures, and any other information needed to understand the dam performance and determine safety. Instruments should be compatible with District automation systems	PMC		X					
3	Turbidity meters will need to be installed at the seepage weir and as appropriate. Turbidity meter will need to be automated.	J. Nelson, Project Requirements Workshop (Internal) on 9/11/13		X	Design Consultant to clarify requirement based on discussion with turbidity meter expert. Jim Nelson to supply turbidity meter product data.				
4	Flow measuring devices shall be incorporated into the outlet works for the full range of flows.	Project Requirements Workshop (Internal) on 9/11/13		X					
5	Seepage collection system shall have automated weir data connection to ADAS.	J. Nelson, Project Requirements Workshop (Internal) on 9/11/13		X					
6	Critical instruments impacted during construction will need to be replaced or relocated and connected to ADAS and SCADA.	J. Nelson, Project Requirements Workshop (Internal) on 9/11/13		X					
7	Critical survey monuments and benchmarks impacted during construction will need to be replaced or relocated.	J. Nelson, Project Requirements Workshop (Internal) on 9/11/13		X					
8	Instrumentation shall include remote sensing and observation of the dam, such as robotic survey equipment and cameras.	Project Requirements Discussion 2/18/14		X					
CONSTRUCTION									
1	Reservoir levels during construction shall not exceed operating restrictions based on agreement with the DSOD. Other construction considerations are likely to further restrict levels.	Project Requirements Workshop (Internal) on 9/11/13	X	X	There is currently an operational requirement of maintaining an emergency supply of 4,000 ac-ft and a smaller fish pool. This requirement may be possible to change during consultation with appropriate board approval. The planner should assume that the pool can be lowered for construction after further clarification during alternatives analysis.				
2	The spillway and existing outlet works shall remain operable and serviceable such that winter flows can be passed in any given year that construction requires these systems to be taken off-line. Further, construction shall be scheduled such that the spillway and outlet works are off-line for no more than one construction season.	Project Requirements Workshop (Internal) on 9/11/13	X	X					

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3	If the reservoir is lowered to facilitate construction, this work shall be carefully coordinated with District Operations. Further, a Plan should be developed that, to the maximum extent possible, beneficially uses stored reservoir water that needs to be discharged to facilitate lowering of the water surface elevation, including diversions for water supply or water storage.	Project Requirements Workshop (Internal) on 9/11/13	X	X					
4	Summer flow releases should anticipate need for discharge of flows in the range of 0-10 cfs.	Project Requirements Workshop (Internal) on 9/11/13	X	X	It is a goal to match temperature of discharge, pre-project, however the temperature of the existing discharges are variable and matching these flows may not make sense. It is possible to utilize distribution system to make releases to creek.				
5	Evaluate power requirements as part of the planned 2 year design period and procure appropriate upgrades to power at site prior to award of a construction contract.	Project Requirements Workshop (Internal) on 9/11/13		X					
6	If the reservoir is lowered to facilitate construction, the drawdown plan must meet requirements of HCP, Maximum releases are 20 cfs (dry season, May 1 - Oct 31) and 75 cfs (wet season, Nov. 1- April 31). Dewatering coordination between all 3 (Almaden/Calero/Guadalupe) projects will need to take place. Minimum releases are 1 cfs for the entire year	T. Neudorf, Project Requirements Workshop (Internal) on 9/11/13	X	X	Planning Consultant instructed to base evaluations on requirements for flow released indicated in the SCVHCP.				
7	If the reservoir is lowered to facilitate construction, the reservoir dewatering plan shall be included as part of the project CEQA review.	Project Requirements Workshop (Internal) on 9/11/13	X	X					
8	Mercury Diffuser System will need to be protected during construction.	Project Requirements Workshop (Internal) on 9/11/13		X					
ENVIRONMENTAL									
1	If the reservoir is lowered to facilitate construction, flow measurements shall be taken within 100-feet of reservoir drawdown discharge point.	T. Neudorf, Project Requirements Workshop (Internal) on 9/11/13		X					
2	Determine baseline turbidity prior to construction and implementation of Turbidity Monitoring Plan, during construction.	Project Requirements Workshop (Internal) on 9/11/13		X					
3	Implement the Conservation Strategies outlined within the SCVHCP/NCCP as it relates to the California tiger salamander	SCVHCP		X					
4	Implement the Conservation Strategies outlined within the SCVHCP/NCCP as it relates to the California red-legged frog	SCVHCP		X					

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5	Impact assessment and implement mitigations to reduce impacts to Steelhead downstream of the reservoir.	Project Requirements Workshop (Internal) on 9/11/13		X					
6	Pre-construction Surveys & Mitigation Strategies developed for various species not covered by the Santa Clara Valley HCP/NCCP: - San Francisco dusky footed wood rat - Migratory birds - Raptor Nests - Special status vegetation	T. Neudorf, Project Requirements Workshop (Internal) on 9/11/13		X					
7	Specific trees subject to damage or removal, or trees that qualify as Protected Trees should be identified. In the event that Protected Trees may be subject to damage and removal, a Mitigation & Monitoring Plan will be prepared by a qualified forester, arborist or restoration ecologist prior to the start of construction.	Project Requirements Workshop (Internal) on 9/11/13		X					
8	Evaluate need for Archaeological & Paleontological Monitoring during Construction.	Project Requirements Workshop (Internal) on 9/11/13		X					
9	From Construction Project Requirements - Creek channel needs to be fixed to eliminate pond and related issues, including maintenance problems caused by pond grass and algae.: Pond at Calero will need to be studied and documented to ensure this is not a breeding ground for the Reg Legged Frog or California Tiger Salamander before repairs to or re-routing of creek channel.	T. Neudorf, Project Requirements Workshop (Internal) on 9/11/13	X	X					
10	Geotechnical explorations will require proper environmental clearance which may indicate work is categorically exempt from CEQA or may require mitigation to support a negative declaration. Seasonal restrictions of work may apply, depending on the environmental concerns associated with specific exploration locations.	T. Neudorf, Project Requirements Workshop (Internal) on 9/11/13	X	X					
11	The discharge piping shall have a port, to allow future injection of muscle eradication/containment chemicals.	Per discussion with Mike Devore 2/20/14		X					
Permit Condition									
1	Obtain Categorical Exemption for Design Phase geotechnical investigations (Seepage/Outlet Works/Spillway)	Project Requirements Workshop (Internal) on 9/11/13		X	Design Consultant to prepare.				

FINAL DRAFT Project Requirements CALERO DAM

PROJECT # 91084020 - CALERO AND GUADALUPE DAMS SEISMIC RETROFIT PROJECT - CALERO DAM

District Project Manager: Bal Ganjoo

Planning Consultant: GEI Inc.

FINAL DRAFT (Revision 7 - 3/6/14)

No.	Project Requirements	Reference Document/ Version/Page	Identified Phase for Incorporation		Comments	Implementation Strategy	Actual Implementation during Design Phase	Team Sign-off, Date/ Remarks	Monitoring Strategy
			Planning	Design					
2	Provide notice & obtain permits if necessary from California Department of Fish and Wildlife, USACE & RWQCB for Design Phase geotechnical investigations within the reservoir.	Project Requirements Workshop (Internal) on 9/11/13		X	Design Consultant to prepare.				
3	Obtain mitigated neg-dec for design phase geotechnical investigations as needed	Project Requirements Workshop (Internal) on 9/11/13		X	Design Consultant to prepare.				
4	Obtain USACE Verified Wetland Delineation	Project Requirements Workshop (Internal) on 9/11/13		X	Planning Consultant to prepare.				
5	Biological Assessment for Project including dewatering if proposed	Project Requirements Workshop (Internal) on 9/11/13		X	Planning Consultant to prepare.				
6	Obtain USACE Individual Permit for Construction (Section 404 of the Clean Water Act)	Project Requirements Workshop (Internal) on 9/11/13		X	Planning Consultant to prepare.				
7	Obtain/Demonstrate USACE National Historic Preservation Act Section 106 Compliance	Project Requirements Workshop (Internal) on 9/11/13		X	Planning Consultant to prepare.				
8	Obtain USFWS ESA Coverage via SCVHCP	Project Requirements Workshop (Internal) on 9/11/13		X	Planning Consultant to prepare.				
9	Obtain NMFS ESA Section 7 Permit, will require Biological Opinion for Central California Coast Steelhead and critical Habitat	Project Requirements Workshop (Internal) on 9/11/13		X	Planning Consultant to prepare.				
10	Obtain RWQCB 401 Water Quality Certification for project	Project Requirements Workshop (Internal) on 9/11/13		X	Planning Consultant to prepare.				
11	Obtain California Department of Fish & Wildlife 1602 Permit	Project Requirements Workshop (Internal) on 9/11/13		X	Planning Consultant to prepare.				
12	Obtain DSOD Permit & Approvals (pre-construction approval of plans & specifications)	Project Requirements Workshop (Internal) on 9/11/13		X	Design Consultant/District				
13	State of California Dept. of Industrial Relations - Divisions of Occupational Safety and Health - Mining and Tunneling Unit Permit required; Underground Classification with respect to the quantities of flammable gas or vapors.	Project Requirements Workshop (Internal) on 9/11/13		X	Designer/District to prepare.				
14	Santa Clara County Grading Permit	Project Requirements Workshop (Internal) on 9/11/13		X	Design Consultant/District				

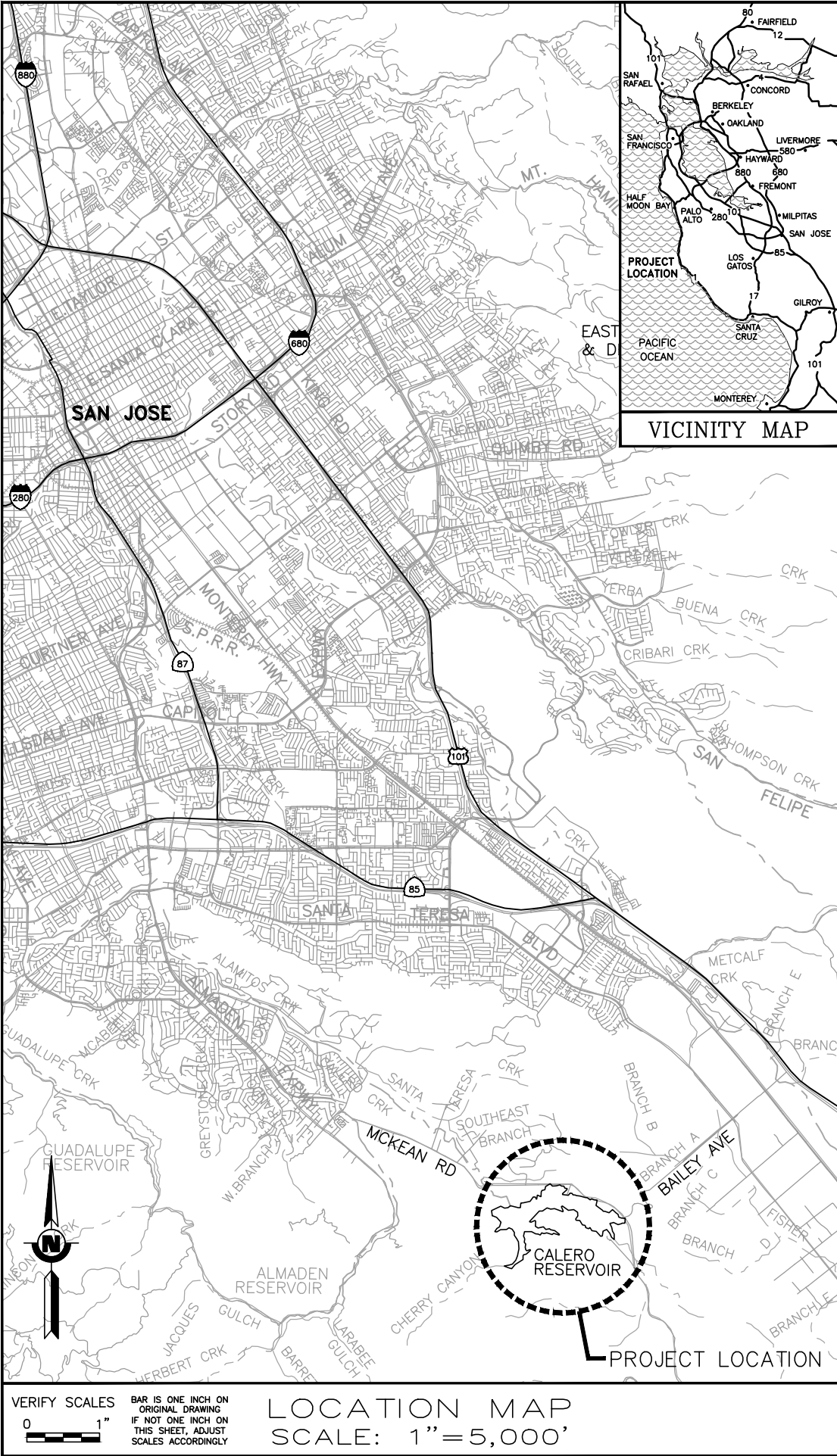
FINAL DRAFT Project Requirements CALERO DAM

PROJECT # 91084020 - CALERO AND GUADALUPE DAMS SEISMIC RETROFIT PROJECT - CALERO DAM									
District Project Manager: Bal Ganjoo									
Planning Consultant: GEI Inc.									
FINAL DRAFT (Revision 7 - 3/6/14)									
No.	Project Requirements	Reference Document/ Version/Page	Identified Phase for Incorporation		Comments	Implementation Strategy	Actual Implementation during Design Phase	Team Sign-off, Date/ Remarks	Monitoring Strategy
			Planning	Design					
15	Santa Clara County Tree Removal Permit	Project Requirements Workshop (Internal) on 9/11/13		X	Planning Consultant to prepare.				
16	Santa Clara County Design Review for visual impacts	Project Requirements Workshop (Internal) on 9/11/13		X	Planning Consultant to prepare.				
17	Obtain Encroachment Permits	Project Requirements Workshop (Internal) on 9/11/13		X	Design Consultant/District				
18	Obtain Bay Area Air Quality Management District Permits/Approvals for: - Generators larger than 50hp; - Compliance with Asbestos ATCM (CA Code Title 17, Sec. 93105)	Project Requirements Workshop (Internal) on 9/11/13		X	Planning Consultant to prepare.				
19	Obtain peizometer well permits	Project Requirements Workshop (Internal) on 9/11/13		X	District				

Appendix C

Calero Dam Staff Recommended Alternative Drawings

Sheet No.	Drawing No.	Drawing Title
<i>General Drawings</i>		
1	G-1	Vicinity / Project Area Map and List of Drawings
2	G-2	Abbreviations and Notes
3	G-3	Overall Site Map and Key Plan
4	G-4	Existing Facilities at Calero Main Dam
5	G-5	Site Use Plan – Main Dam, Auxiliary Dam, Spillway, Stockpile, Staging, Disposal, and Borrow Areas
6	G-6	Borrow, Stockpile and Miscellaneous Details
<i>Embankment Drawings</i>		
7	E-1	Main Dam Crest Raise & Buttress Plan
8	E-2	Main Dam Excavation & Drainage Plans
9	E-3	Main Dam Profiles
10	E-4	Main Dam Cross Sections
11	E-5	Auxiliary Dam Plan, Profile and Sections
<i>Outlet Works Drawings</i>		
12	O-1	Outlet Works Plan & Profile
13	O-2	Outlet Works Intake Plan, Profile and Sections
14	O-3	Intake Control House General Arrangement
15	O-4	Access Tunnel and Pipeline Trench and Cross Sections
16	O-5	Outlet Valve House General Arrangement
<i>Spillway Drawings</i>		
17	S-1	Spillway Plan, Profile and Sections
<i>Fellows Dike Drawings</i>		
18	F-1	Fellows Dike



PRELIMINARY DESIGN DRAWINGS
FOR
STAFF—RECOMMENDED
ALTERNATIVE
FOR
CALERO DAM AND RESERVOIR

SEISMIC RETROFIT PROJECT
SAN JOSE, CALIFORNIA



PREPARED BY:



WILLIAM RETTBERG, P.E.
PROJECT MANAGER



FINAL
04-22-15

LIST OF DRAWINGS		
SHEET NO	SHEET CODE	TITLE
1	G-1	VICINITY / PROJECT AREA MAP AND LIST OF DRAWINGS
2	G-2	ABBREVIATIONS AND NOTES
3	G-3	OVERALL SITE MAP AND KEY PLAN
4	G-4	EXISTING FACILITIES AT CALERO MAIN DAM
5	G-5	SITE USE PLAN - MAIN DAM, AUXILIARY DAM, SPILLWAY, STOCKPILE, STAGING, DISPOSAL AND BORROW AREAS
6	G-6	BORROW, STOCKPILE, AND MISCELLANEOUS DETAILS
7	E-1	MAIN DAM CREST RAISE & BUTTRESS PLAN
8	E-2	MAIN DAM EXCAVATION AND DRAINAGE PLANS
9	E-3	MAIN DAM PROFILES
10	E-4	MAIN DAM CROSS SECTIONS
11	E-5	AUXILIARY DAM PLAN, PROFILE, AND SECTIONS
12	O-1	OUTLET WORKS PLAN & PROFILE
13	O-2	INTAKE PLAN, PROFILE AND SECTIONS
14	O-3	INTAKE CONTROL HOUSE GENERAL ARRANGEMENT
15	O-4	TUNNEL AND PIPELINE SECTION AND DETAILS
16	O-5	OUTLET VALVE HOUSE GENERAL ARRANGEMENT
17	S-1	SPILLWAY PLAN, PROFILE AND SECTION
18	F-1	FELLOWS DIKE

PROJECT NUMBER
132838-0
SHEET CODE
G-1
SHEET NUMBER:
1 OF 18

Cal_02_G-2-Abbreviations and Notes

ABBREVIATIONS

- ALIGN

APPROX

CL

CLR

CONC

DIA

DISTRICT

DSOD

D/S

EL

EXIST

FT

GEI

HORIZ

HJW

ID

INV

MIN

NMWS

N/A

NO

NTS

OD

REINF

REQ'D

S

SCCPRD

SCVWD

SHT

SPECS

SRA

STD

STL

TYP

URS

U/S

VERT

WS

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C

Ø

ℙ
- ALIGNMENT

– APPROXIMATE

– CLEARANCE

– CLEAR

– CONCRETE

– DIAMETER

– SCVWD

– CA DIVISION OF SAFETY OF DAMS

– DOWNSTREAM

– ELEVATION

– EXISTING

– FEET

– GEI CONSULTANTS, INC.

– HORIZONTAL

– HJW GEOSPATIAL, INC.

– INSIDE DIAMETER

– INVERT

– MINIMUM

– NORMAL MAXIMUM WATER SURFACE

– NOT APPLICABLE

– NUMBER

– NOT TO SCALE

– OUTSIDE DIAMETER

– REINFORCED

– REQUIRED

– SLOPE

– SANTA CLARA COUNTY PARKS AND RECREATION DEPARTMENT

– SANTA CLARA VALLEY WATER DISTRICT

– SHEET

– SPECIFICATIONS

– STAFF RECOMMENDED ALTERNATIVE

– STANDARD

– STEEL

– TYPICAL

– URS CORPORATION

– UPSTREAM

– VERTICAL

– WATER SURFACE

– WITH

– AND

– AT

– CENTERLINE

– DIAMETER

– PROPERTY LINE

LEGEND

- ----

- PROPERTY LINE

NORMAL MAXIMUM WATER SURFACE

DSOD RESTRICTED WATER SURFACE ELEVATION

WATER COURSE

PRELIMINARY HAUL ROUTE

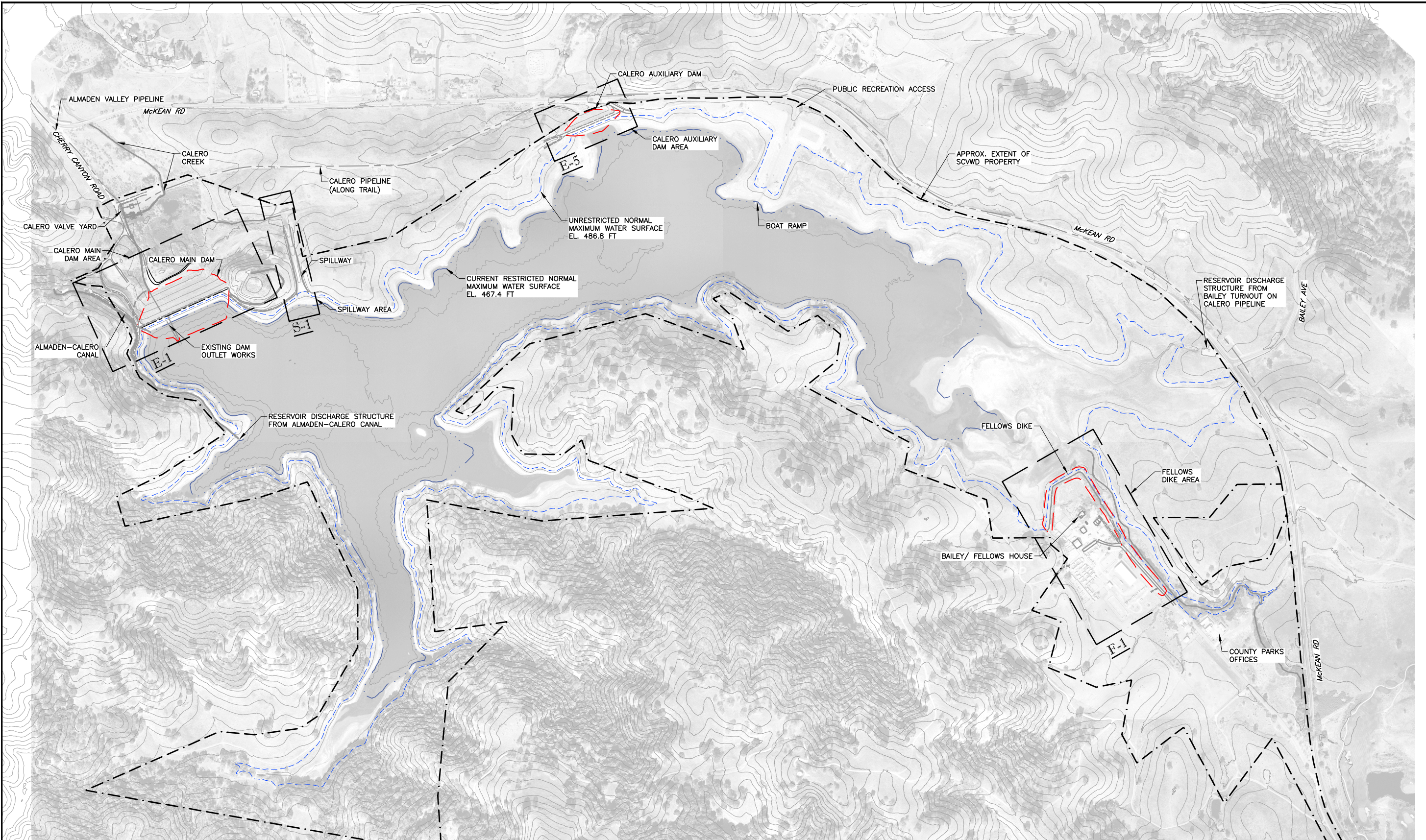
APPROXIMATE LIMIT OF STOCKPILE, BORROW, DISPOSAL, OR STAGING AREA AS NOTED

GENERAL NOTES

1. THESE DRAWINGS REPRESENT THE CONFIGURATION AND KEY FEATURES OF THE DISTRICT’S STAFF RECOMMENDED ALTERNATIVE (SRA) CONSISTENT WITH AN APPROXIMATE 20% LEVEL OF DESIGN CONCEPT DEVELOPMENT. AS SUCH, ADDITIONAL INVESTIGATIONS, ANALYSES AND FINAL DESIGNS WILL BE REQUIRED TO FURTHER DEVELOP THE 30%, 60%, 90% AND 100% DESIGN DRAWINGS, SPECIFICATIONS AND SUPPORTING INFORMATION NEEDED FOR DISTRICT REVIEW, DSOD REVIEW, AND OTHER APPROVALS PRIOR TO BIDDING AND CONSTRUCTION.
2. THE SRA IS BASED UPON EXISTING INFORMATION PROVIDED BY THE DISTRICT INCLUDING THE FINAL REPORT SSE1B – SEISMIC STABILITY EVALUATION OF CALERO MAIN DAM AND CALERO AUXILIARY DAM, BY URS CORPORATION, OCTOBER 2012; AS WELL AS PLANNING LEVEL EVALUATIONS BY GEI CONSULTANTS AS SUMMARIZED IN THE CALERO DAM PROBLEM DEFINITION REPORT, DATED SEPTEMBER 2014 AND THE CALERO DAM ALTERNATIVES REPORT, REVISED MARCH 2015. THE FINAL DESIGN CONSULTANT WILL NEED TO FURTHER CONFIRM AND VERIFY THE INFORMATION TO FORM THE BASIS FOR FINAL DESIGN.
3. THE VERTICAL DATUM IS NAVD88 FEET (AT THIS SITE NAVD88 IS APPROXIMATELY EQUAL TO NGVD29+2.89 FT).
4. THE HORIZONTAL COORDINATE SYSTEM IS BASED ON CA ZONE III, NAD 83.
5. REGIONAL TOPOGRAPHY IS FROM 2006 USGS LiDAR. IN THE DAM AND RESERVOIR VICINITY THE SOURCE OF THE AERIAL IMAGERY AND SURVEY DATA IS THE NOVEMBER 2002 AERIAL SURVEY BY HJW.
6. TO THE BEST OF OUR KNOWLEDGE, THESE DRAWINGS MEET THE DISTRICT’S PROJECT REQUIREMENTS FOR THE SRA. HOWEVER, THE FINAL DESIGN CONSULTANTS, IN CONCERT WITH THE DISTRICT, DSOD AND OTHER ENVIRONMENTAL AND REGULATORY AGENCIES, WILL BE REQUIRED TO CRAFT THE SRA TO MEET THE DISTRICT’S REQUIREMENTS AND ALL OTHER REGULATORY PERMITS AND APPROVALS.
7. TUNNEL PORTALS AND ALIGNMENT, AND INTAKE STRUCTURE LOCATION ARE PRELIMINARY AND WILL REQUIRE ADDITIONAL GEOTECHNICAL INVESTIGATIONS TO CONFIRM FINAL LOCATION AND CONFIGURATION.
8. DISTRICT WILL FULLY LOWER THE RESERVOIR PRIOR TO CONSTRUCTION AND WILL HALT DELIVERY OF RAW WATER DURING CONSTRUCTION. AFTER INITIAL RESERVOIR LOWERING BY THE DISTRICT, THE CONTRACTOR SHALL BE RESPONSIBLE FOR TEMPORARY DIVERSION OF NATURAL RESERVOIR INFLOW THROUGH THE WORKSITE AND MAY USE THE EXISTING OUTLET WORKS FOR SUCH PURPOSES. IF NECESSARY, THE DISTRICT WILL SATISFY MINIMUM DOWNSTREAM FLOW REQUIREMENTS DURING CONSTRUCTION USING THE CALERO BYPASS PIPELINE. CONTRACTOR SHALL CONTINUOUSLY MAINTAIN, PROTECT AND OPERATE THE EXISTING OUTLET WORKS IN A FULLY SERVICEABLE CONDITION, INCLUDING POTENTIAL EMERGENCY USE, UNTIL THE NEW OUTLET WORKS IS SUBSTANTIALLY COMPLETE AND ACCEPTED FOR USE BY THE DISTRICT, FINAL DESIGN CONSULTANT, AND DSOD.
9. THERE ARE DELINEATED WETLANDS DOWNSTREAM OF THE MAIN DAM (URS 2014) AND OUTLET WORKS. THE FINAL DESIGN CONSULTANT WILL NEED TO ADDRESS AND PROTECT THESE WETLANDS TO THE MAXIMUM PRACTICABLE EXTENT SUBJECT TO ENVIRONMENTAL PERMIT CONDITIONS – TO BE DETERMINED.
10. PRELIMINARY DESIGN CONCEPT IS BASED ON THE REMOVAL OF A PORTION OF THE MAIN DAM EMBANKMENT, REMOVAL OF THE FOUNDATION SOIL BELOW THE REMOVED EMBANKMENT AND NEW BUTTRESS (ALLUVIAL AND COLLUVIAL SOILS). THE EXCAVATION WILL EXPOSE UNDISTURBED FRANCISCAN COMPLEX SEDIMENTARY FORMATION ROCK; CONFIRMATION BY GEOLOGIC INSPECTION; AND REMOVAL OF LOOSE, DESICCATED, WET OR OTHERWISE DAMAGED FOUNDATION MATERIALS IMMEDIATELY PRIOR TO PLACEMENT OF EMBANKMENT BUTTRESS MATERIAL. THE DAM FOUNDATION OBJECTIVE AND PREPARATION REQUIREMENTS WILL BE REFINED DURING FINAL DESIGN BY THE FINAL DESIGN CONSULTANT, AND SUBJECT TO CONFIRMATION BY DSOD.

REV	DESCRIPTION	DATE	APPR.	REFERENCE INFORMATION AND NOTES	GEI Consultants		DATE	ENGINEERING CERTIFICATION	Santa Clara Valley Water District	PROJECT NAME AND SHEET DESCRIPTION:	SCALE	PROJECT NUMBER
							04-22-15				AS NOTED	1328380
							DESIGN			CALERO DAM SEISMIC RETROFIT PROJECT STAFF-RECOMMENDED ALTERNATIVE ABBREVIATIONS AND NOTES	VERIFY SCALES 01" BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	SHEET CODE: G-2
							N.K.S.		ACCEPTED BY DISTRICT			
							N.K.S.					
							CHECKED					
							J.G.H.	PROJECT ENGINEER	DATE	PROJECT ENGINEER		SHEET NUMBER: 2 OF 18

Cal_03_G-3-Overall Site Map and Key Plan



PLAN

SCALE: 1"=400'

REV	DESCRIPTION	DATE	APPR.	REFERENCE INFORMATION AND NOTES

GEI Consultants	DATE	04-22-15
	DESIGN	N.K.S.
	DRAWN	N.K.S.
	CHECKED	J.G.H.
	PROJECT ENGINEER	DATE

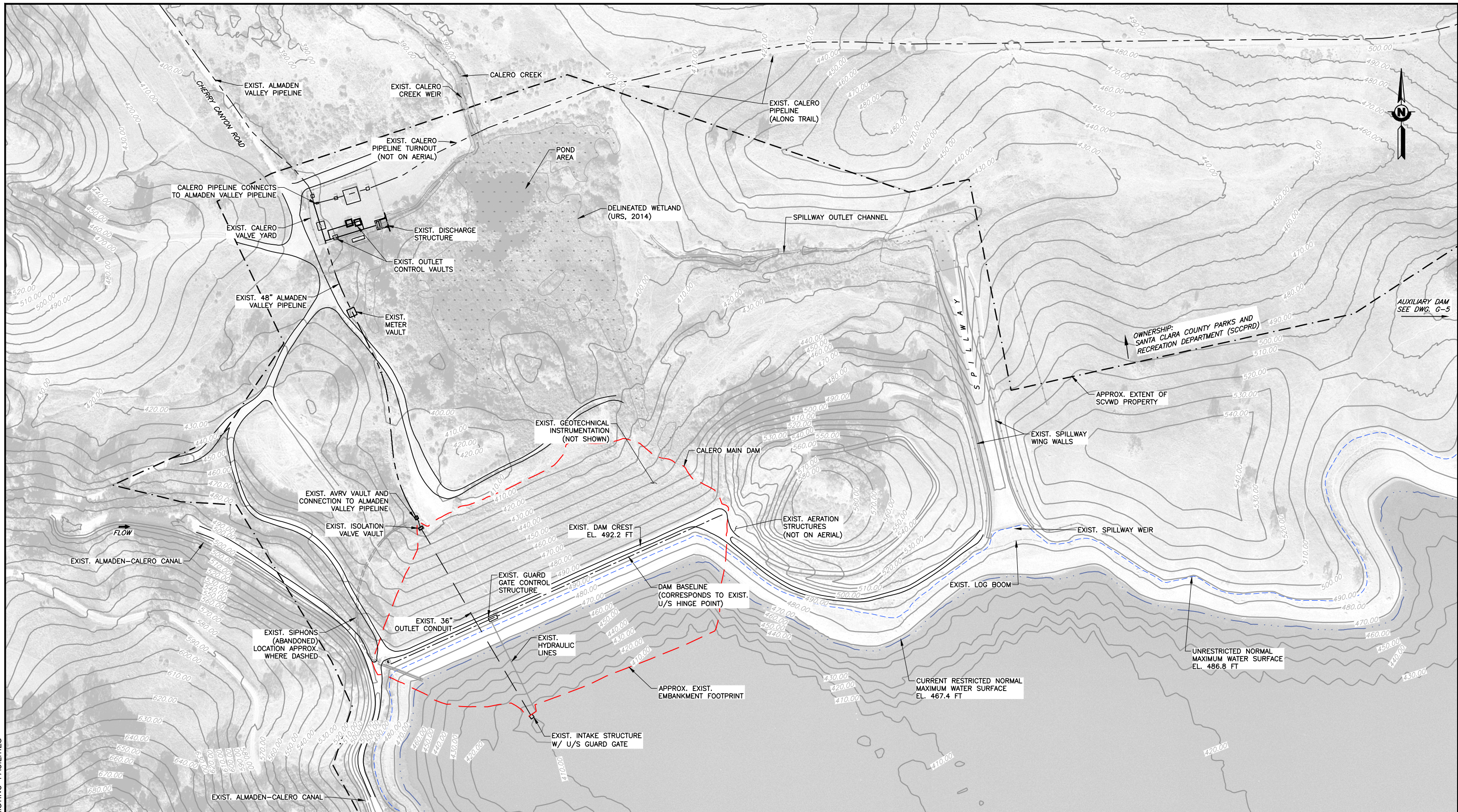
Santa Clara Valley Water District	
ACCEPTED BY DISTRICT	
PROJECT ENGINEER	DATE

PROJECT NAME AND SHEET DESCRIPTION:	
CALERO DAM SEISMIC RETROFIT PROJECT	
STAFF-RECOMMENDED ALTERNATIVE	
OVERALL SITE MAP AND KEY PLAN	

SCALE	PROJECT NUMBER
AS NOTED	1328380
VERIFY SCALES	SHEET CODE:
0 1"	G-3
BAR IS ONE INCH ON ORIGINAL DRAWING	SHEET NUMBER:
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	3 OF 18

PROJECT NUMBER
1328380
SHEET CODE:
G-3
SHEET NUMBER:
3 OF 18

Col_04_G-4-EXISTING FACILITIES



PLAN

SCALE: 1"=100'

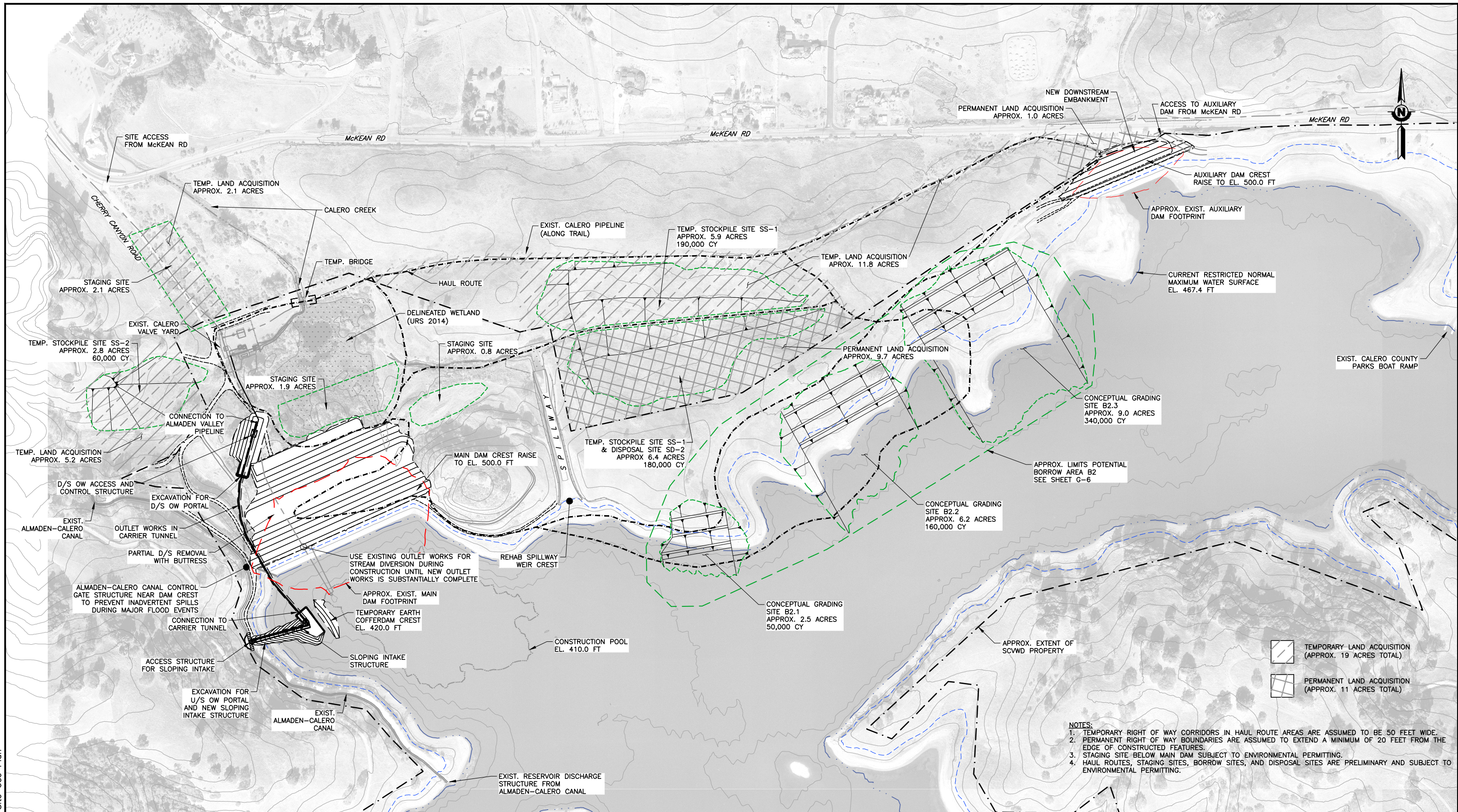
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GEI Consultants	DATE	04-21-15
	DESIGN	N.K.S.
	DRAWN	N.K.S.
	CHECKED	N.K.S.
	PROJECT ENGINEER	J.G.H.
ENGINEERING CERTIFICATION		DATE

Santa Clara Valley Water District	
ACCEPTED BY DISTRICT	
PROJECT ENGINEER	DATE

PROJECT NAME AND SHEET DESCRIPTION:	
CALERO DAM SEISMIC RETROFIT PROJECT	
STAFF-RECOMMENDED ALTERNATIVE	
EXISTING FACILITIES	
AT CALERO MAIN DAM	

SCALE	PROJECT NUMBER
AS NOTED	1328380
VERIFY SCALES	SHEET CODE:
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BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	SHEET NUMBER:
	4 OF 18



PLAN

SCALE: 1"=200'

REV	DESCRIPTION	DATE	APPR.	REFERENCE INFORMATION AND NOTES

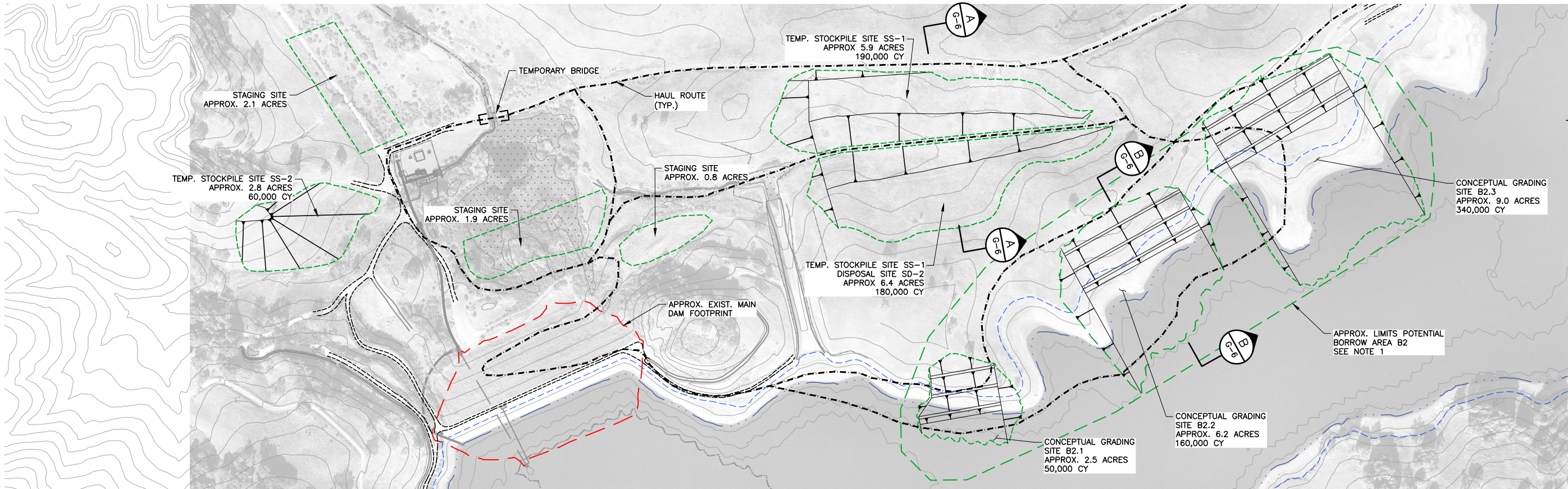
GEI Consultants	DATE	04-22-15
	DESIGN	N.K.S.
	DRAWN	N.K.S.
	CHECKED	J.G.H.
	PROJECT ENGINEER	DATE

Santa Clara Valley Water District	
ACCEPTED BY DISTRICT	
PROJECT ENGINEER	DATE

PROJECT NAME AND SHEET DESCRIPTION:	
CALERO DAM SEISMIC RETROFIT PROJECT	
STAFF-RECOMMENDED ALTERNATIVE	
SITE USE PLAN - MAIN DAM, AUXILIARY DAM, SPILLWAY, STOCKPILE, STAGING, DISPOSAL, AND BORROW AREAS	

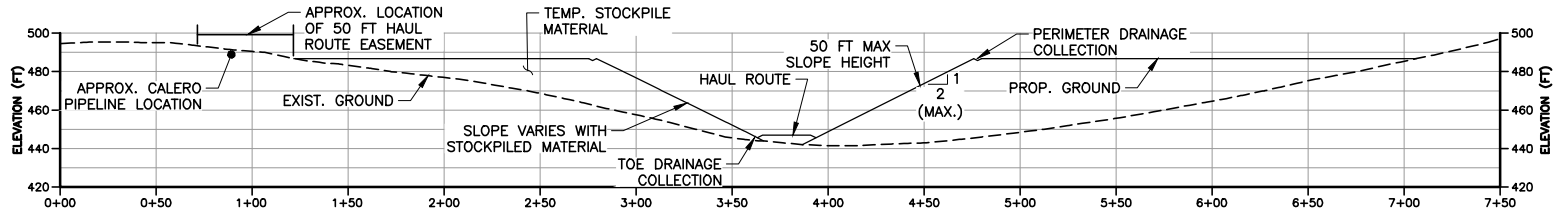
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BAR IS ONE INCH ON ORIGINAL DRAWING. IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY.	SHEET NUMBER:
	5 OF 18

Cal_06_G-6-Borrow, Stockpile, and Miscellaneous Details



PLAN

SCALE: 1"=200'

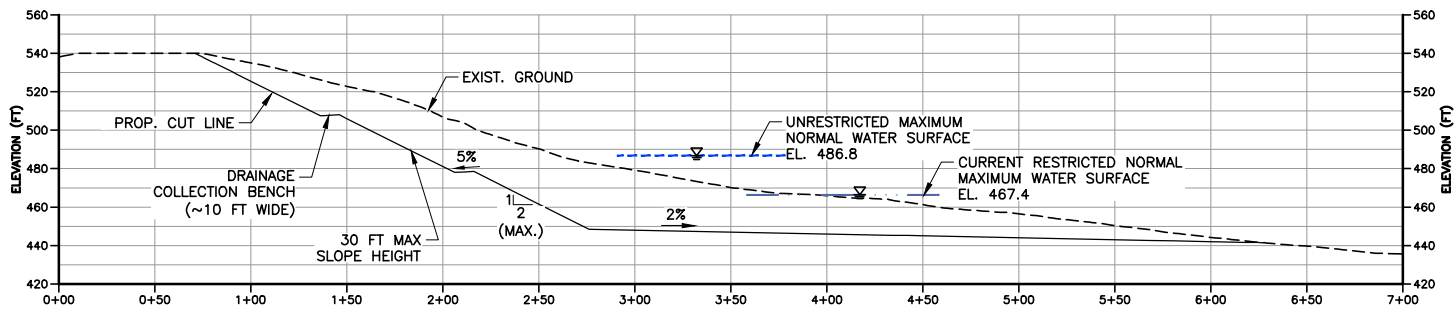


SECTION A

G-6

TYP. HILLSIDE STOCKPILE SITE SS-1/SD-2

SCALE: 1" = 50'



SECTION B

G-6

TYP. HILLSIDE BORROW CUT SITE B2.2

SCALE: 1" = 50'

NOTES:

1. IT IS ASSUMED THAT STAGING AND STOCKPILING FOR BORROW SCREENING AND PROCESSING OPERATIONS WILL BE ESTABLISHED AT THE PERIPHERY OF GRADING AREAS WITHIN THE DELINEATED POTENTIAL BORROW AREA BOUNDARY.
2. THE BORROW AREAS, STOCKPILE AREAS, STAGING AREAS, DISPOSAL AREAS, AND HAUL ROUTES ARE PRELIMINARY AND SUBJECT TO CONFIRMATION BY THE FINAL DESIGN CONSULTANT, ENVIRONMENTAL PERMITTING, AND LAND ACCESS.
3. EXCAVATION SLOPES ARE PRELIMINARY AND SUBJECT TO CONFIRMATION DURING FINAL DESIGN.

REV	DESCRIPTION	DATE	APPR.	REFERENCE INFORMATION AND NOTES



DATE	04-22-15
DESIGN	N.K.S.
DRAWN	N.K.S.
CHECKED	J.G.H.

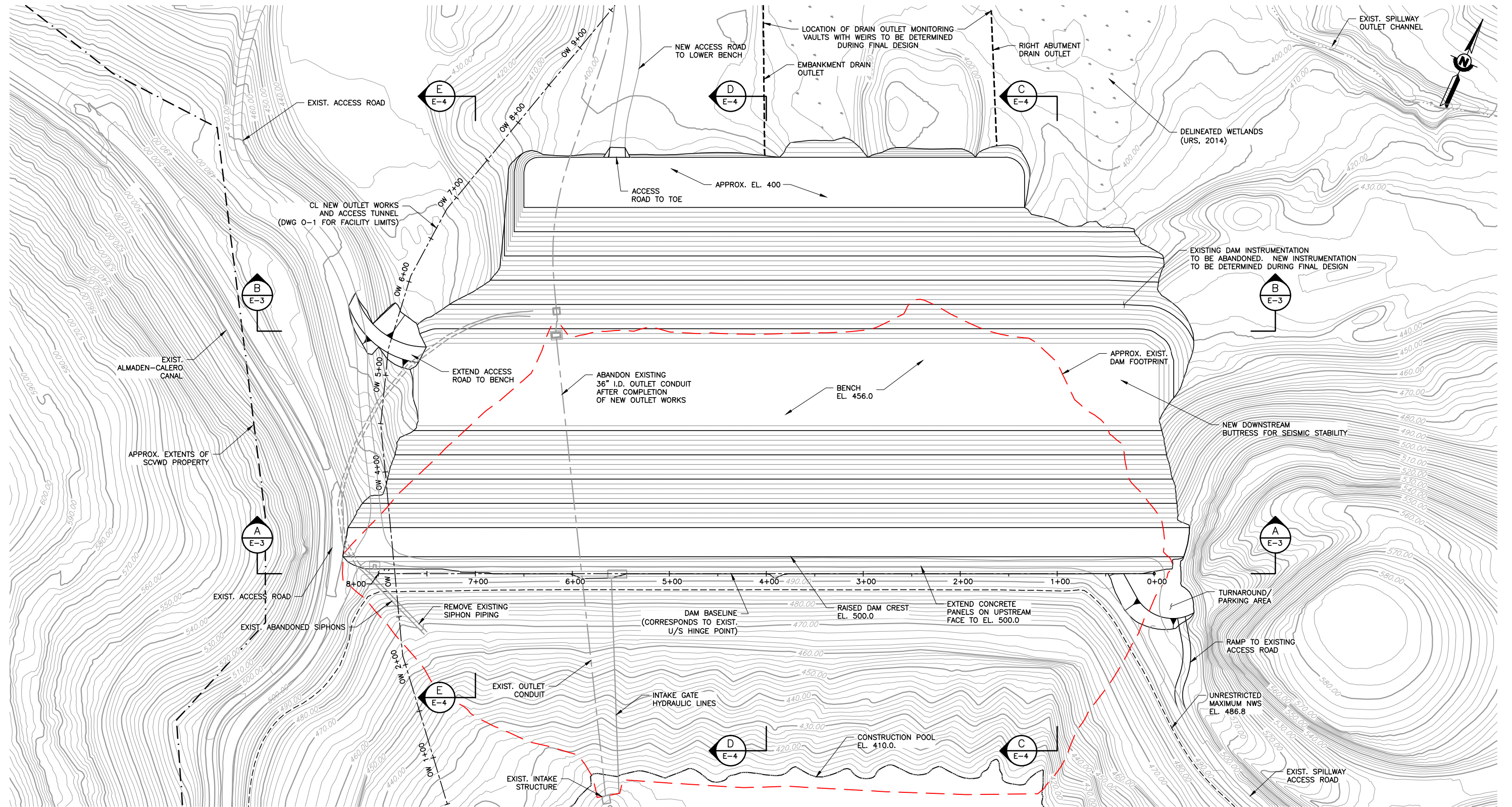
ENGINEERING CERTIFICATION	
PROJECT ENGINEER	DATE

Santa Clara Valley Water District	
ACCEPTED BY DISTRICT	
PROJECT ENGINEER	DATE

PROJECT NAME AND SHEET DESCRIPTION:
CALERO DAM SEISMIC RETROFIT PROJECT
STAFF-RECOMMENDED ALTERNATIVE
BORROW, STOCKPILE, AND MISCELLANEOUS DETAILS

SCALE	PROJECT NUMBER
AS NOTED	1328380
VERIFY SCALES	SHEET CODE:
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BAR IS ONE INCH ON ORIGINAL DRAWING	SHEET NUMBER:
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	6 OF 18

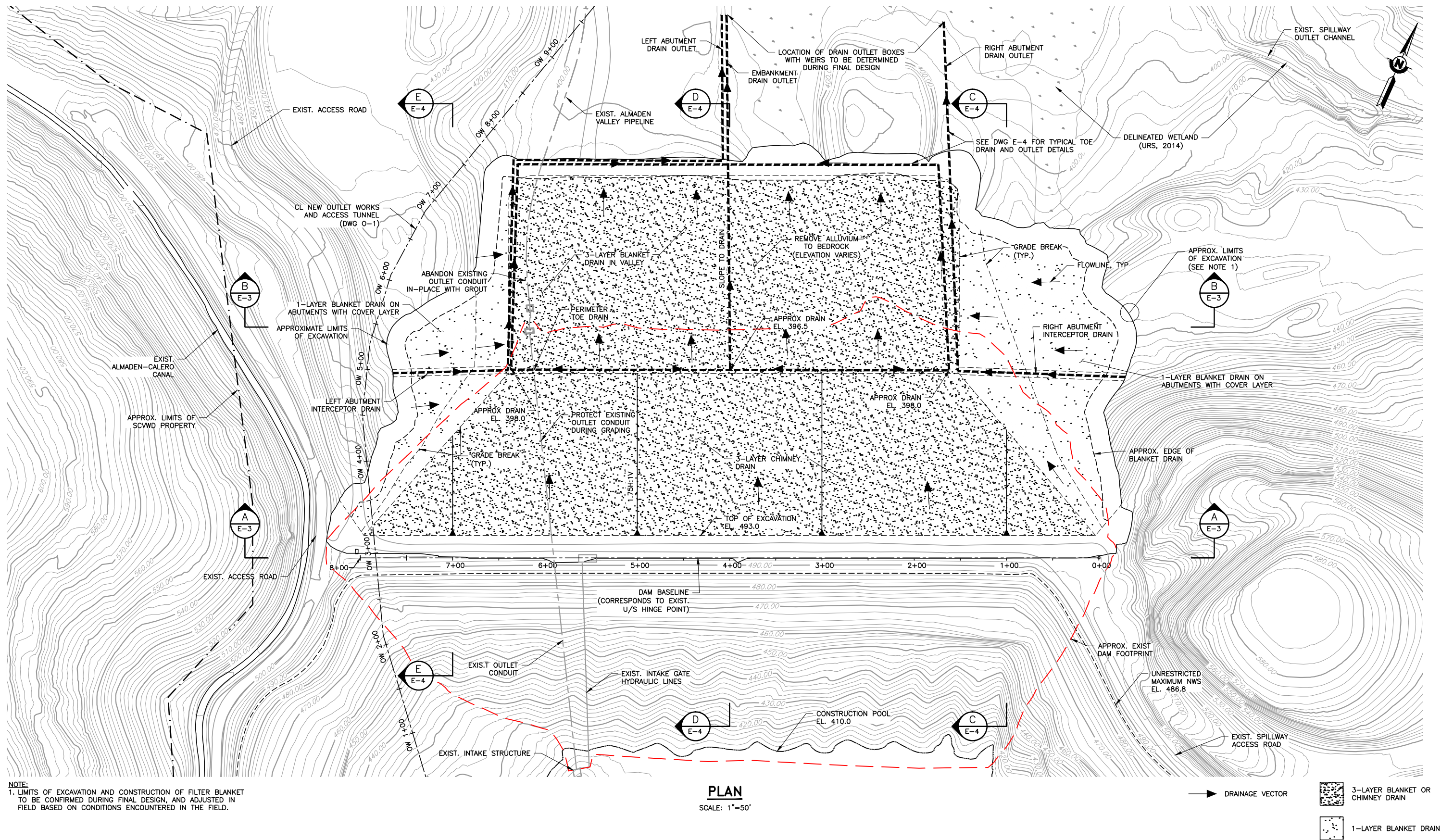
Col_07_E-1-Main Dam Plan



PLAN

SCALE: 1"=50'

REV	DESCRIPTION	DATE	APPR.	REFERENCE INFORMATION AND NOTES	GEI Consultants	DATE	ENGINEERING CERTIFICATION	Santa Clara Valley Water District	PROJECT NAME AND SHEET DESCRIPTION:		SCALE	PROJECT NUMBER	
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						DESIGN				STAFF-RECOMMENDED ALTERNATIVE		VERIFY SCALES	SHEET CODE:
						P.J.E.				MAIN DAM		0 1"	E-1
						DRAWN				EMBANKMENT PLAN		BAR IS ONE INCH ON ORIGINAL DRAWING	
						P.J.E.						IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	SHEET NUMBER:
					CHECKED						7 OF 18		
					J.G.H.	PROJECT ENGINEER	DATE	PROJECT ENGINEER	DATE				



REV	DESCRIPTION	DATE	APPR.	REFERENCE INFORMATION AND NOTES

DATE
04-22-15
DESIGN
P.J.E.
DRAWN
P.J.E.
CHECKED
J.G.H.

ENGINEERING CERTIFICATION

PROJECT ENGINEER DATE

ACCEPTED BY DISTRICT

PROJECT ENGINEER DATE

PROJECT NAME AND SHEET DESCRIPTION:

CALERO DAM SEISMIC RETROFIT PROJECT
STAFF-RECOMMENDED ALTERNATIVE

MAIN DAM
EXCAVATION AND DRAINAGE PLAN

SCALE
AS NOTED
VERIFY SCALES
0 1"
BAR IS ONE INCH ON ORIGINAL DRAWING
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY

PROJECT NUMBER
1328380
SHEET CODE:
E-2
SHEET NUMBER:
8 OF 18

48" I.D. OUTLET PIPE WITHIN CONCRETE-LINED ACCESS TUNNEL

1-LAYER BLANKET DRAIN ON ABUTMENTS

EXIST. OUTLET CONDUIT

ABANDON EXISTING OUTLET CONDUIT IN-PLACE WITH GROUT AFTER COMPLETION OF NEW OUTLET WORKS

EXCAVATE AND REPLACE ALLUVIUM WITH APPROVED FILL

ALLUVIUM

APPROX. TOP OF BEDROCK

APPROX. LIMITS OF DAM FOUNDATION

EXIST. DAM TOE

3-LAYER BLANKET DRAIN IN VALLEY

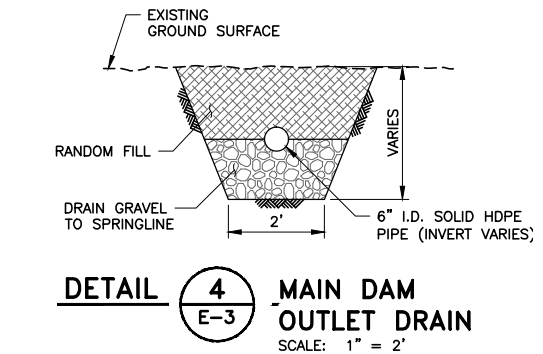
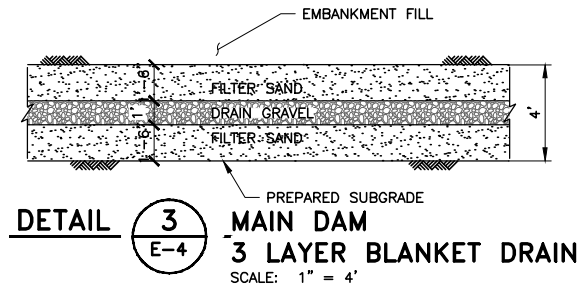
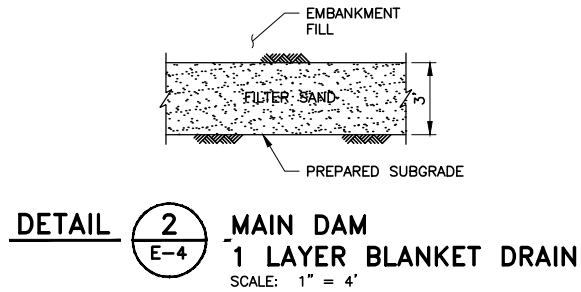
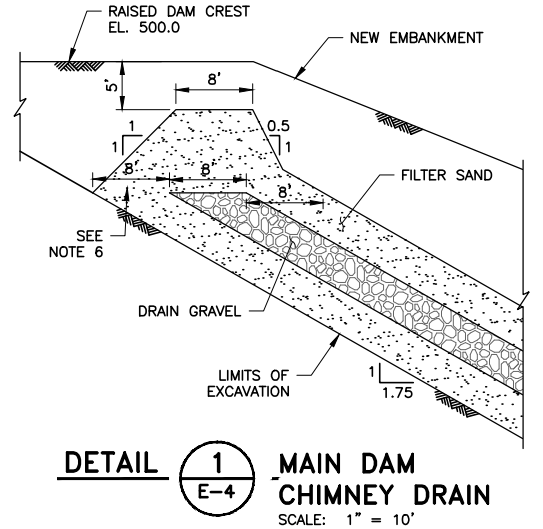
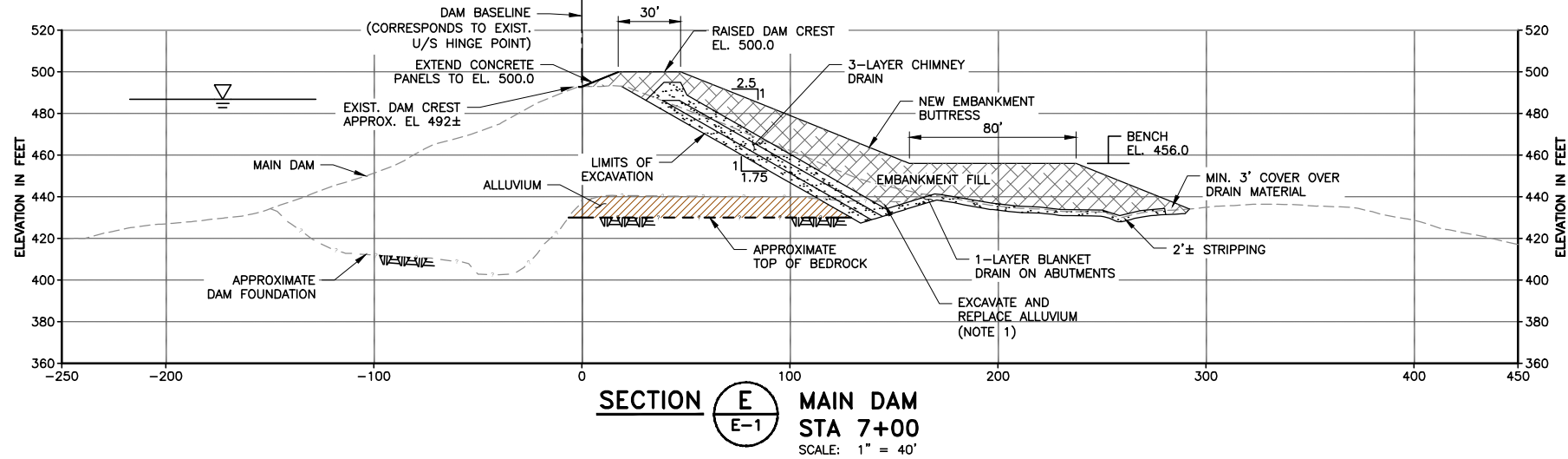
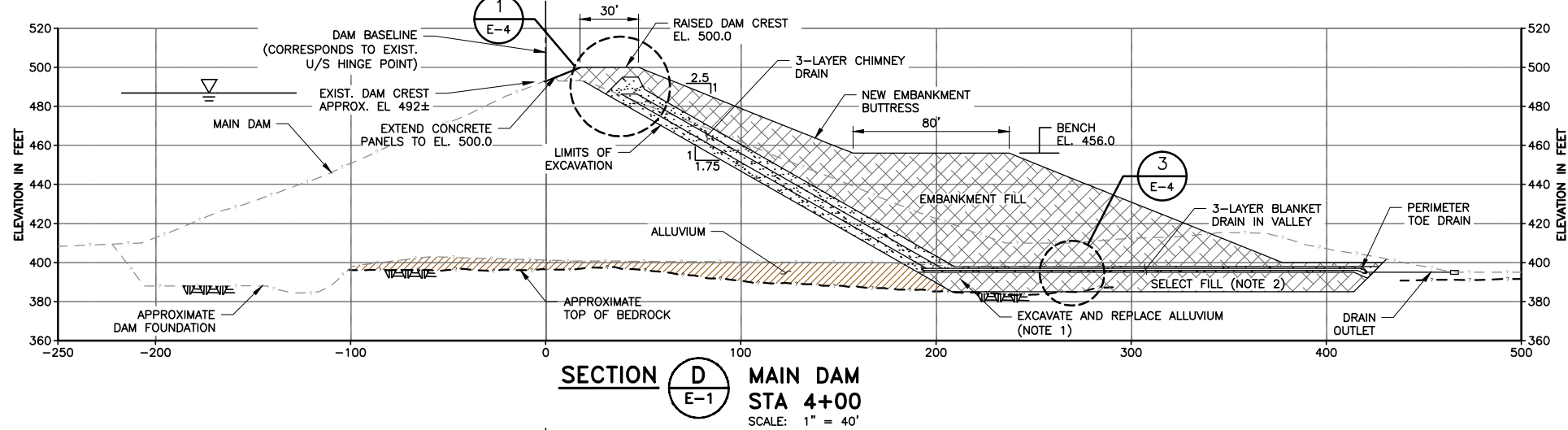
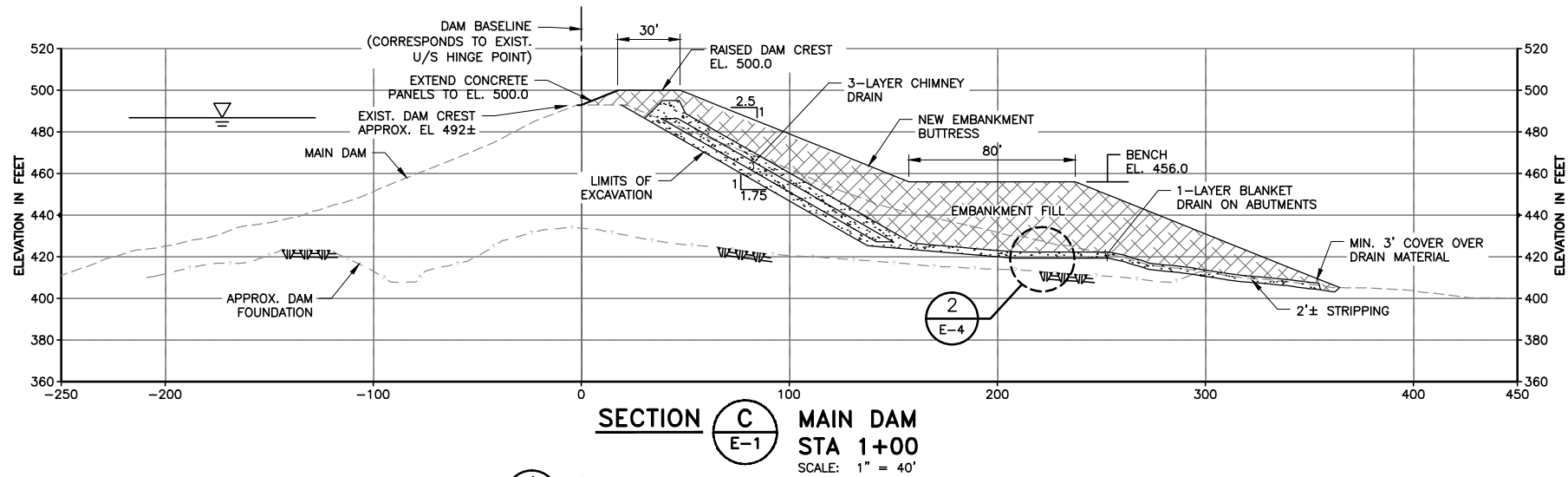
NEW EMBANKMENT BUTTRESS EL. 456.0

LIMITS OF EXCAVATION (SEE NOTES 1 & 2)

ELEVATION IN FEET

STATION

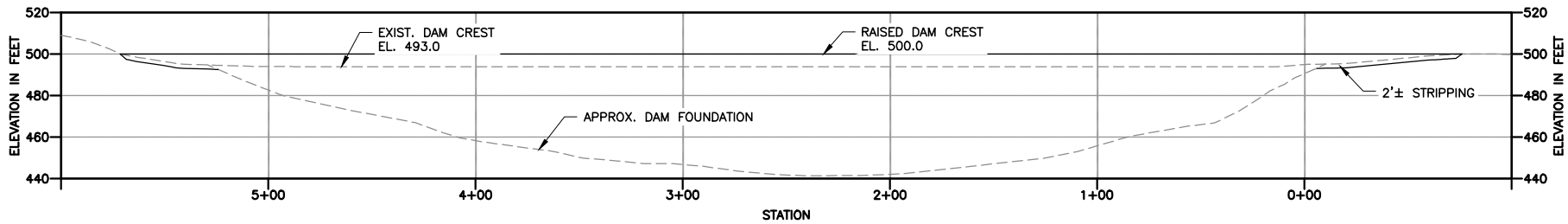
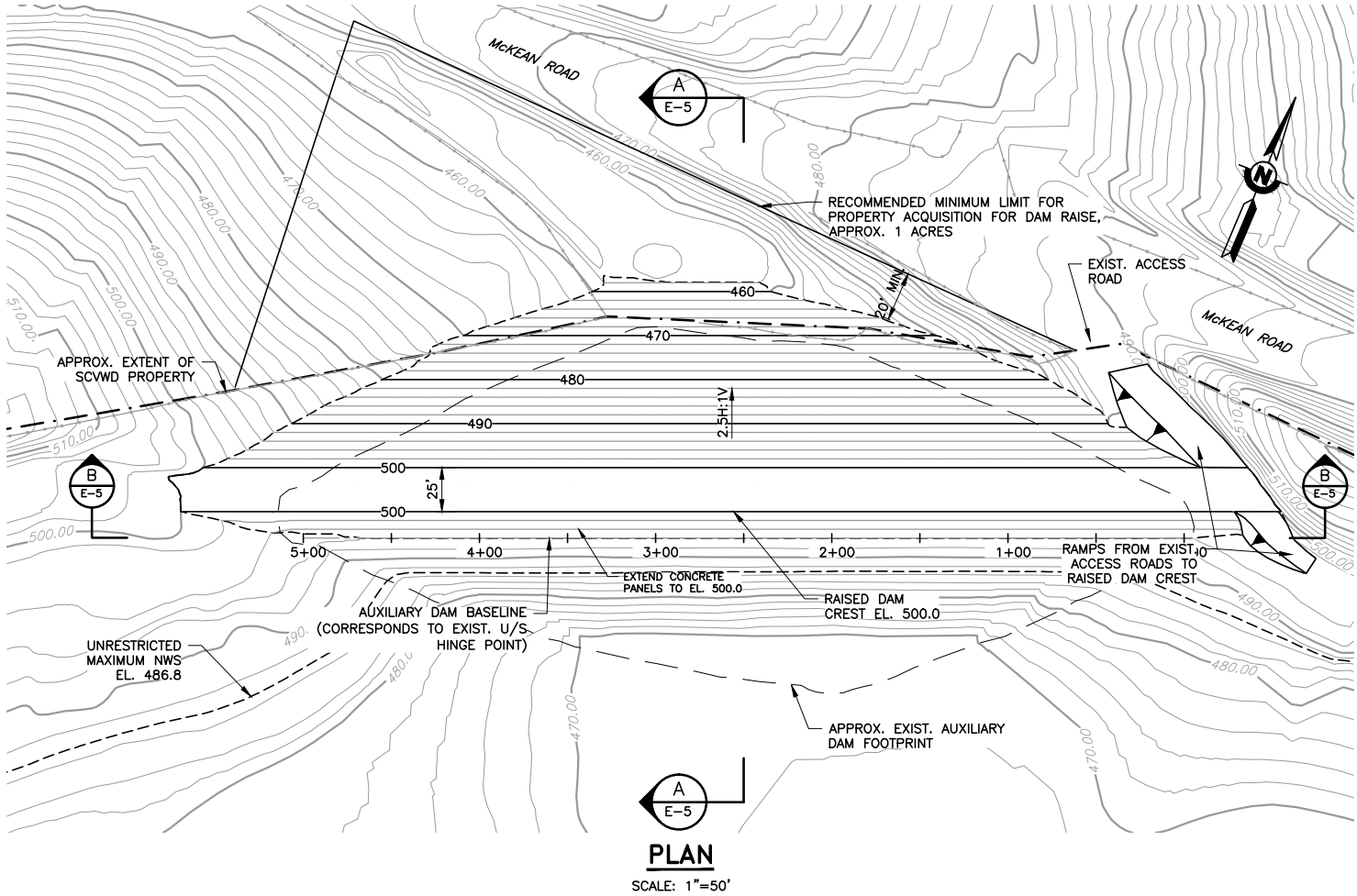
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					DESIGN			ACCEPTED BY DISTRICT	VERIFY SCALES	SHEET CODE:	
					P.J.E.					E-3	
					DRAWN				BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY		SHEET NUMBER:
					P.J.E.						9 OF 18
				CHECKED							
					J.G.H.	PROJECT ENGINEER DATE					



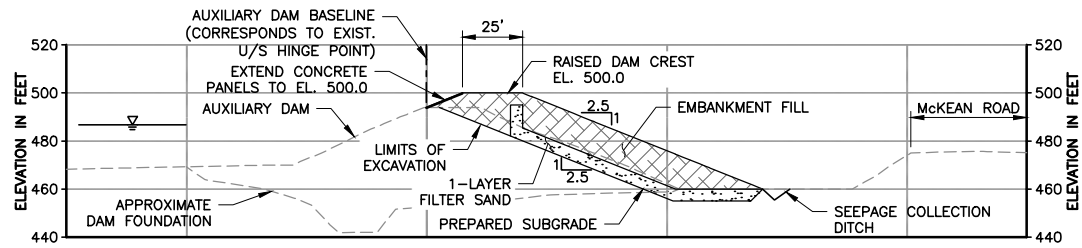
- NOTES:
- EXCAVATE FOUNDATION TO REMOVE ALLUVIUM AND EXPOSE FIRM, UNDISTURBED SEDIMENTARY FORMATION TO MEET APPROVED FOUNDATION OBJECTIVE.
 - SELECT FILL PLACED ON PREPARED FOUNDATION. SPECIFICATIONS TO BE DETERMINED DURING FINAL DESIGN.
 - PLACE 12-INCHES OF TOPSOIL AND SEED FINISHED EMBANKMENT SLOPES.
 - PLACE 12-INCHES OF GRAVEL ROAD SURFACING ON FINISHED DAM CREST.
 - DAM INSTRUMENTATION NOT SHOWN. NEW DAM INSTRUMENTATION TO BE DETERMINED DURING DESIGN.
 - CHIMNEY DRAIN LAYER SHOWN AS 8' WIDE FOR CONTRACTIBILITY; MINIMUM HORIZONTAL WIDTH IS 5' PER LAYER.

REV	DESCRIPTION	DATE	APPR.	REFERENCE INFORMATION AND NOTES	DATE	ENGINEERING CERTIFICATION	PROJECT NAME AND SHEET DESCRIPTION:	SCALE	PROJECT NUMBER
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					P.J.E.	DRAWN	MAIN DAM CROSS SECTIONS	VERIFY SCALES	SHEET CODE:
					P.J.E.	CHECKED		0 1" BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	E-4
					J.G.H.	PROJECT ENGINEER			SHEET NUMBER: 10 OF 18

- NOTES:
1. PLACE 12-INCHES OF TOPSOIL AND SEED FINISHED EMBANKMENT SLOPES.
 2. PLACE 12-INCHES OF GRAVEL ROAD SURFACING ON FINISHED AUXILIARY DAM CREST.



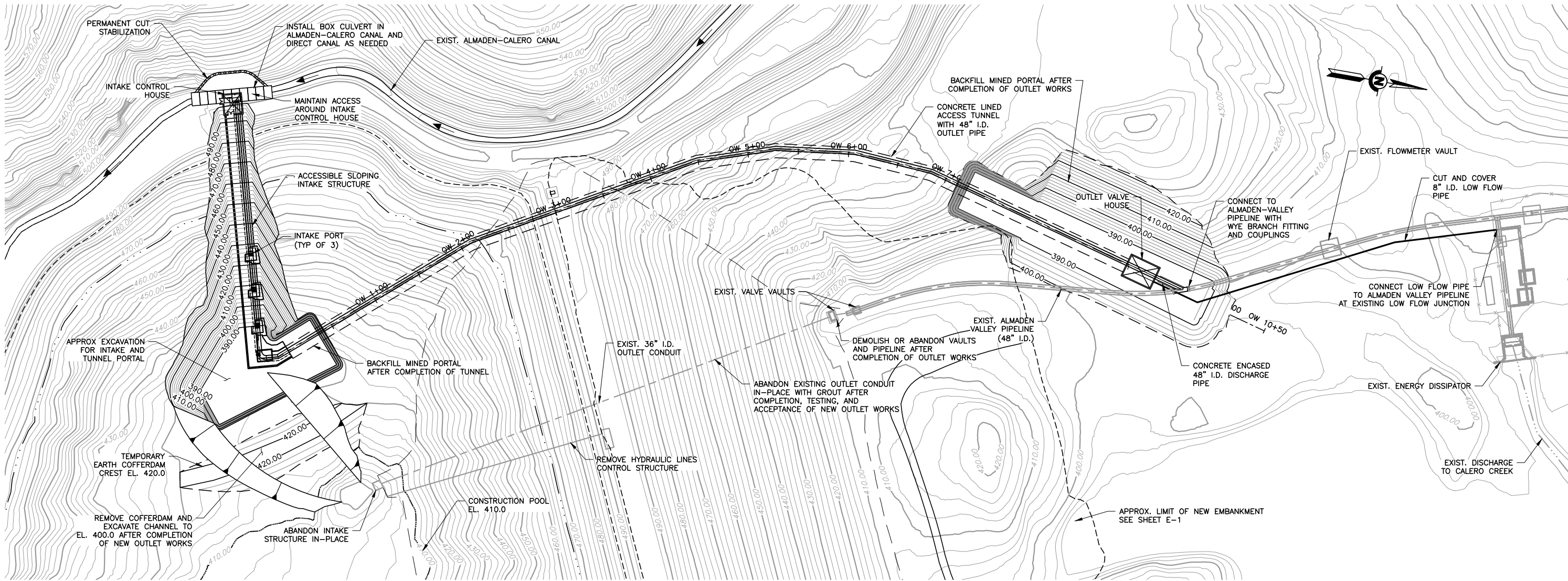
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E-5
AUXILIARY DAM
PROFILE ALONG DAM AXIS
SCALE: 1" = 40'



SECTION **A**
E-5
AUXILIARY DAM
STA 2+50
SCALE: 1" = 40'

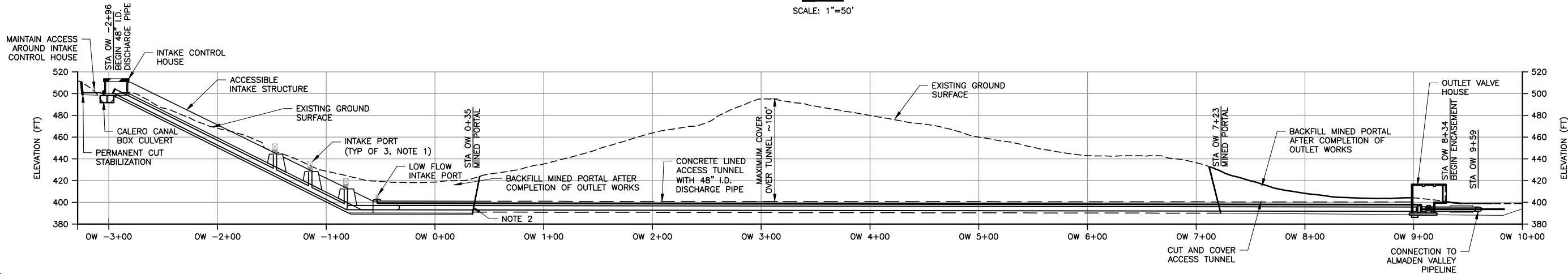
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							04-22-15						AS NOTED	1328380
							DESIGN						VERIFY SCALES	SHEET CODE:
							P.J.E.						0 1"	E-5
							DRAWN						BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	SHEET NUMBER:
							P.J.E.							11 OF 18
							CHECKED							
							J.G.H.	PROJECT ENGINEER DATE						

CaL_12_O-1-OW Plan and Profile



PLAN

SCALE: 1"=50'



PROFILE

SCALE: 1"=50'

- NOTES:
1. FINAL NUMBER AND ELEVATION OF INTAKE PORTS TO BE DETERMINED DURING FINAL DESIGN.
 2. INSTALL TEMPORARY TUNNEL BULKHEAD AT UPSTREAM TUNNEL PORTAL TO PREVENT DOWNSTREAM FLOODING DURING WINTER RAINY SEASON.

REV	DESCRIPTION	DATE	APPR.	REFERENCE INFORMATION AND NOTES



DATE
04-22-15
DESIGN
P.J.E.
DRAWN
P.J.E.
CHECKED
J.G.H.

ENGINEERING CERTIFICATION

PROJECT ENGINEER DATE

ACCEPTED BY DISTRICT

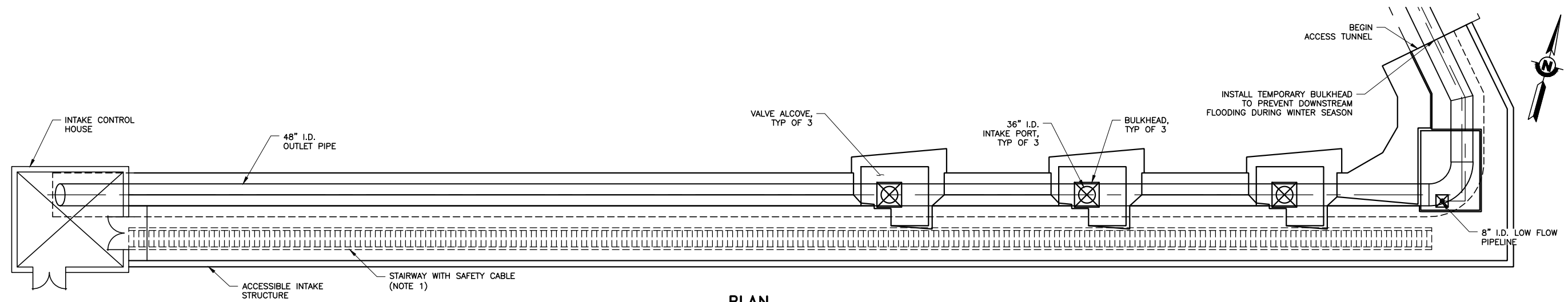
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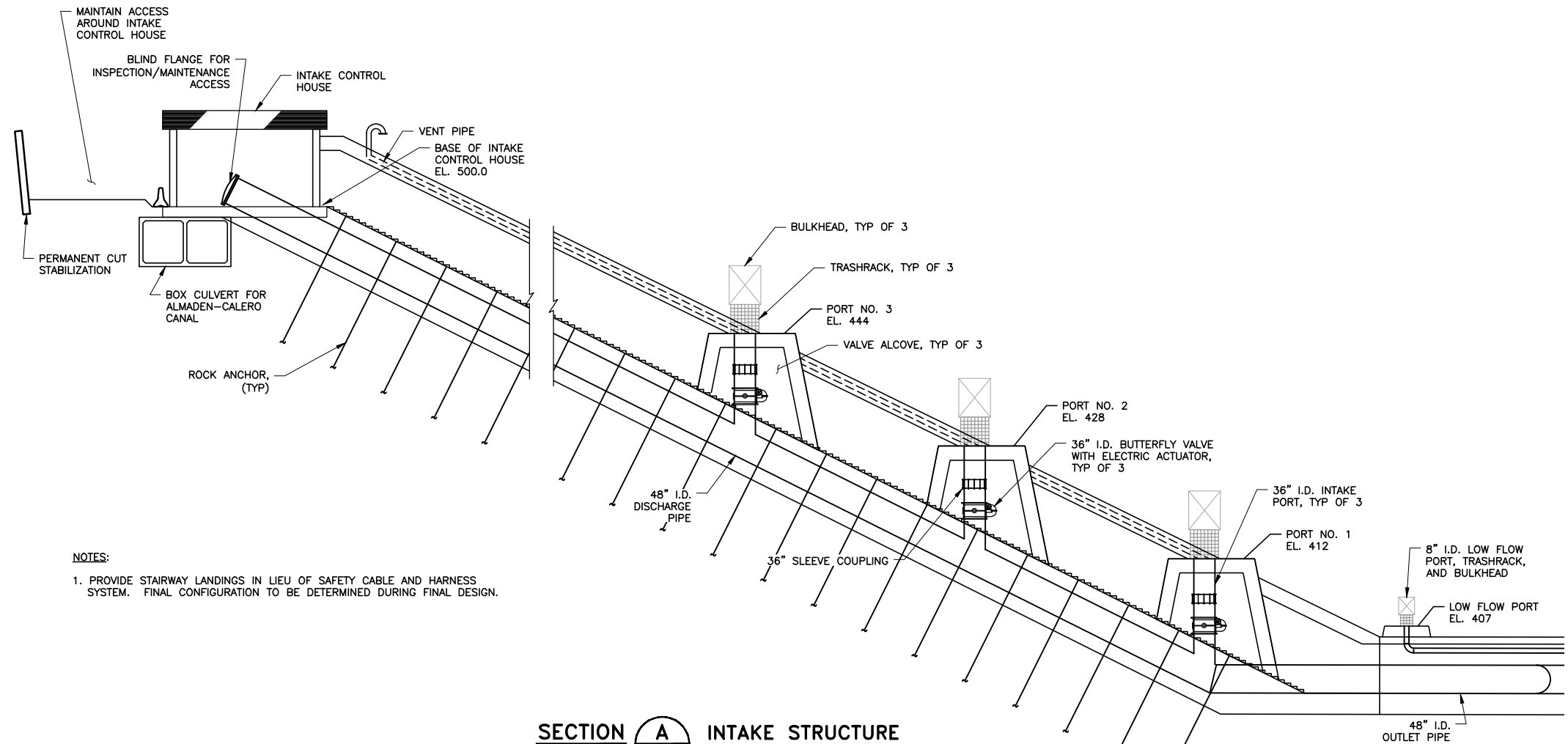
PROJECT NAME AND SHEET DESCRIPTION:
CALERO DAM SEISMIC RETROFIT PROJECT
STAFF-RECOMMENDED ALTERNATIVE
OUTLET WORKS
PLAN AND PROFILE

SCALE AS NOTED VERIFY SCALES 0 1" BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	PROJECT NUMBER 1328380 SHEET CODE: 0-1 SHEET NUMBER: 12 OF 18
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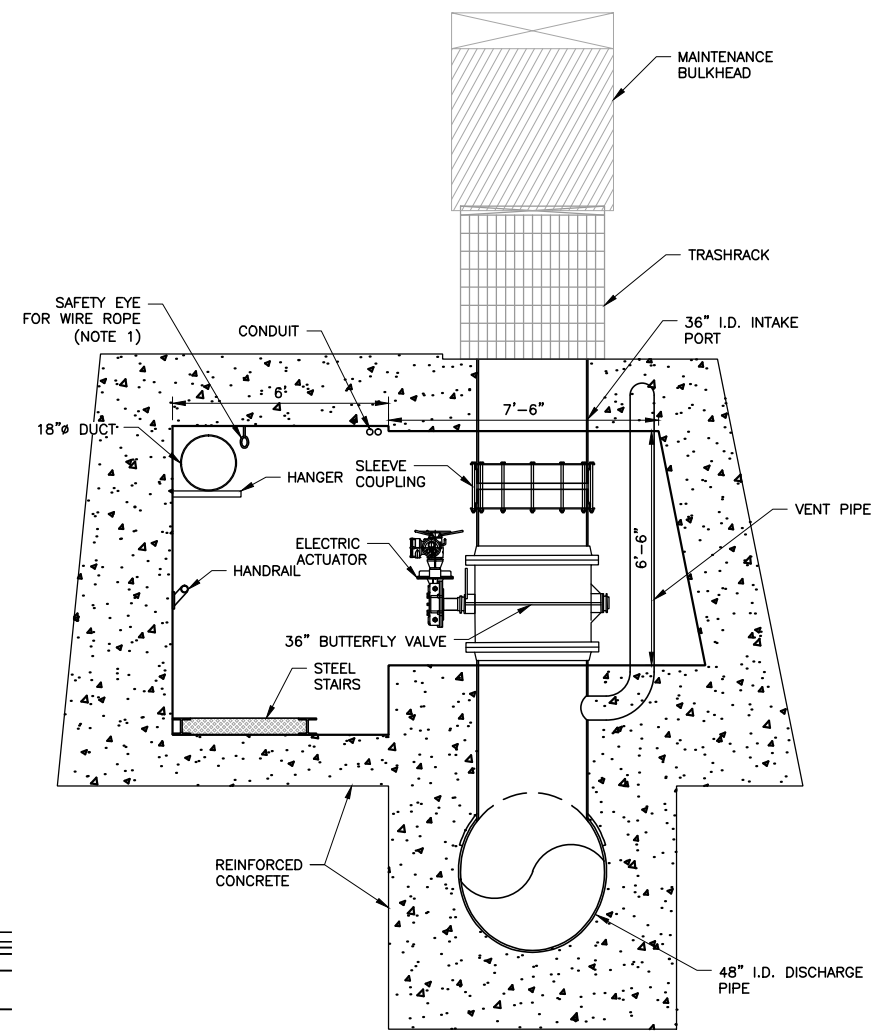
Cal_13_0-2-Intake Plan and Section



PLAN
SCALE: 1"=10'



SECTION **A** INTAKE STRUCTURE
0-2
SCALE: 1" = 10'

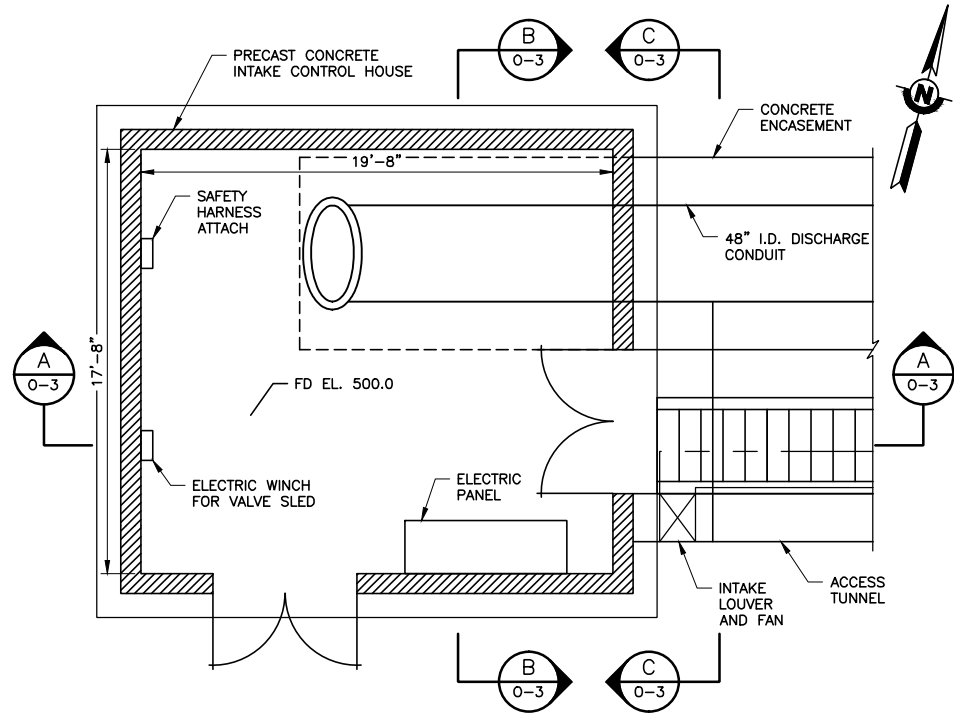


TYPICAL SECTION VALVE ALCOVE
SCALE: 3/8" = 1'

NOTES:
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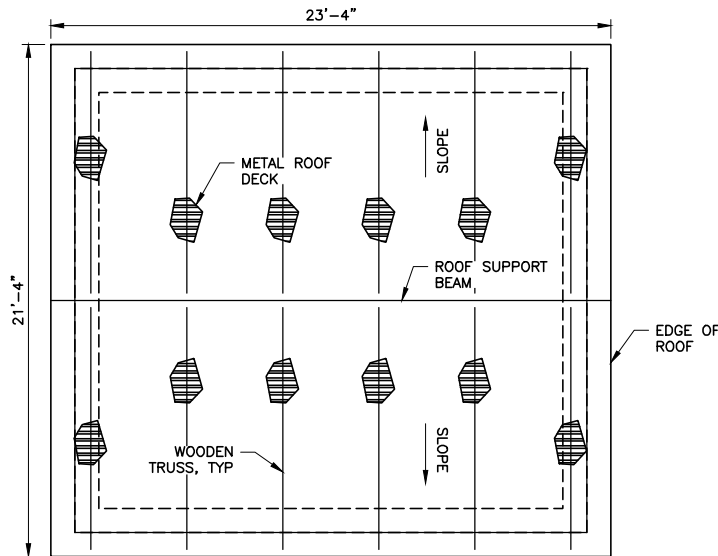
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							04-22-15						AS NOTED	1328380
							DESIGN						VERIFY SCALES	SHEET CODE:
							P.J.E.						0 1" BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	0-2
							P.J.E.							SHEET NUMBER: 13 OF 18
							CHECKED							
							J.G.H.	PROJECT ENGINEER	DATE	PROJECT ENGINEER	DATE			

Calero_14_0-3-Intake Control House



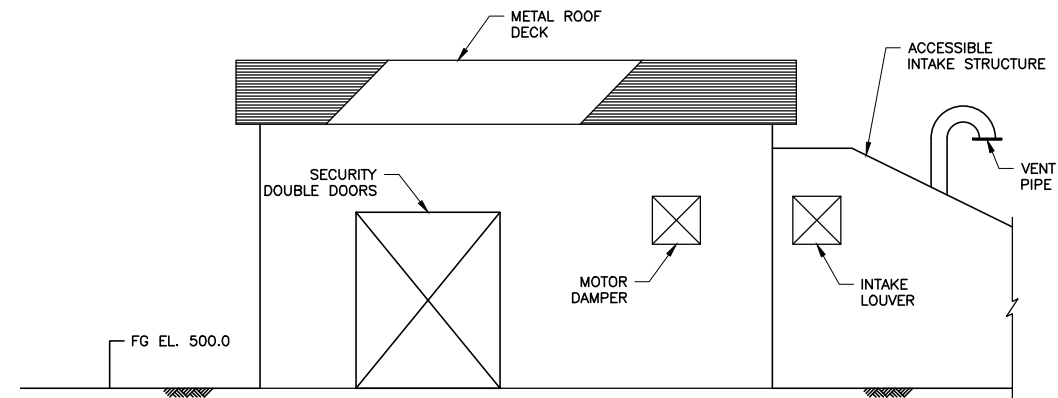
FLOOR PLAN

SCALE: 1/4" = 1'



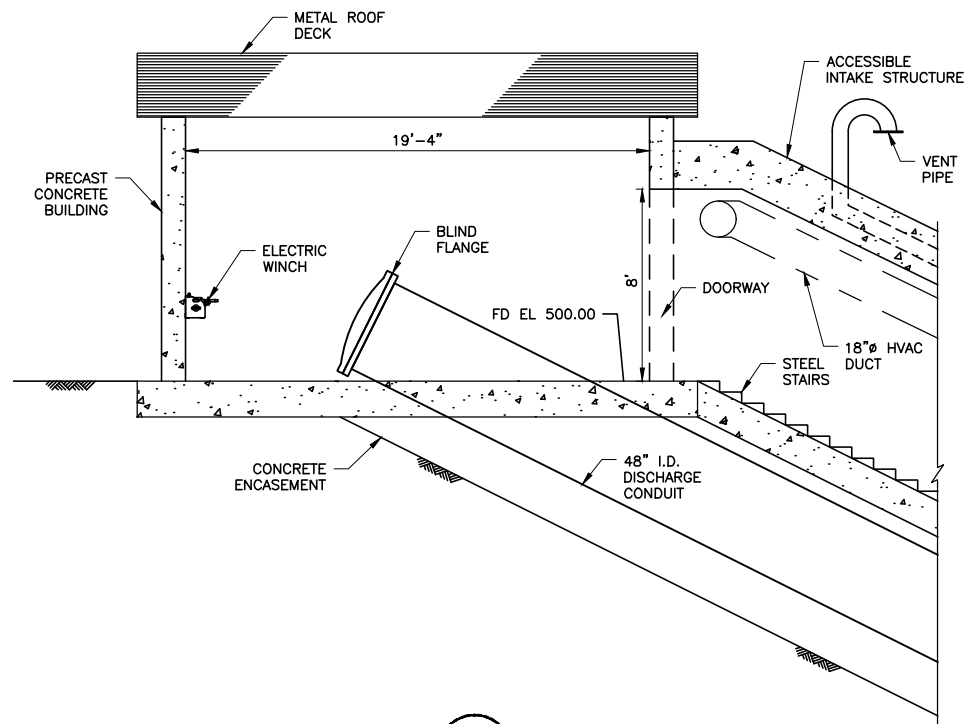
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SCALE: 1/4" = 1'



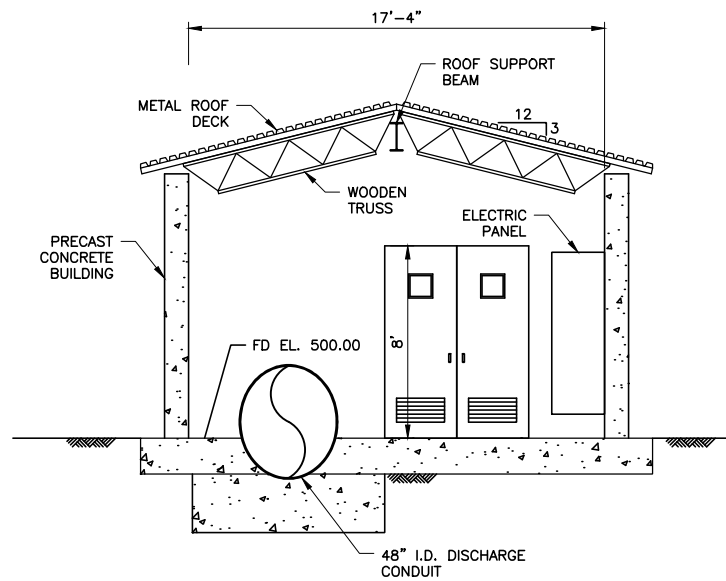
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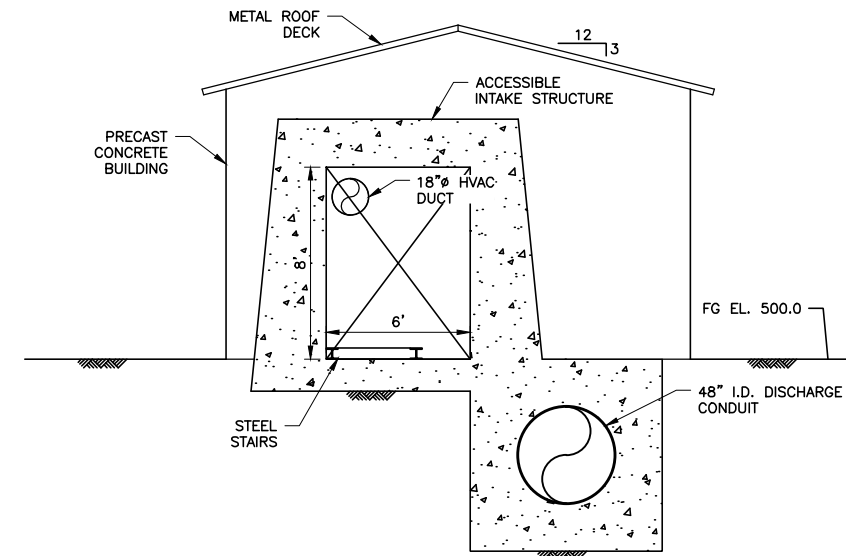
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0-3

SCALE: 1/4" = 1'



SECTION B
0-3

SCALE: 1/4" = 1'



SECTION C
0-3

SCALE: 1/4" = 1'

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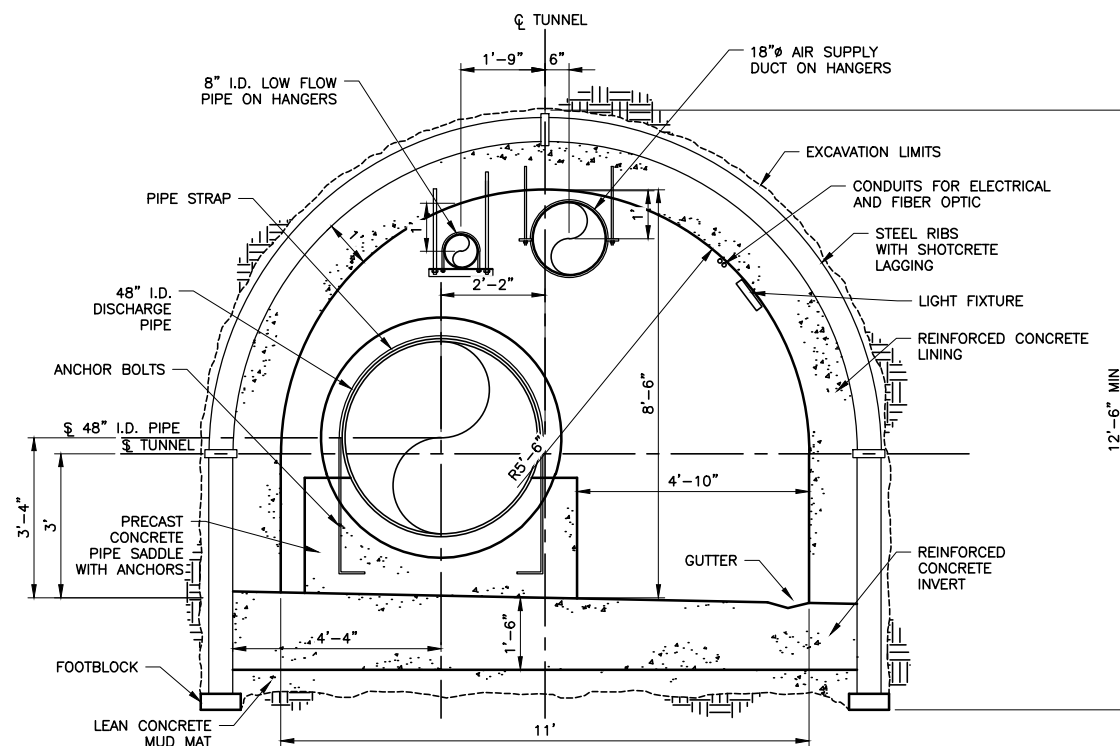


DATE 04-22-15	ENGINEERING CERTIFICATION
DESIGN P.J.E.	
DRAWN P.J.E.	
CHECKED J.G.H.	
PROJECT ENGINEER	DATE

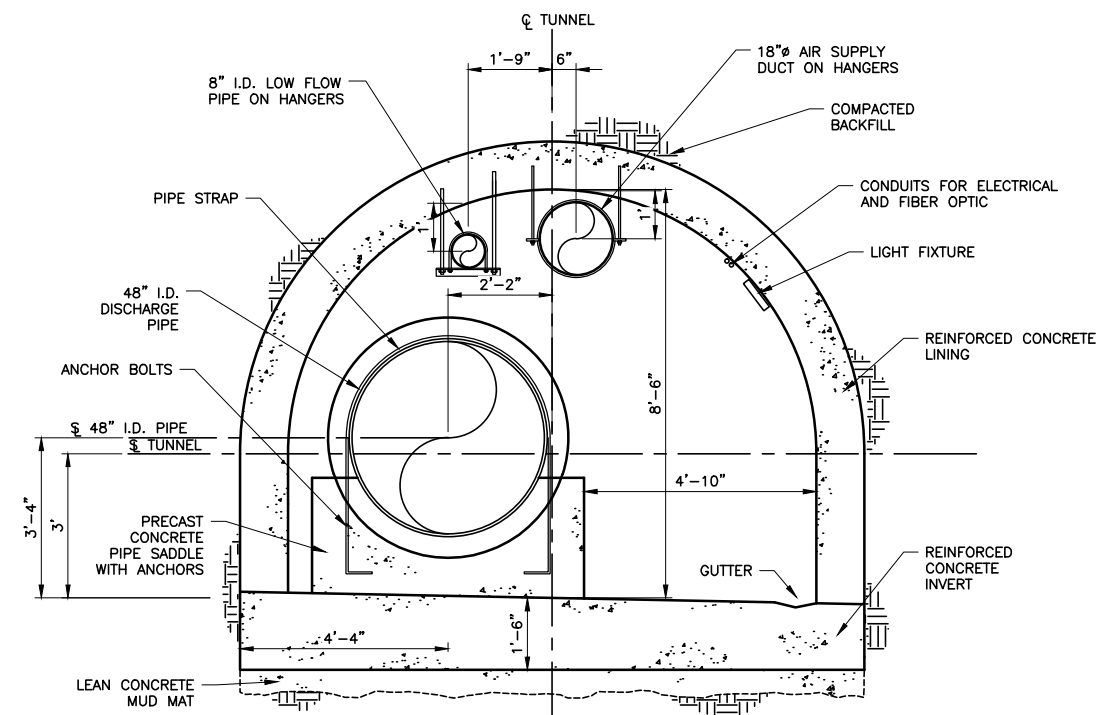
Santa Clara Valley Water District 	
ACCEPTED BY DISTRICT	
PROJECT ENGINEER	DATE

PROJECT NAME AND SHEET DESCRIPTION:
CALERO DAM SEISMIC RETROFIT PROJECT
STAFF-RECOMMENDED ALTERNATIVE
INTAKE CONTROL HOUSE
GENERAL ARRANGEMENT

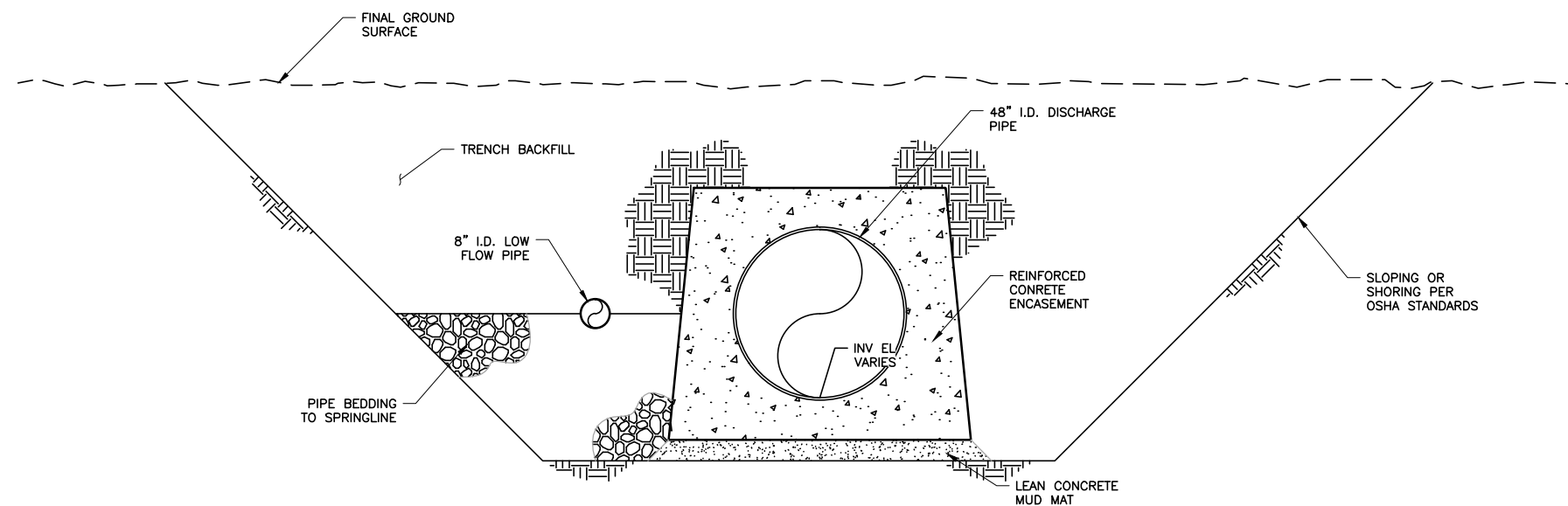
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TYPICAL SECTION  ACCESS TUNNEL - MINED SECTION
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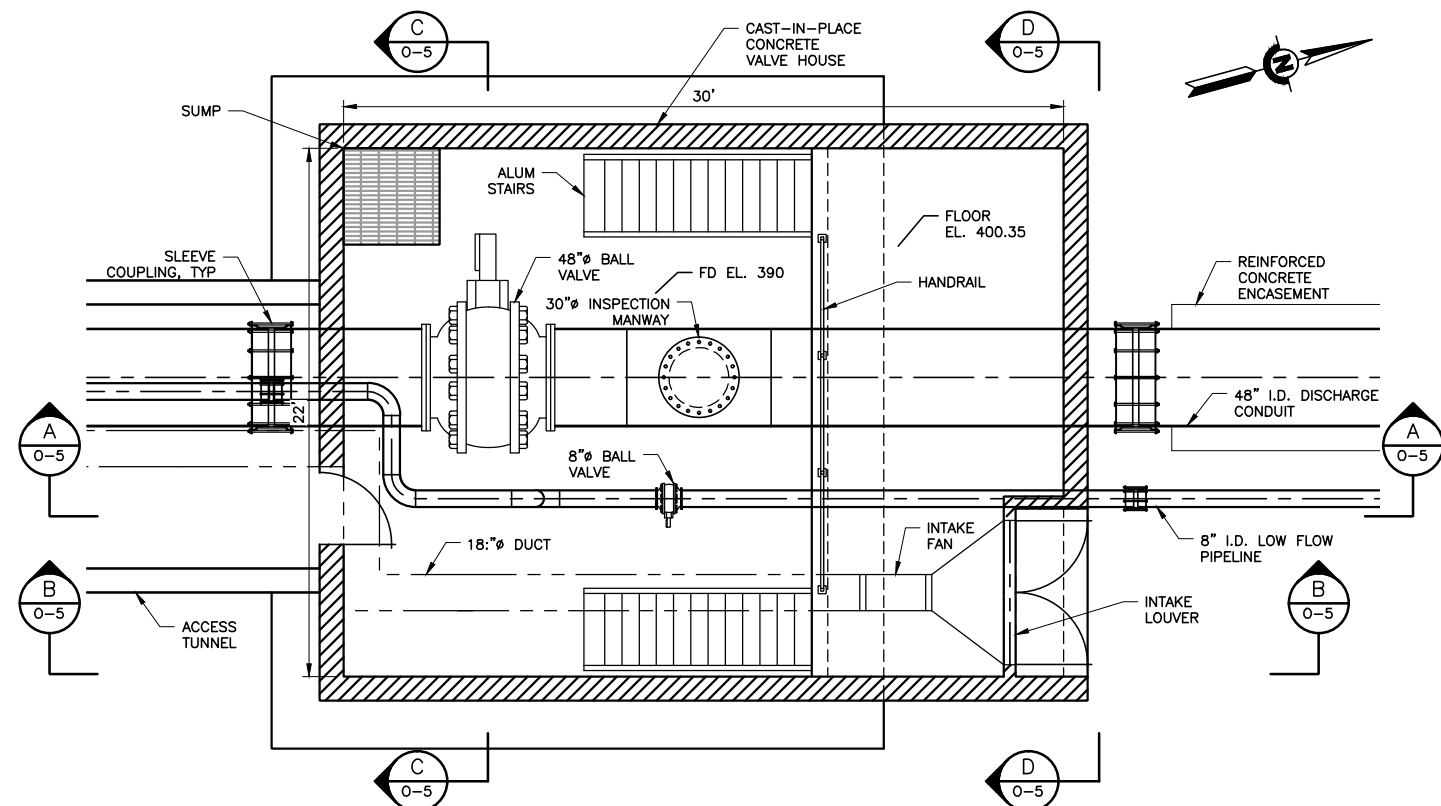


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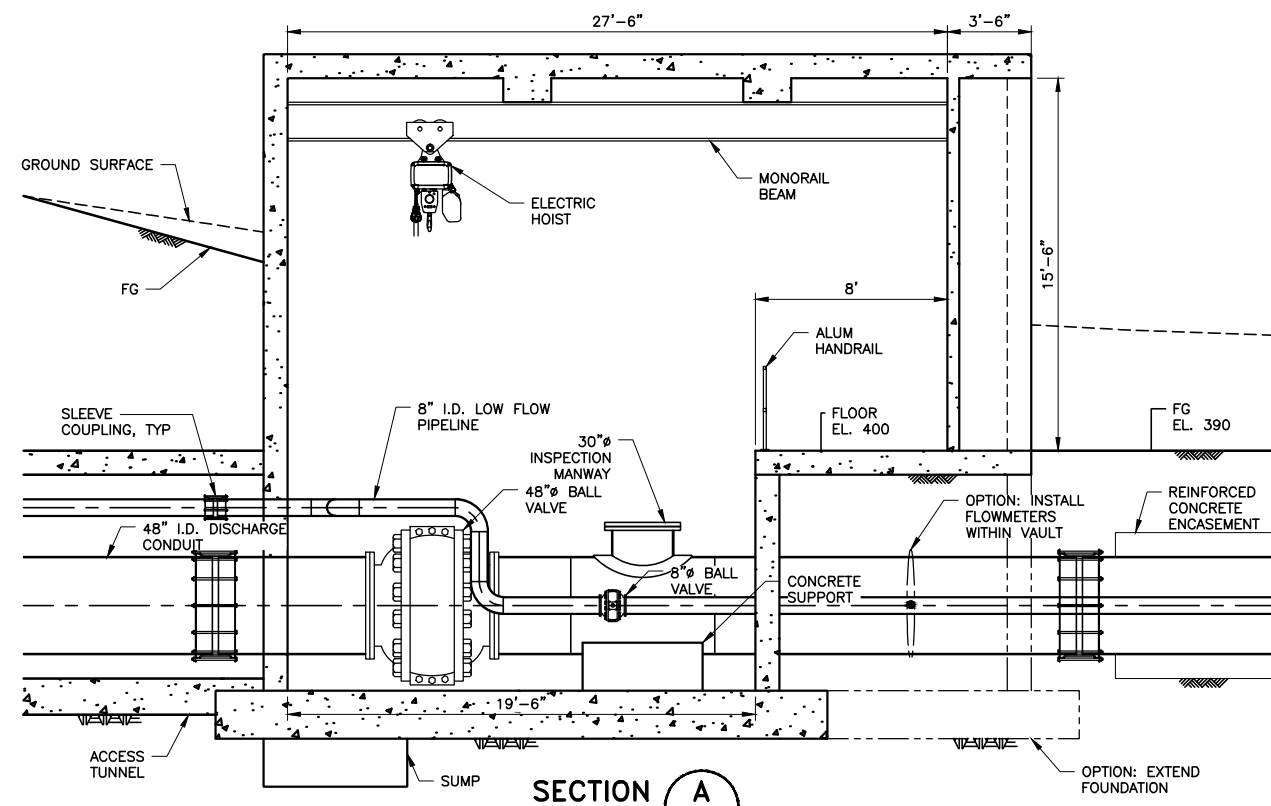
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REV	DESCRIPTION	DATE	APPR.	REFERENCE INFORMATION AND NOTES		DATE 04-22-15 DESIGN P.J.E. DRAWN P.J.E. CHECKED J.G.H. PROJECT ENGINEER DATE	 ACCEPTED BY DISTRICT PROJECT ENGINEER DATE	PROJECT NAME AND SHEET DESCRIPTION: CALERO DAM SEISMIC RETROFIT PROJECT STAFF-RECOMMENDED ALTERNATIVE ACCESS TUNNEL AND PIPE TRENCH CROSS SECTIONS	SCALE AS NOTED VERIFY SCALES  0 1" BAR IS ONE INCH ON ORIGINAL DRAWING IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	PROJECT NUMBER 1328380 SHEET CODE: 0-4 SHEET NUMBER: 15 OF 18
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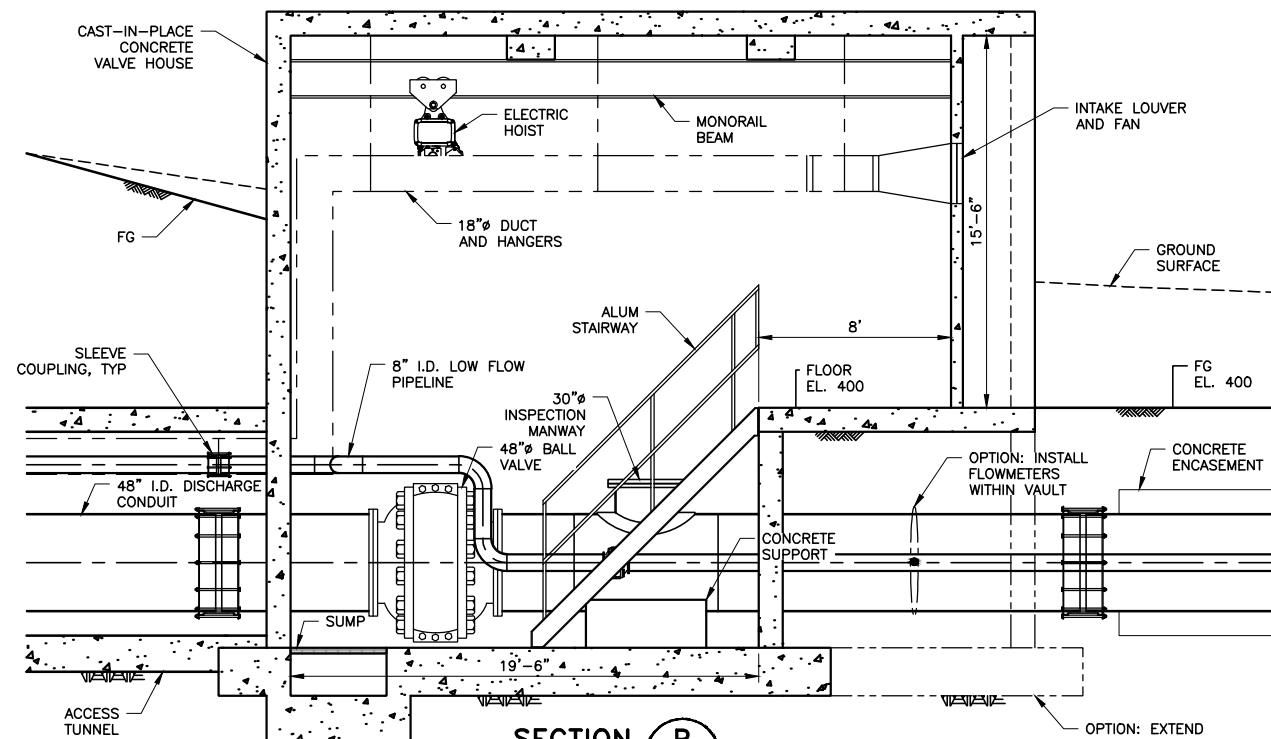
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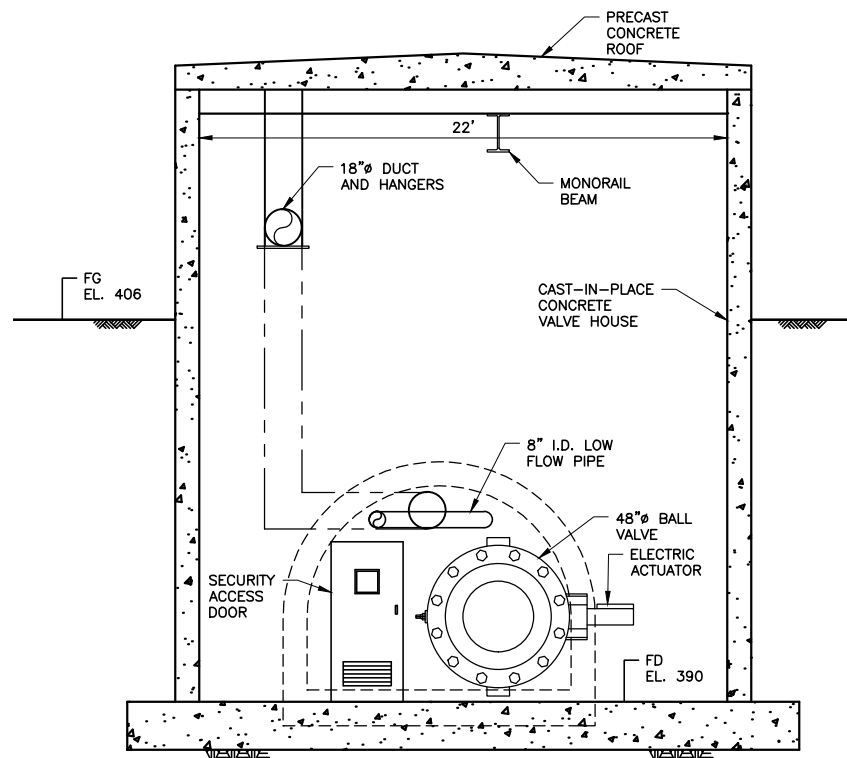
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0-5

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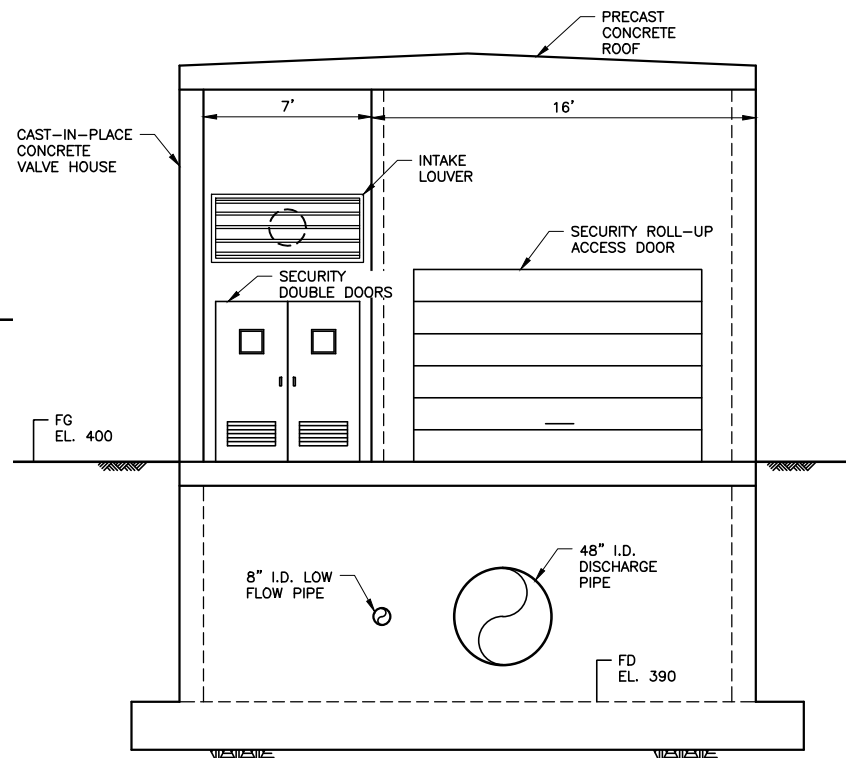
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0-5

SCALE: 1/4" = 1'



SECTION C
0-5

SCALE: 1/4" = 1'



SECTION D
0-5

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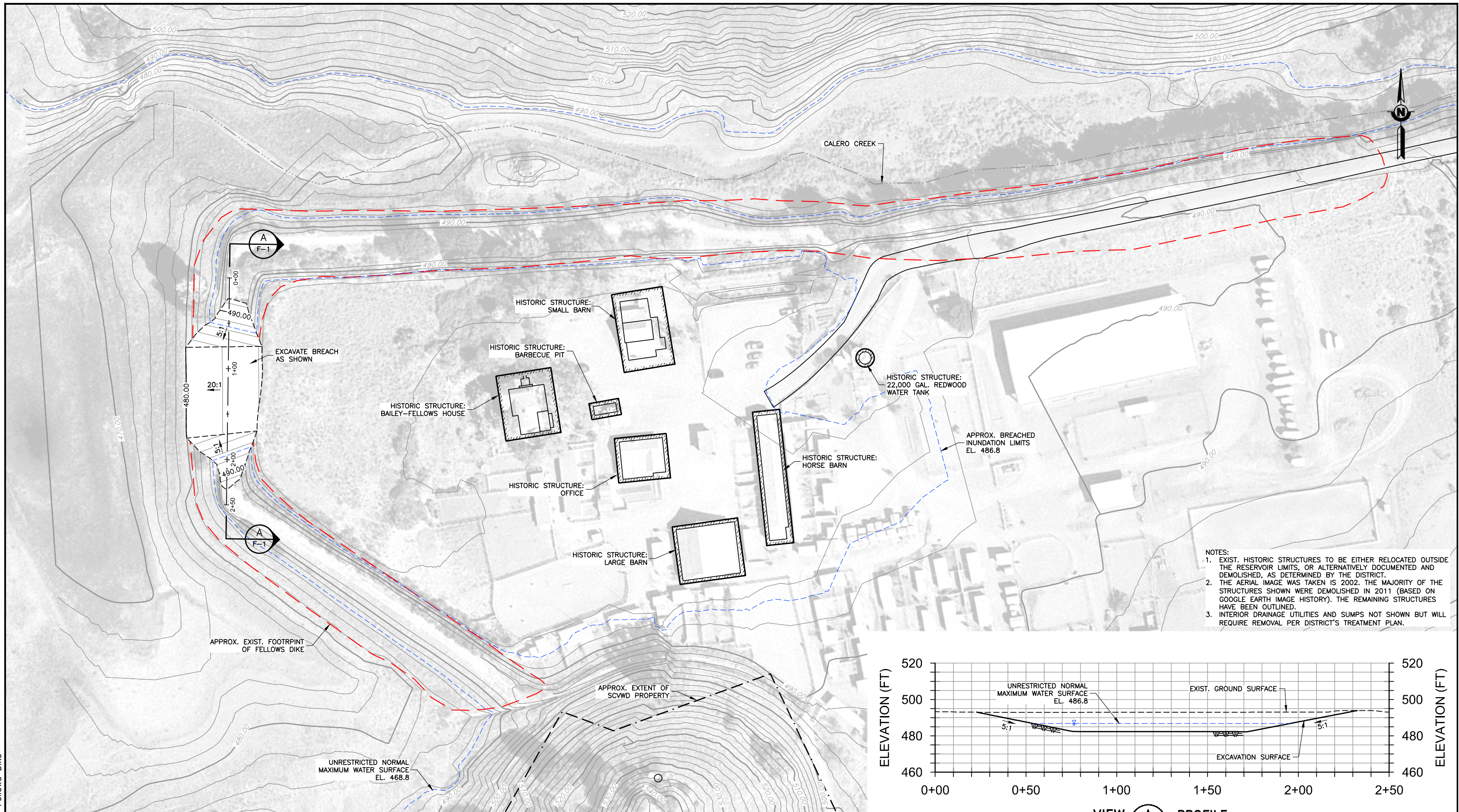
DATE 04-22-15	ENGINEERING CERTIFICATION
DESIGN	
P.J.E. DRAWN	
P.J.E. CHECKED	
J.G.H.	PROJECT ENGINEER DATE

Santa Clara Valley Water District
ACCEPTED BY DISTRICT
PROJECT ENGINEER DATE

PROJECT NAME AND SHEET DESCRIPTION:
CALERO DAM SEISMIC RETROFIT PROJECT
STAFF-RECOMMENDED ALTERNATIVE
OUTLET VALVE HOUSE
GENERAL ARRANGEMENT

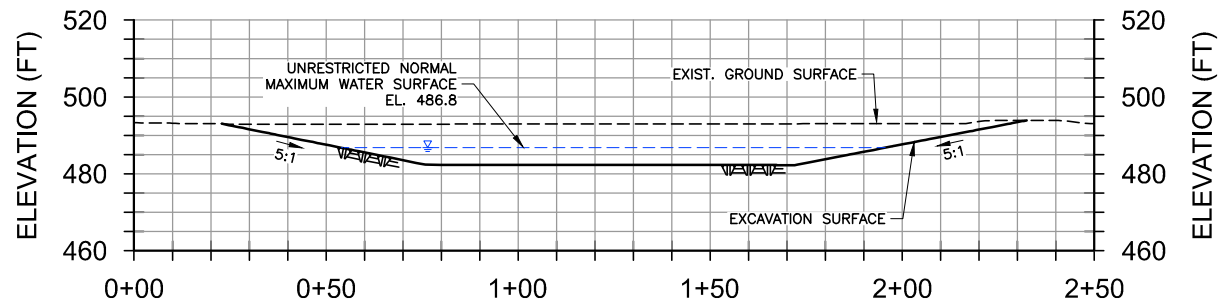
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Col_18_F-1-Fellows Dike



PLAN

SCALE: 1"=50'



VIEW



PROFILE
FELLOWS DIKE BREACH

SCALE: 1" = 50'

REV	DESCRIPTION	DATE	APPR.	REFERENCE INFORMATION AND NOTES

GEI Consultants	DATE	04-22-15
	DESIGN	N.K.S.
	DRAWN	N.K.S.
	CHECKED	N.K.S.
	J.G.H.	
ENGINEERING CERTIFICATION		
PROJECT ENGINEER DATE		

Santa Clara Valley Water District	
ACCEPTED BY DISTRICT	
PROJECT ENGINEER	DATE

PROJECT NAME AND SHEET DESCRIPTION:	
CALERO DAM SEISMIC RETROFIT PROJECT	
STAFF-RECOMMENDED ALTERNATIVE	
FELLOWS DIKE	

SCALE	PROJECT NUMBER
AS NOTED	1328380
VERIFY SCALES	SHEET CODE:
0 1"	F-1
BAR IS ONE INCH ON ORIGINAL DRAWING	SHEET NUMBER:
IF NOT ONE INCH ON THIS SHEET, ADJUST SCALES ACCORDINGLY	18 OF 18

FINAL

Calero Dam Benefit-Cost Analysis

January 23, 2020

Prepared for:

Bal Ganjoo
Project Manager

Valley Water
5750 Almaden Expressway
San Jose, CA 95118

Prepared by:

Nik Carlson
Senior Economist

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Oakland, CA 94612

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List of Acronyms and Abbreviations

\$/af	dollars per acre foot
af	acre-feet
BCA	Benefit-Cost Analysis
BCR	Benefit-Cost Ratio
cfs	cubic feet per second
CVP	Central Valley Project
DSOD	Division of Safety of Dams
EAD	equivalent annual damages
ESA	Endangered Species Act
ESR	Emergency Supply Reserves
FEMA	Federal Emergency Management Agency
FR	Federal Register
GIS	geographic information system
IP	Intrinsic Potential
LCA	least cost alternative
MCE	maximum credible earthquake
\$M/yr	million dollars per year
NAVD88	North American Vertical Datum of 1988
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPV	Net Present Value
O&M	operating and maintenance
PMF	probable maximum flood
PV	Present Value
RUVD	Recreation Use Values Database
SCVHA	Santa Clara Valley Habitat Agency
SWRCB	State Water Resources Control Board
TAF/yr	total acre-feet per year

Executive Summary

Introduction

Valley Water owns and operates Calero Dam and facilities located approximately 12 miles southeast of downtown San Jose. Design and construction of the facilities occurred in the 1930's with completion in 1935. Calero Reservoir fulfills two primary roles within Valley Water's raw water system; water supply and operational reliability. Calero Reservoir allows Valley Water to use its annual water rights of 9,500 acre-feet (3,500 acre-feet [af] from the Calero Watershed and 6,000 af from the Almaden Calero Canal) and stores approximately 10,000 (af) at full capacity. The reservoir is filled from local watershed runoff, water transferred from Almaden Reservoir (via the Almaden-Calero Canal) and imported water from the Federal Central Valley Project and Anderson Reservoir supplies (via the Cross-Valley Pipeline). Calero Dam and facilities are under the jurisdiction of the California Division of Safety of Dams (DSOD).

Calero Reservoir's original and future primary purpose is water retention for groundwater basin recharge, short-term storage and water transfer. The reservoir predominantly operates as an annual fill and drain facility with limited quantities of carry-over water held over between water years. Retained water is used to supply both groundwater recharge and Valley Water's drinking water treatment facilities and is also held in reserve for drinking water during emergency conditions. Calero Dam and reservoir also provide a flood control benefit for a portion of the upper Guadalupe River watershed.

An evaluation completed in 2012 determined that Calero Dam has inadequate seismic stability from ground shaking associated with the maximum credible earthquake¹ (MCE) on local controlling faults. On that basis, Calero Reservoir is restricted to elevation 467.4 feet, approximately 19 feet below spillway level which limits storage to approximately 4,414 acre-feet or 46 percent of the normal 9,738 af storage capacity. Additional studies in 2013 to 2017 indicated other dam safety issues including inadequate spillway capacity and design, and outlet works deficiencies due to the aging infrastructure.

Since 2013, the planning, investigation, and analyses, have advanced the retrofit of Calero Dam and facilities to the 60 percent design, and the environmental has been initiated. The implementation of the complete retrofit will not only remove the DSOD storage restrictions allowing full operational use of the reservoir, but also improve reliability and extend the service life of the Calero Dam facilities for another 50 to 100 years.

Valley Water seeks to determine if the realized benefits of a complete seismic retrofit of the Calero Dam facilities exceed the anticipated costs. This technical report provides a preliminary Benefit-Cost Analysis (BCA) comparing the benefits and costs of the seismic retrofit project with two conceptual alternatives to assist Valley Water in its capital projects evaluation and decision-making.

The BCA estimates are based on those benefits and costs that can be quantified for each alternative. The BCA estimated and aggregated the expected future benefits and costs for each project alternative to determine their expected Net Present Value (NPV) and their Benefit-Cost Ratios (BCRs). The BCA results show the complete retrofit of Calero Dam and facilities is the best value for the Valley Water expenditure.

Project Alternatives

Base Case – Complete Retrofit of Calero Dam and Facilities to Restore Full Storage Capacity

The Base Case would retrofit the dam to improve its seismic stability and dam safety deficiencies by partially removing the downstream embankment of the main dam and underlying liquefiable soils,

¹ The maximum credible earthquake on local controlling faults is a Richter scale magnitude 7.9 event on the San Andreas Fault (approximately 8 miles from dam site), or 6.7 event on the Shannon Fault (approximately 1 mile from the dam site).

stabilizing the downstream portion of the dam with an internal filter and drain system and earthfill buttress, installing new intake and outlet works and replacing the spillway with a larger capacity spillway meeting current standards. The retrofit will remove the DSOD storage restrictions and restore the reservoir maximum storage capacity to approximately 9,740 acre-feet.

Alternative 1 – Lowered Spillway

This alternative would partially retrofit the dam. A new spillway would be constructed at an elevation approximately 20 feet lower than the existing level to permanently conform with the current DSOD storage restrictions. The embankment would also be buttressed to improve its seismic stability. The lowered spillway results in an estimated future maximum storage capacity of 4,414 acre-feet. This represents an estimated permanent storage capacity loss of 5,324 acre-feet compared to the Base Case design. Calero Dam and facilities would remain under DSOD jurisdiction. The DSOD would have to approve the design of less thorough dam modifications to meet their seismic standards.

Alternative 2 – Dam Removal

Calero Dam would be partially removed to the approximate original stream-bed elevation with the reservoir area restored as streambed and riparian habitat. This alternative would entail a permanent storage capacity loss of approximately 9,740 acre-feet, with no future ability to regulate stream-flow for water supply, environmental or other purposes. A flood detention basin within the existing reservoir footprint is planned to provide some replacement flood control benefits.

Project Benefits

Complete Retrofit (Base Case) or implementation of Alternatives 1 or 2 will result in future water supply, water quality, flood protection, recreation and habitat benefit changes. The BCA identifies, and when possible, quantifies each alternative's projected operational performance on an "average-year" annual basis. The projected average year operations are based on Calero's past operations adjusted for known past performance factors (e.g. water year precipitation, facility constraints and system outages) and future facility constraints (e.g. Alternative's reduced storage capacity and emergency water supply reserve requirements).

The water supply benefit values determined for the BCA Alternatives depend on their average future quantities of supplied water and the unit benefit values applied to that water. Water supply benefit values are generally determined by the corresponding cost for its replacement based on the least cost alternative supply option available (see Section 6.6). The BCA uses \$950/acre-foot benefit value for the Los Vaqueros Expansion and Sites Reservoir imported supplies as a conservative unit benefit value for the analysis. Use of this unit benefit value, rather than the system originated supply (\$1,600 per acre-foot) ensures that the BCA will understate the actual benefits for water related use and that the BCA findings will consequently represent a conservative representation and evaluation of the BCA Alternatives.

Water Supply Benefits

The average future system originated water supply yield of the BCA Alternatives would range from 5,751 acre-feet per year (Base Case) to 302 acre-feet per year (Alternative 2) (see Section 6.1).

Table ES-1 shows the average annual surface water retention quantities projected for each Calero Dam alternative and the estimated annual benefit value of the system originated water supply yields. The table also shows the replacement water quantities and estimated minimum cost required under Alternatives 1 and 2 to meet the Base Case's system originated water supply conditions.

Table ES-1: Average Annual Surface Water Retention and Supply Benefits (2019\$)

Water Supply Quantity/Benefit Values	Base Case	Alternative 1	Alternative 2
Retained Calero Watershed Natural Inflow	3,024 af	1,002 af	0 af
Almaden to Calero Transfers	3,151 af	1,366 af	0 af
Total Retained Surface Water (Avg. Year)	6,174 af	2,368 af	0 af
Evaporation	(424) af	(162) af	0 af
System Originated Supply – Annual (Avg. Year)	5,751 af	2,206 af	302 af
<i>Water Supply Unit Benefit Value (a)</i>	<i>\$950/af</i>	<i>\$950/af</i>	<i>\$950/af</i>
System Originated Supply Value – Annual (a)	\$5.46M	\$2.10M	\$0.29M
Replacement Water Supply Need	0 af	3,545 af	5,448 af
Replacement Water Supply Cost – Annual (a)	\$0	\$3.37M	\$5.18M

Note: (a) Benefit value conservatively based on imported water supplies as a least cost alternative (see Section 6.6).

Total Annual Benefits

Table ES-2 shows the estimated annual benefits by benefit type for each alternative (see Section 7). The one-time benefit for Alternative 2's environmental improvements in 2030 are shown as an annualized value to allow direct comparison with the other benefit value estimates.

Table ES-2: Annual Benefit Summary and Comparison

Benefit Type	Annual Benefits (\$M/yr, 2019\$)		
	Base Case	Alternative 1	Alternative 2
Water Supply	\$5.46	\$2.10	\$0.29
Emergency Use	\$0.07	\$0.07	\$0
Water Reliability (a) (d)	Extensive	Limited	None
Flood Reduction	No Change	Reduced	Reduced
Water Rights (a) (e)	No Change	Major Loss Potential	Near Full Loss Potential
Water Quality (b)	\$0	\$0	\$0
Habitat (Riparian + Wildlife)	\$0	\$0	\$0.98 (c)
Recreation	\$1.48	\$1.13	\$0
Total Benefits	\$7.01	\$3.30	\$1.27

Notes:

- (a) Benefits quantified but no monetized benefit estimation.
- (b) All alternatives maintain existing conditions and consequently no projected benefit change.
- (c) Annualized value of Alternative 2's estimated \$25.1 million total environmental benefits in 2030.
- (d) Non-supply benefits from both operational flexibility (i.e. water system management for routine and planned system needs) and operational resilience (i.e. water system management for unplanned system needs).
- (e) Senior appropriate entitlements (based on historical use) for surface water retained by Calero facilities.

Alternative Costs

Estimated Construction and O&M Costs

Table ES-3 shows the estimated total construction and operating and maintenance (O&M) costs for each alternative with the estimated present value of their total lifecycle costs over the 50-year study period in 2019 dollars terms assuming a 2.5 percent discount rate. Construction costs were developed by HDR (Base Case) and GEI Consultants (Alternatives 1 and 2) (Appendix A).

Table ES-3: Total Project Costs by Alternative – Present Value (2.5%, \$M, 2019\$)

Cost Item	Base Case	Alternative 1	Alternative 2
<i>Water Storage capacity</i>	<i>9,738 af</i>	<i>4,414</i>	<i>0 af</i>
Total Construction	\$119.6	\$58.3	\$58.5
Interest During Construction	\$5.5	\$1.6	\$3.0
Total Development Cost – Nominal	\$125.1	\$59.9	\$61.5
Total Development Cost – NPV	\$107.7	\$51.6	\$52.9
O&M – Annual	\$0.35	\$0.35	\$0.25
Total O&M – NPV	\$7.8	\$7.8	\$5.5
Total Lifecycle Cost – NPV	\$115.5	\$59.3	\$58.5

Total Supply Replacement Cost

Table ES-4 shows the replacement water quantity needed under Alternative 1 and 2 to offset the net loss in Water Valley's system originated supplies if the Base Case is not developed. It also shows the additional cost for Valley Water to replace that foregone local supply of water.

Table ES-4: Supply Replacement Costs (2019\$)

Cost/Benefit Values	Base Case	Alternative 1	Alternative 2
System Originated Supply – Annual (Avg. Year) (af)	5,751 af	2,206 af	302 af
Estimated Average Cost of Supply – Total (\$M/yr)	\$5.21	\$2.68	\$2.64
Estimated Average Cost of Supply – Unit (\$/af)	\$906	\$1,213	\$8,737 (b)
Replacement Water Quantity Required (af)	0 af	3,545 af	5,448 af
Replacement Water Supply Cost – Annual (a) (\$M/yr)	\$0	\$3.37	\$5.18
Replacement Water Supply Cost – NPV (\$M)	\$0	\$86.6	\$133.0
Total Water Supply Cost (Base Case Quantity) (\$M/yr)	\$5.21	\$6.05	\$7.82
Total Water Supply Cost (Base Case Quantity) – NPV (\$M)	\$115.5	\$145.9	\$191.5

Notes:

- (a) Benefit value of \$950/acre-foot conservatively based on imported Los Vaqueros Expansion water as a least cost alternative.
- (b) Water supply is not a primary purpose of Alternative 2's design and operations and its estimated water supply cost has not been adjusted for cost-sharing between non-supply purposes. Consequently, its high estimated water supply cost.

BCA Findings

Net Benefits and Benefit-Cost Ratio

Table ES-5 shows the estimated NPV of the monetized annual benefits. Over Calero Dam's projected 50-year lifespan, the Base Case's future operations are estimated to result in total benefits with a \$155.4 million NPV.

Table ES-5: Total Benefit Summary (2030 to 2079) and Comparison

Factor	Total Net Present Value (2030 to 2079) (\$M, 2019\$)		
	Base Case	Alternative 1	Alternative 2
Water Supply	\$121.0	\$46.4	\$6.4
Emergency Use	\$1.6	\$1.6	\$0
Habitat (Riparian + Wildlife)	\$0	\$0	\$19.1
Recreation	\$32.7	\$25.1	\$0
Total Benefit Value	\$155.4	\$73.1	\$25.5
Total Development Cost	\$107.7	\$53.3	\$52.9
Total O&M Cost	\$7.8	\$7.8	\$5.5
Total Lifecycle Cost	\$115.5	\$59.3	\$58.5
Net Benefits	\$39.9	\$13.8	(\$33.0)
Benefit-Cost Ratio	1.35	1.23	0.44

The BCA results clearly show that the Base Case would be most economically beneficial option for Valley Water with expected future net benefits totaling approximately \$40 million NPV over the 50-year study period. It is also the most economically efficient alternative since its BCR of 1.35 is the highest. This indicates that Base Case will generate more benefits per dollar invested than Alternative 1 which has a BCR of only 1.23.

Alternative 1 would also be economically beneficial but would result in total net benefits with only a \$13.8 million NPV which would be more than \$26 million less than the Base Case.

Alternative 2 is projected to result a \$33.0 million (NPV) net benefit loss (i.e. net cost) and have a BCR of 0.44. This indicates that Alternative 2 would be a costly undertaking for Valley Water that would not be expected to yield enough future benefits to offset its expense.

Specific Benefit Findings

- System originated water supplies obtained from Calero watershed surface water run-off and Almaden-Calero Canal transfer storage are the largest and most important benefit category.
 - Base Case: 5,751 acre-feet/year with total future benefits of \$121 million (NPV)
 - Alternative 1: 2,206 acre-feet/year with total future benefits of \$46.4 million (NPV)
 - Alternative 2: 302 acre-feet/year with total future benefits of \$6.4 million (NPV)
- The Base Case's operational flexibility and resiliency benefits could not be quantified but are an important component of Valley Water's system-wide operations capabilities for: (1) Imported water and carryover storage; (2) Secondary supply for water treatment plants; and (3) System redundancy for unplanned outages.

Summary Comparison

Base Case

- Restores Calero Reservoir to its previous (original) storage capacity and performance levels.
- Highest net benefits (\$39.9 million NPV) and most cost-effective based on the BCR (BCR = 1.35).
- Highest level of operational flexibility, recreation, and emergency supply reserve benefits.
- Maintains existing water rights, flood reduction, habitat and water quality conditions.
- Provides greatest flood risk reduction benefits of all the alternatives.

Alternative 1

- Reduced storage capacity greatly limits future operational performance and benefits.
- Positive net benefits (\$13.8 million NPV) and positive BCR (BCR = 1.23).
- Estimated minimum \$3.4 million/year replacement water cost compared to the Base Case.
- Operational flexibility use and benefits greatly decreased from Base Case levels.
- Potential loss of 5,086 acre-feet of water rights.
- Flood reduction capabilities are less than Base Case but would meet current flood damage curve requirements.
- Maintains existing (current) recreation, habitat and water quality conditions and comparable emergency supply reserves.

Alternative 2

- Loss of reservoir storage eliminates or severely reduces future water supply, operational flexibility, water rights, water recreation, and emergency water reserves availability.
- Net cost (\$33.0 million NPV) and BCR less than 1 (BCR = 0.44) indicating not cost-effective.
- Estimated minimum \$5.2 million/year replacement water cost compared to the Base Case
- Maintains existing water quality conditions
- Flood reduction capabilities are less than Base Case but would meet current flood damage curve requirements.
- May provide some limited environmental benefit through restoration of steelhead passage to low-to moderately-suitable upstream habitat. However, this would be highly dependent on flows in Calero Creek, which would return to its natural state as an intermittent stream with limited upstream habitat for overwintering juvenile steelhead.

1. Introduction

Valley Water owns and operates the Calero Dam and Reservoir, located in southern Santa Clara County, south of the city of San Jose. Calero Dam impounds Calero Reservoir, which stores approximately 10,000 acre-feet of water at full capacity (Elevation 486.8 feet North American Vertical Datum of 1988 [NAVD88]) and covers approximately 350 acres. Calero Dam and Reservoir are located on Arroyo Calero.

Calero Reservoir is one of Valley Water's ten reservoirs. Valley Water's reservoirs make up nearly 30 percent of the total water supply for Santa Clara County and its 1.8 million residents (Valley Water 2019a). Calero Reservoir stores local watershed runoff from Calero and Cherry Canyon Creeks. In addition, Calero Reservoir can store water imported from the Federal Central Valley Project as well as Anderson Reservoir, transferred via the Cross Valley Pipeline, water transfers from Almaden Reservoir via the Almaden-Calero Canal, and water from the Almaden Valley Pipeline that is pumped through the Calero Dam outlet, into Calero Reservoir. Water from the Cross Valley Pipeline can also bypass Calero Reservoir entirely.

The Calero Dam facilities include the main dam, a small auxiliary dam, the intake/outlet works, the spillway, and Fellows Dike (a small embankment at the upstream end of the reservoir). The facilities are under the jurisdiction of the California Department of Water Resources, Division of Safety of Dams (DSOD), which requires regular dam monitoring, inspection and periodic evaluations of dam safety.

Valley Water conducted seismic safety evaluations for some of its DSOD jurisdictional dams, including the Calero Dam facilities. In an evaluation completed in 2012, the Calero main dam demonstrated inadequate seismic stability relative to the maximum credible earthquake² (MCE) event. Valley Water also commissioned a Problem Definition Report and a Planning Study Report that included additional investigations and analyses to further define safety and operational deficiencies at the Dam. Based on these analyses, the following primary deficiencies have been identified at the Dam:

- **Seismic Stability:** The Main Dam embankment could experience excessive and unacceptable deformations under the MCE.
- **Spillway Capacity:** The probable maximum flood³ (PMF), based on current standards, exceeds the existing spillway capacity and could potentially overtop the main dam and auxiliary dam.
- **Outlet Works Capacity:** The existing low-level outlet works provides only marginal capacity for emergency drawdown in accordance with DSOD guidelines.

Valley Water seeks to determine if the anticipated expenditure for a full seismic retrofit of the Calero Dam facilities would potentially be worth the realized benefits. This technical report provides a preliminary Benefit-Cost Analysis (BCA) comparing the costs and benefits of the seismic retrofit project with several alternatives, to assist Valley Water in its planning and decision-making.

Alternatives for analysis in this BCA include a seismic retrofit of the main dam and related improvements (including spillway improvements and a new outlet works), lowering the spillway to meet the current reservoir level restriction; and removal of a portion of the main dam down to the streambed level. For Alternative 1, this will involve lowering the spillway by 20 feet and a partial buttress for a seismic retrofit to the main dam. Alternative 2 will not include a seismic retrofit but instead the dam will be modified to not allow permanent storage and a low capacity flood detention facility will be built.

² For this project, the maximum credible earthquake (MCE) is defined as a Richter scale magnitude 7.9 event on the San Andreas Fault (approximately 8 miles from dam site), or a magnitude 6.7 event on the Shannon Fault (approximately 5 miles from the dam site).

³ The Probable Maximum Flood (PMF) is the flood that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in a particular drainage area.

The BCA findings are intended to provide Valley Water with a systematic estimate and comparison of the various alternatives' costs and various benefits. The BCA estimates the expected Net Present Value (NPV) and its Benefit-Cost Ratio (BCR) for those parameters that can be quantified for each alternative.

This technical report is organized as follows:

1. Introduction
2. Valley Water Supply System
3. BCA Overview
4. Alternatives
5. Cost Estimation
6. Projected Operations
7. Benefit Evaluation
8. Benefit-Cost Analysis Findings
9. Summary
10. References

Several attachments are also included that provide further details on the engineering cost estimates, flood risk and recreation.

2. Valley Water Supply System

Valley Water's water supply system is comprised of storage, conveyance, conservation, recharge, treatment and distribution facilities that include local reservoirs, the groundwater basin, groundwater recharge facilities, treatment plants, imported supply, and raw and treated water conveyance facilities. Figure 1 shows the Valley Water's raw water and treated water conveyance system, treatment facilities, reservoirs, and recharge facilities.

3. Benefit-Cost Analysis Overview

BCA is a well-established and widely used economic tool for project evaluation and selection. BCA estimates and aggregates the expected future benefits and costs for a proposed project or set of project alternatives. The central component of BCA is to identify and represent all cost and benefit parameters into a single common and equivalent monetary unit whenever possible. This facilitates comparisons between the different cost and benefit trade-offs of different project alternatives. BCA is a particularly helpful tool for evaluating alternatives that have differing schedules in their future costs or benefits over their future operational lifecycle.

For Calero Dam, a high-level review of the major modification alternatives' expected costs and performance outcomes (e.g. water supply, water quality, flood control etc.) has been performed. This has been conducted for three dam modification alternatives (including the base case alternative). The costs and benefits of each project alternative are assessed so that fair comparisons can be made. In some cases, particularly with respect to benefits, there was insufficient information for quantitative analysis. When benefits could not be quantified and monetized (e.g. operational flexibility and water rights), comparative qualitative analysis was conducted.

A joint work session with Valley Water to obtain guidance from Valley Water on BCA input parameters was conducted on June 26, 2019. This workshop session with Valley Water staff and the consultant team was an integral part of the BCA development process. A proposed BCA approach was presented at the workshop and Valley Water staff discussed the costs and benefits that they considered important to address. Valley Water participants included staff from: Raw Water Operations; Water Supply; Financial Planning; Dam Safety; and Watershed Stewardship Divisions. The team discussed Valley Water data that

might be available and agreed on the qualitative parameters could be used in cases where economic quantification of benefits is not possible. On September 4, 2019 a second workshop was conducted to review the preliminary BCA analysis and findings.

The following sections and tables present the BCA approach, information sources, analysis and findings.

3.1 Methodology

The assessment approach for each Alternative consisted of the following steps:

- Collection and review of available relevant project information;
- Consultation with Valley Water staff to determine BCA evaluation approach, factors and assumptions;
- Identification with Valley Water staff on benefits (e.g. water quality, habitat and water rights) to be qualitatively analyzed;
- Developed preliminary cost estimates for the BCA Alternatives development and operations over the 50-year study period;
- Benefit evaluation and estimation (when possible) Alternative's average year operations for the 50-year study period.
- Determine NPV and BCRs to evaluate project alternatives' lifecycle economic performance

3.2 Economic Factor Assumptions

Calculated in constant 2019 dollar terms based on:

- Construction costs include escalation
- Real Interest Rate = 3% with 100% financing
- Interest During Construction = Deferred repayment with 3% real interest rate
- Construction period = 2 to 3 years
- Repayment Terms = Full development cost repaid over 50 years
- Useful life of Facility Improvement = 50 to 75 years
- Residual Value = pro-rated for asset value in 2080
- Depreciation = 50-year straight-line
- Operations = 50 years (2030 until 2079)
- Discount Rate = 2.5%
- NPV expressed in 2019 dollars and 2019 base year.

4. Alternatives

The BCA considers the base case and two alternatives described below. The accompanying Figure 2 provides a general site layout showing the existing dam facilities and the base case for comparison with two other options. Figures 3 through 5 illustrate the key concepts related to the alternatives. Figure 3 illustrates Alternative 1 – Lowering the spillway to the current reservoir restriction level (elevation 464.5 feet National Geodetic Vertical Datum of 1929; 467.4 NAVD88). Figure 4 shows cross sections of the spillway lowering concept. Figure 5 shows Dam Notching to near the original stream level.

4.1 Base Case – Retrofit Dam to Full Storage Capacity

This alternative would follow through with the seismic retrofit project currently at the 60 percent design phase and would entail the following key components:

- **Embankment Stabilization:** Partially remove the downstream embankment of the main dam to remove liquefiable alluvium below the downstream shell; install an internal filter and drain system; and stabilize the downstream portion of the dam with a buttress to protect against liquefaction of alluvial soils and embankment deformation during the MCE. Further, raise the dam crest 4 feet for additional freeboard during the PMF. Finally, add a clay blanket to the right upstream slope and abutment to reduce seepage.
- **Auxiliary Dam:** Raise the embankment by 4 feet and add internal filter and drains.
- **Outlet Works Replacement:** Replace the existing intake structure with a new multi-level intake structure located upstream of the existing dam on the left side. The existing outlet conduit would also be replaced with a new tunneled outlet conduit and downstream release structure, and the existing outlet abandoned. Add new valve house.
- **Spillway:** Demolish the existing spillway and replace it at its current location to meet modern design standards to pass the PMF.
- **Other Components:** Breach Fellows Dike and relocate historic Bailey-Fellows House.

The dam and other project components (i.e., auxiliary dam, spillway, outlet works, Fellows Dike) would remain subject to DSOD regulation. Fellows Dike would be removed from DSOD regulation. This alternative is the Base Case for the BCA.

4.2 Alternative 1 – Lowered Spillway

Alternative 1 would reduce required modification of the dam embankment by lowering the existing spillway about 20 feet to permanently conform with the current DSOD storage restriction. Under this alternative, Calero Reservoir would have an estimated future maximum storage capacity of 4,414 acre-feet which would represent an estimated permanent storage capacity loss of 5,324 acre-feet compared to its original and proposed Base Case designs.

- **Embankment Stabilization Component:** For comparative purposes, it has been assumed that some lesser amount of main dam foundation removal and embankment buttressing is still required for addressing liquefaction and dam deformation risks in an earthquake. Additional analysis and regulatory approvals by DSOD would be necessary to determine the extent of foundation removal and buttressing. However, it has been assumed that most of the material from the required spillway excavation would be hauled to the main dam and placed as buttress material supplemented by import filter and drain material.
- **Auxiliary Dam:** No raising or retrofit.
- **Outlet Works Rehabilitation:** Utilize the existing intake and rehabilitate the existing outlet conduit by re-lining and reuse of the downstream release structure and control valves.
- **Spillway:** Permanently lower the spillway crest by approximately 20 feet.
- **Other Components:** Eliminate the right abutment seepage blanket. Also eliminate the need to relocate the historic Bailey-Fellows house and necessity to breach Fellows Dike.

The plan of Alternative 1 and cross-sections of the lowered spillway are illustrated on Figures 3 and 4. The dam and other components (i.e., spillway, outlet works.) would remain subject to DSOD regulation.

4.3 Alternative 2 – Dam Removal

This alternative would involve removing Calero Dam down to the approximate original stream-bed elevation by cutting a notch through the embankment to near the original stream elevation. The facility would no longer function as a dam and reservoir but would be operated as part of the watershed/floodway, with the reservoir area restored as streambed restoration and riparian habitat providing connection to the existing Calero Creek and other tributaries upstream from the current reservoir site. The auxiliary dam and spillway would be abandoned. This alternative would entail a permanent storage capacity loss of approximately 9,740 acre-feet, with no future ability to regulate stream-flow for water supply, environmental or flood management purposes.

It has been assumed that a smaller flood detention facility may be necessary to mitigate for loss of downstream flood control benefits and ensure downstream water quality is maintained. The cost for a flood detention basin was based on a recent project in Antioch for the Contra Costa Flood Control District. As envisioned, the existing outlet would be used to release normal stream flows, but an overflow weir would divert flood floods into detention storage to be created from excavation spoil from the dam notching. Further planning and analysis would be necessary to complete alternatives for the detention basin design.

The dam removal (notching) concept is illustrated on Figure 5.

5. Cost Estimation

Preliminary construction and net lifecycle cost estimates for each alternative have been developed.

Comparative cost estimates have been developed for use in the Calero BCA for the base case and alternative in the tables attached. Note that the 60-percent design by HDR was used for the Base Case cost estimate and cost comparison with Alternatives 1 and 2.

The estimates are broken down into 15 categories to include: embankment modifications, spillway modifications, outlet works replacement, miscellaneous, and environmental restoration. For Alternatives 1 and 2, actual quantities and factored quantities and unit costs from the Base Case 60-percent design for comparison we have used to develop the Alternative 1 and 2 cost estimates. If Valley Water decides not to proceed with the Base Case-full retrofit and instead selects Alternative 1 or 2 for future development, it is recommended that additional re-planning analysis of the selected alternative is performed to confirm its feasibility and to develop a higher-confidence estimate of its cost. Any such re-planning effort should also include further field work, testing, analyses, designs, and regulatory consultations.

Note: The actual configuration and costs for Alternative 1 (Lowered Spillway) and Alternative 2 (Dam Removal) could vary significantly from those assumed for this preliminary BCA. The potential differences could occur partly due to site uncertainties related to actual sediment quantities and characteristics, and partly due to currently unknown objectives and requirements for habitat restoration and sediment handling/disposal. The preliminary concepts and cost estimates are suitable for initial benefit-cost comparison. However detailed site investigations, feasibility studies and discussions with regulatory agencies and stakeholders would be required to evaluate dam removal options in more detail and to obtain more precise and accurate estimates of their development costs.

The cost analysis also determined the expected average annual operating and maintenance (O&M) costs for the facility's future operation. In addition to labor, utility and equipment repair costs, the future O&M costs may also include environmental costs (e.g. increased and long-term vegetation management or habitat restoration requirements). Future decreased or increased downstream monitoring requirements were also considered.

Tables 1 and 2 show the estimated total construction and O&M costs for each alternative with the estimated present value of their total lifecycle costs over the 50-year study period and a 2.5 percent discount rate in 2019 dollar terms. Construction costs were developed by GEI Consultants (Appendix A). Annual O&M costs have been estimated based on input from Valley Water staff.

Table 1: Total Project Costs by Alternative – Present Value (2.5%, 2019\$)

Cost Item	Base Case	Alternative 1	Alternative 2
<i>Water Storage capacity</i>	<i>9,738 af</i>	<i>4,414 af</i>	<i>0 af</i>
Total Construction	\$119.6	\$58.3	\$58.5
Interest During Construction	\$5.5	\$1.6	\$3.0
Total Development Cost – Nominal	\$125.1	\$59.9	\$61.5
Total Development Cost – NPV	\$107.7	\$51.6	\$52.9

Notes:

af = acre-feet

NPV = Net Present Value

Table 2: Operating and Maintenance Costs by Alternative – Annual (2019\$)

Cost Item	Base Case	Alternative 1	Alternative 2
Calero Reservoir O&M and Dam Safety	\$0.19	\$0.19	\$0
Water Quality Monitoring	\$0.16	\$0.16	\$0
Habitat Maintenance	\$0	\$0	\$0.25
Total O&M	\$0.35	\$0.35	\$0.25
Total O&M – NPV (2.5%)	\$7.8	\$7.8	\$5.5

Notes:

NPV = Net Present Value

O&M = operating and maintenance

Table 3 shows the estimated total lifecycle costs for each alternative over the 50-year study period and a 2.5 percent discount rate in 2019 dollar terms.

Table 3: Operating and Maintenance Costs by Alternative – Annual (2019\$)

Cost Item	Base Case	Alternative 1	Alternative 2
Total Development Cost – NPV	\$107.7	\$53.3	\$52.9
Total O&M – NPV (2.5%)	\$7.8	\$7.8	\$5.5
Total Lifecycle Cost – NPV (2.5%)	\$115.5	\$59.3	\$58.5
<i>Residual Value – 2080 (NPV)</i>	<i>\$0</i>	<i>\$0</i>	<i>\$0</i>

Notes:

NPV = Net Present Value

O&M = operating and maintenance

The proposed reservoir improvements could be expected to have a useful operating life ranging from 50 to 75 years after construction. As a result, at the end of the 50-year analysis period in 2080, the reservoir improvements could have up to 25 more years of operational use and benefits. Based on straight-line depreciation, the reservoir improvements could have a potential 2080 residual value equal to

up to 33.3% of its original construction cost. The NPV of any projected residual value could reasonably be subtracted from the project's cost in the BCR and net benefit calculation. Any such residual value adjustment would improve the project's estimated economic performance.

However, for the purposes of the BCA under all of the BCA alternatives their facility improvements were conservatively assumed to have no residual value at the end of the 50-year analysis period in 2080.

6. Future Operations Projections

Retrofit or modification of Calero Dam may result in future water supply, water quality, flood protection, recreation and habitat benefit changes. The BCA identifies, and when possible, quantifies each alternative's projected operational performance on an average annual basis.

Numerous factors may contribute in determining reservoir operations in any individual year. A factor's role, interrelationships and effect on the reservoir's operations may vary depending on the circumstances. Typically, key factors influencing future reservoir operations will include (and are not limited too):

- Facility design and operational capabilities;
- Operational requirements;
- Maintenance requirements for distribution system;
- Recent and current hydrologic conditions;
- System supply and demand;
- Management priorities; and
- Other facilities operations (both system and external).

While the operations in any individual year may vary greatly, the BCA's average year operational projections were developed as conservative representations of the capabilities of the three BCA alternatives and expected typical future use. The projected average year operations are fundamentally based on Calero's past operations adjusted for known past performance factors (e.g. water year types, facility constraints and system outages) and future facility constraints (e.g. Alternative's reduced storage capacity and emergency water supply reserve requirements).

Systemwide water modeling of the Alternatives was not possible due to data, resource and schedule constraints. Consequently, the BCA's operational projections are not optimized for facility utilization and/or support of Valley Water's future water system needs. As a result, the BCA's projected use of the Base Case reservoir likely represents a very conservative estimate of its full benefit potential benefits that could be achieved from re-operation for increased utilization and greater system integration/coordination.

Future "average year" surface water retention, imported supplies and releases/use quantities for each Alternative are provided below. Future use of reservoir storage for the purposes of maintaining emergency water supply reserves and provide incidental flood reduction benefits are also discussed below. The least cost alternatives (LCAs) for replacement water supplies are also analyzed below.

6.1 Surface Water Retention

Calero Reservoir's past and future primary purpose is as a water retention and short-term storage/transfer facility. As a result, the reservoir predominantly operates as an annual fill and drain facility with limited quantities of carry-over water held over between water years. Retained water is used to supply both Valley Water's groundwater recharge and drinking water treatment facilities and is also held in reserve for drinking water treatments during emergency conditions.

Typically, the majority of the reservoir's water is gradually released between late Spring and early Autumn into Arroyo Calero to supply groundwater recharge facilities downstream during periods without rainfall

and low natural inflows. As a result, these releases increase Arroyo Calero water flows between late Spring and early Autumn.

Table 4 shows the average annual surface water retention quantities projected for each Calero Dam alternatives.

Table 4: Calero Reservoir Annual Surface Water Retention by Alternative

Water Supply (Average Year)	Base Case	Alternative 1	Alternative 2
Retained Calero Watershed Natural Inflow	3,024 af	1,002 af	0 af
Almaden to Calero Transfers	3,151 af	1,366 af	0 af
Total Retained Surface Water (Avg. Year)	6,174 af	2,368 af	0 af
Evaporation	(424) af	(162) af	0 af
System Originated Supplies (Avg. Year)	5,751 af	2,206 af	302 af (a)

Notes:

(a) Estimated recharge supply quantities obtained from future free flow conditions in Arroyo Calero.

Totals may not sum exactly due to rounding.

af = acre-feet

The primary benefit under both the Base Case and Alternative 1 is their quantity of system-originated water supplies which is consequently a major focus of the BCA. These water supplies represent “net new water” for Valley Water which otherwise (e.g. without retention as shown under Alternative 2 in Table 4) would mostly flow out into San Francisco Bay. System-originated water supplies represent water supplies independently obtained and managed solely by Valley Water. As such they generally represent a more secure and predictable water source than imported water supplies which are dependent on the water provider and subject to other external factors outside of Valley Water’s control.

6.1.1 Base Case

As shown in Table 4, the Base Case is expected to result in surface water run-off retention averaging 5,751 acre-feet (net of evaporation losses) during an average water year.

6.1.2 Alternative 1

Due to its limited operational storage, Alternative 1 future surface water retention capacity and annual use levels is expected to be greatly reduced from the Base Case. As shown in Table 4, under Alternative 1, a total (net of evaporation losses) of 2,206 acre-feet of surface water run-off is expected to be retained during an average water year. Compared to the Base Case operations, Alternative 1 would result for Valley Water in approximately a 3,545 acre-foot/year loss in its system originated water supplies. This reduction in system originated water supplies is due to several factors:

- Arroyo Calero recharge facilities’ limited recharge capacity during the winter and spring which reduces its ability for beneficial use of Alternative 1’s releases;
- Limited raw water supply demands of San Teresa and other Valley Water treatment plants during the winter/spring period; and
- Operational storage constraints (reduced capacity, emergency supply and flood free-board requirements) which limit Almaden transfers in Calero.

These constraints on the Alternative 1 retention quantities are during wetter years when there is greater run-off water availability and reduced demand (for both recharge and water treatment plant deliveries).

6.1.3 Alternative 2

Under Alternative 2, only a small proportion (302 acre-feet or 10 percent) of the uncontrolled flows out the Calero Watershed would be expected to result in winter/spring groundwater recharge use and benefits. This primarily due to the Arroyo Calero recharge facilities' limited recharge capacity during the winter and spring which limits their ability for beneficial use of Alternative 2's unmanaged flows. The recharge capacity constraint is even greater during wetter years when the recharge facilities receive high quantities of other natural inflow water.

Compared to the Base Case operations, Alternative 2 would result in approximately a 5,450 acre-foot/year net loss in Valley Water's system originated water supplies.

6.2 Imported Water Supply

Valley Water transfers significant quantities of imported water to Calero Reservoir for short-term storage and subsequent release. For the purposes of this BCA it is assumed that in response to either Calero Reservoir's reduced operational storage (Alternative 1) or its total elimination (Alternative 2) Valley Water can re-operate its other facilities to maintain imported water supplies. In which case, Alternative 1 and 2's reduced imported water transfer capabilities will have no net effect on Valley Water's overall water supply and no net *water supply* benefit. However, there will be a significant impact to operational flexibility that exists currently, see Section 7.3.1.

Calero Reservoir's imported water transfer and short-term storage capabilities are instead evaluated qualitatively in terms of their potential use and beneficial contribution to water flexibility performance of Valley Water's future system-wide operations.

6.2.1 Base Case

As shown in Table 5, under the Base Case, Calero Reservoir future imported water transfer operations are expected average of 3,408 acre-feet (net of evaporation losses) per year during an average water year.

Table 5: Calero Reservoir Annual Imported Water by Alternative

Water Supply (Average Year) (a)	Base Case	Alternative 1	Alternative 2
Imported Water Supply (Central Valley Project [CVP])	3,659 af	2,477 af	0 af
Evaporation	- 251 af	- 170 af	0 af
Net Imported Water Supply (CVP)	3,408 af	2,307 af	0 af
System Originated Supplies (Avg. Year)	5,751 af	2,206 af	302 af (b)
Total Available Water Supply	9,159 af	4,513 af	302 af (b)

Notes:

- (a) Data is based on actual Raw Water Operations Unit annual data for a limited sample size post-implementation of seismic restriction which may reflect system outages.
- (b) Estimated recharge supply quantities obtained from future free flow conditions in Arroyo Calero.

af = acre-feet

CVP = Central Valley Project

6.2.2 Alternative 1

Under Alternative 1, Calero Reservoir's future imported water transfer operations are expected to be greatly reduced from the Base Case due its reduced operational storage capacity (see Section 6.4.2). As shown in Table 4, under the Alternative 1, future imported water transfer operations are expected average of 2,307 acre-feet (net of evaporation losses) per year during an average water year. Alternative 1 would result in approximately a 1,101 acre-foot annual loss in Valley Water's imported water transfer operations compared to future Base Case conditions.

6.2.3 Alternative 2

As shown in Table 5, no imported water transfer operations would occur under Alternative 2. Alternative 2 would result in approximately a 3,408 acre-foot annual loss in Valley Water's imported water transfer operations compared to future Base Case conditions.

6.3 Water Supply Use

Calero Reservoir's past water release quantities have varied greatly largely due to water availability and demand conditions. Table 5 shows the projected "average water year" water uses under each of the BCA Alternatives. The total water use quantities in Table 6 match the Table 5 total available water supplies.

Table 6: Calero Reservoir Annual Water Use by Alternative

Water Use (a)	Base Case	Alternative 1	Alternative 2
Groundwater Recharge	5,495 af	2,801 af	302 af (b)
Drinking Water Treatment Plants	3,206 af	1,712 af	0 af
Total Deliveries	8,701 af	4,513 af	302 af (b)
Carryover	458 af	0 af	0 af
Total Water Use	9,159 af	4,513 af	302 af (b)

Notes:

(a) Data is based on actual Raw Water Operations Unit annual data for a limited sample size post implementation of seismic restrictions which may reflect system outages.

(b) Estimated recharge supply quantities obtained from future free flow conditions in Arroyo Calero.

af = acre-feet

As discussed previously in Section 6.0, these water use projections are largely based on Valley Water's past operations and have not been optimized for facility utilization and/or support of Valley Water's future water system needs.

6.3.1 Groundwater Recharge

On average the majority (approximately 60 percent) of Calero Reservoir's past water supplies have been released into Arroyo Calero for groundwater recharge downstream at the percolation ponds. The demand for Calero Reservoir water releases to these recharge facilities is highest during the summer and early fall. During the winter and spring, the demand for Calero Reservoir releases is more limited – especially during wetter years when the facilities typically receive more water from natural flows and therefore have less need for additional water to be released from Calero.

As discussed above, the Table 6 water use projections have not been modified to better align with Valley Water's expected future water use demands. The more extensive system analysis and modeling necessary to determine more optimal reoperation opportunities under the Base Case and Alternative 1 were beyond the scope and resources of the BCA. Nonetheless, future implementation of the state's Sustainable Groundwater Management Act requirements can be expected to increase Valley Water's future groundwater recharge operations and need for water deliveries from its reservoirs.

6.3.1.1 Base Case

As shown in Table 6, under the Base Case, Calero Reservoir future deliveries for groundwater recharge use are expected average of 5,495 acre-feet per year during an average water year.

6.3.1.2 Alternative 1

Under Alternative 1, Calero Reservoir's future imported water transfer operations are expected to be greatly reduced from the Base Case due to both its reduced water retention capabilities during the winter/spring and its limited operational storage capacity during the summer and fall (see Section 6.4.2).

As shown in Table 6, under the Alternative 1, future deliveries for Groundwater Recharge use are expected average of 2,801 acre-feet per year during an average water year. As a result, Alternative 1 would result in approximately a 2,694 acre-foot annual loss in deliveries to Valley Water's groundwater recharge operations compared to that under the Base Case.

6.3.1.3 Alternative 2

Alternative 2 would only result in potential groundwater recharge benefits during the winter and spring either through natural groundwater infiltration or from water supplied by Arroyo Calero's free flow conditions to the existing Arroyo Calero recharge facilities.

Overall, it is conservatively assumed that approximately 10 percent (302 acre-feet) of Calero Creek watershed's surface water run-off will result in groundwater recharge benefits. As a result, Alternative 2 would be expected to result in approximately a 5,193 acre-foot annual loss Valley groundwater recharge conditions compared to those under the Base Case. Evaluation of the potential sedimentation and reduced infiltration impacts resulting from dam removal was not performed and consequently more precise quantification of Alternative 2's future groundwater recharge performance is not possible.

6.3.2 Raw Water Supply to Water Treatment Plant

Calero Reservoir has typically delivered a large portion (approximately 35 percent) of its water into the Almaden Valley Pipeline for delivery to the Santa Teresa Water Treatment Plant. The demand for Calero Reservoir water treatment deliveries is general greater during the summer and early fall due primarily to higher customer demand and to a lesser extent as a result reduced availability from other supply sources.

6.3.2.1 Base Case

As shown in Table 5, under the Base Case, Calero Reservoir future raw water deliveries for water treatment and subsequent potable water use are expected average of 3,206 acre-feet per year during an average water year.

6.3.2.2 Alternative 1

Under Alternative 1, Calero Reservoir's future raw water deliveries for water treatment use are expected to be greatly reduced from the Base Case due to both its reduced water retention capabilities during the winter/spring and its limited summer/fall operational storage capacity (see Section 6.4.2). Additionally, due to the shallower depth of pool there is an increased likelihood of water quality related issues due to higher reservoir temperatures which could impact deliveries to water treatment facilities.

As shown in Table 5, under the Alternative 1, future raw water deliveries for water treatment use are expected average of 1,712 acre-feet per year during an average water year. As a result, Alternative 1 would result in approximately a 1,494 acre-foot annual loss in deliveries to Valley Water's groundwater recharge operations compared to that under the Base Case.

6.3.2.3 Alternative 2

No raw water deliveries for water treatment use would occur under Alternative 2. As a result, Alternative 2 would result in an estimated 3,206 acre-foot reduction in annual deliveries to Valley Water's water treatment system compared to future Base Case conditions.

6.3.3 Carryover Storage

After Calero's groundwater recharge releases and water treatment deliveries, the relatively small remaining quantity of water (approximately 5 percent) has been used to replenish its required Emergency Supply Reserves (ESR) or held as carryover storage water.

6.3.3.1 Base Case

Future winter carryover quantities under the Base Case are projected to average 458 acre-feet annually on an average water year basis. However, potentially up a total of 5,104 acre-feet of winter carryover could be storage under the Base Case after accounting for its operational requirements for Emergency Water Supply Reserves (3,500 acre-feet during winter/spring then increased to 4,000 acre-feet between

May 1 and October 31) and the minimum flood freeboard requirements (1,134 acre-feet of freeboard on December 1 per Calero Reservoir's current flood risk curves).

6.3.3.2 Alternatives 1 and 2

As shown in Table 6, no carryover storage would occur under Alternatives 1 or 2. As a result, Alternatives 1 and 2 would result in approximately a 458 acre-foot annual reduction in Valley Water's carryover storage operations compared to future Base Case conditions.

6.4 Emergency Supply Reserves

Anderson Reservoir is Valley Water's primary source of emergency water storage with 20,000 acre-feet of its storage permanently committed and reserved for availability during the event of an emergency. Calero Reservoir is Valley Water's second largest source of emergency water storage and is considered especially important due to its close proximity to Santa Teresa (3.8 miles) and Valley Water's other water treatment plants. In comparison, water supplies from Anderson Reservoir must be conveyed approximately another 13 miles down the Cross Valley Pipeline for delivery to Santa Teresa or other treatment facilities. Recent analysis of the Valley Water's Infrastructure vulnerability also indicates that there is significant risk of failure to that section of the Cross Valley Pipeline in the event of major seismic or storm events (Valley Water 2016).

During the summer period (May 1 to October 31) Valley Water currently requires that Calero Reservoir's operations maintain 4,000 acre-feet of ESR. This operating requirement is reduced to 3,500 acre-feet during the winter (November 1 to April 30). As result, over the entire year, ESR supply availability averages 3,750 acre-feet.

Under both the Base Case and Alternative 1, it is assumed that the current ESR operational requirement would continue to be implemented unchanged from its current scheduled storage quantities and have been incorporated in Calero Reservoir's future water supply and use projections above (see Tables 5 and 6).

Table 7 shows Calero Reservoir's future storage capacity, requirement and "average water year" use projected for each of the BCA Alternatives. The table also includes the minimum flood freeboard conditions required for incidental flood protection between December 1 and March 31. Calero Reservoir's Incidental Flood Reduction use is discussed in more detail below.

The Operational Storage represents the portion of the reservoir's storage available for managed use (e.g. surface water retention, transfer of imported water or carryover storage).

Table 7: Calero Reservoir Storage Capacity and Use

Storage Use	Base Case	Alternative 1	Alternative 2
Maximum Storage Capacity	9,738 af	4,414 af	0 af
Summer			
Emergency Supply Reserve Requirement	4,000 af	4,000 af	0 af
Operational Storage (Max.)	5,738 af	414 af	0 af
Winter			
Emergency Supply Reserve Requirement	3,500 af	3,500 af	0 af
Flood Freeboard Required (December 1)	1,134 af	1,134 af	0 af
Operational Storage (Max. December 1)	5,104 af	(220) af (a)	0 af
Carryover	458 af	0 af	0 af
Flood Freeboard Available (December 1)	4,646 af	(220) af (a)	0 af

Notes: (a) Project would not meet its emergency reserves requirement between December 1 and January 25.

af = acre-feet

6.4.1 Base Case

Figure 6 shows the ESR and flood curve storage restriction on the Base Case's future facilities and operations with its resulting operational storage capacity over both the winter and non-winter periods. Under the Base Case, Calero Reservoir's operating storage would generally range from 5,738 acre-feet during the summer (May 1 to October 31) and decrease to a minimum of 5,104 acre-feet on December 1 when the maximum flood freeboard requirements are in effect.

As discussed above, the future Base Case operations are projected to remain similar to its past use. Consequently, future use of Calero Reservoir's operational storage would be of relatively limited use (especially during the winter season) and Calero Reservoir would operate significantly below its full capacity most all of the year. Nonetheless, the Base Case's operational storage capabilities and offers Valley Water major operational flexibility opportunities and increased system resiliency.

As shown in Table 7, during the non-winter period of May through October the ESR requirement would be 4,000 acre-feet and the Base Case's maximum net operational storage capacity would be 5,738 acre-feet. As a result, the Base Case future operations are expected to be relatively unconstrained by its storage capabilities.

6.4.2 Alternative 1

Under Alternative 1 it is assumed that Valley Water's current flood curve storage restrictions would continue to be implemented unchanged. As a result, Alternative 1's future flood reduction effects would similarly be expected to remain unchanged from past performance levels and there the flood risk would be unchanged from current conditions.

Figure 7 applies the same flood curve storage restriction on Alternative 1 future facilities and operations. The restrictions range from 1,134 acre-feet on December 1 to 314 acre-feet on March 31 after which they no longer apply (Valley Water 2019b). Based on the current restrictions, the ESR would have to be reduced by 220 acre-feet from December 1 until December 15. During which time there would be only 3,280 acre-feet of ESR instead of its 3,500 acre-foot winter period requirement. After which the ESR deficit would gradually decrease until January 25 when the combined flood restriction (913 acre-feet of freeboard) and the Emergency Reserve requirement (3,500 acre-feet) will match Alternative 1's maximum storage capacity of 4,414 acre-feet. As a result of the ESR supply decrease between in December and January, averaged over the entire year, Alternative 1's average ESR supply availability be 24 acre-foot (0.6 percent) less than the Base Case conditions.

In addition to a loss of all operational storage capacity between December 1 and January 25, Figure 7 also indicates that the reservoir's operational capabilities during February and March would also be significantly constrained.

As shown in Table 7, during the summer period of May through October, the ESR requirement would be 4,000 acre-feet and Alternative 1's maximum net operational storage capacity would be 414 acre-feet. As a result, Alternative 1's future operations are expected to be significantly limited by its storage capabilities.

6.4.3 Alternative 2

Under Alternative 2, Valley Water would lose all its current ESR storage capabilities at Calero Reservoir.

Consequently, Valley Water would need to develop new alternative replacement storage or re-operate its other reservoirs to maintain the necessary reserve water quantities elsewhere in its water system. However, re-operation of the existing reservoir storage can be expected result in corresponding reduced water supply availability that would need to be replaced for Valley Water to remain "whole" from the loss of Calero Reservoir's ESR storage capabilities.

6.5 Incidental Flood Reduction

Although Calero Reservoir is primarily operated for groundwater recharge purposes and deliveries to water treatment plants, the facility also currently results in incidental flood control benefits. These benefits result from the free board conditions which ensure that Calero Reservoir maintains unused storage capacity that can be used to retain stormwater flows during major storm events and therefore avoid their contribution to downstream flooding within Calero Creek.

Valley Water has implemented reservoir operating strategies at Calero Reservoir to provide flood storage and optimize its water supply function since 1997. These rule curves recognize that if the reservoir storage approaches full capacity early enough in the rainfall season, some stored water needs to be released to provide increased flood storage capacity without significantly reducing the probability of filling the reservoir by the end of the season (Valley Water 2010). During major storm events the unused Calero Reservoir storage capacity can be used for stormwater retention to reduce the downstream releases and decrease the severity of flood events in Arroyo Calero and further downstream (e.g. within the Upper Guadalupe River). The flood rule curve restriction ranges from 1,134 acre-feet on December 1 to 314 acre-feet on March 31. There are no flood curve storage restrictions after April 1.

Current operations further restrict Calero Reservoir storage levels for dam safety, per DSOD requirements. This effectively provides additional flood storage and flood reduction potential that far exceeds that from the flood rule curve restrictions.

6.5.1 Base Case

Under the Base Case, it is assumed that Valley Water's current flood curve storage restrictions would continue to be enforced, but the DSOD dam safety restriction will no longer be in effect. This will permit Calero Reservoir to maintain higher storage quantities. As a result, if Valley Water operates the future reservoir at a higher fill level than its current operations, the Base Case Alternative's future flood reduction capabilities could be reduced from its current performance levels. However, given Calero Reservoir's restored capacity, Valley Water would have the option to manage the future reservoir operations to maintain the current flood storage capabilities and thereby ensure no increase in future flood risk from the current conditions. Figure 6 shows the storage restrictions from the flood curves, the emergency reserve requirements and the resulting maximum operational storage available over the year.

Figure 6 shows the flood curve restrictions have minimal impact on the reservoir operations. This is a conservative estimate since it does not include any allowance for the future increase drawdown outflow capacity increase from 50 cubic feet per second (cfs) (99 acre-feet/day) to 150 cfs (298 acre-feet/day) which would further reduce the flood risk conditions under the future Base Case operations.

However, based on discussions with Valley Water staff, the most likely future operation of Calero Reservoir will be a "maximize retention" operating approach. In which case, future carryover storage use would be limited to past levels and Calero Reservoir would be drawn down during the fall so that it has a high volume of unused storage capacity available for catchment and storage of rainfall with the Calero watershed. Operated in this way, the Base Case would have increased incidental flood reduction capacity since its freeboard conditions will substantially exceed those required by the current flood rule curve requirements.

6.5.2 Alternative 1

Under Alternative 1 it is assumed that Valley Water's current flood curve storage restrictions would continue to be implemented unchanged and have a higher operational priority than the ESR requirements. The additional flood reduction capabilities currently provided by the dam safety restriction under the current facility storage conditions will be eliminated. As a result, Alternative 1's future flood reduction capabilities would be reduced from current performance levels. As a result, the future flood risk would be higher than the current conditions.

Figure 7 applies the flood curve storage restriction to Alternative 1. As discussed previously under Section 6.4.1, the flood curve storage restrictions will reduce the ESR by 220 acre-feet from December 1 until December 15. After which the deficit in reserve quantity would gradually decrease until January 25 when the combined flood restriction (913 acre-feet of freeboard) and the Emergency Reserve requirement (3,500 acre-feet) will match Alternative 1's maximum storage capacity of 4,414 acre-feet. Alternatively, if the Emergency Reserve requirement is instead maintained then there would corresponding be a limited increase in the flood risk due to the reservoir's reduced retention capacity during the December 1 to January 25 period.

Figure 7 also indicates that there would be significant constraints on reservoir operations under Alternative 1 during the December to March period and no carryover storage potential.

6.5.3 Alternative 2

Based on the current maximum flood curve requirement of 1,134 acre-feet it has been assumed that a flood retention structure with 1,134 acre-feet of storage capability will provide a comparable flood reduction benefits as both the Base Case and Alternative 1. However, Alternative 2 would not provide the option of applying a "maximize retention" operating approach and thus its future flood reduction capabilities would be decreased from the current performance levels. As a result, the future flood risk would be higher than the current conditions.

6.6 Least Cost Alternative Supply

The water supply benefit values determined for the BCA Alternative depend on their average future quantities of supplied water and the unit benefit values applied to that water.

Water supply benefit values are generally determined by the corresponding cost for its replacement based on the LCA supply option available. The water supply benefit value is attributed to the quantity of water provided without consideration of its subsequent use. As a result, for the purposes of the BCA there is no difference in the benefit value attributed to the reservoirs supplied water irrespective of whether it is used for groundwater recharge, treated for potable use or for carryover storage.

The replacement supply for any water supply decreases from Calero Reservoir should meet the following conditions to ensure that the full benefit and use potential of the lost water is represented and compensated for:

- "Net new water" supplies (i.e. uncommitted additional future development/use). Projects that are already planned for will not qualify as substitute alternatives since Valley Water would incur an overall net loss in its system capabilities if their future use were actually reassigned to mitigate for BCA Alternative changes.
- Comparable delivery availability/reliability (i.e. scheduling, dry water year availability and Valley Water management and control).
- Similar water quality and usability (i.e. delivered to same use locations).

For the purposed of the BCA it was assumed that any additional conveyance expenses for water delivered into Cross Valley and Almaden Valley Pipelines as a replacement for Calero Reservoir supplied water would be negligible.

Table 8 shows alternative projects previously identified by Valley Water as potential sources of additional water supply for its future system needs. Several of these projects would not qualify as suitable LCA projects and use for the BCA benefit valuation. Although Anderson Reservoir has the benefit of being a local project, it is already included within Valley Water future planning and therefore is not source of "net new water".

Table 8: Alternative Supply Options and Estimated Unit Costs

Project Name	Yield (TAF/yr)	Lifecycle Cost (PV)	Unit Cost (\$/af)
Local Sources			
<i>Anderson Reservoir</i> ^(a)	30	\$551 million	\$640
Regional Desalination	5	\$227 million	\$1,600
<i>Potable Reuse</i> ^(a)	24	\$1,200 million	\$1,800
Additional Potable Reuse	21	\$1,600 million	\$2,400
<i>Pacheco Reservoir</i> ^(a)	4 to 6	\$470 million	\$2,700
Imported Water			
<i>State Water Project Delta Conveyance</i> ^(a)	18	\$281 million	\$600
<i>Additional Delta Conveyance</i> ^(b)	25	\$376 million	\$600
Los Vaqueros Expansion	3.5 to 3.6	\$78 to 131 million	\$700 to \$1,200
Sites Reservoir	8	\$165 million	\$1,200

Source: Valley Water 2019c.

Notes:

(a) Anderson Seismic Retrofit, Potable Reuse (24 TAF/yr), Pacheco Reservoir, and Delta Conveyance are all part of the Water Supply Master Plan and as such would not represent net new supply. It is also unclear if any of the identified projects could replace the emergency benefit that Calero provides.

(b) Future development and availability of Delta Conveyance supplies are too uncertain to be a viable alternative supply source.

af = Acre Feet

PV = Present Value

TAF/yr = total acre feet per year

There are currently major uncertainties associated with the Delta Conveyance Project (formerly known as the California Water Fix). Similarly, successful future development of other proposed major water supply projects is very challenging and uncertain. Furthermore, even if they are developed major concerns remain that they likely may not be able to prevent major imported water price increases over the long term – especially if future environmental and climate change issues impact their operations. In general, imported water supplies will not have the reliability of in-system sources. As a result, their substitution in place of local reservoirs could result in water shortages during periods of drought or other water shortage conditions when the need and marginal value of water is highest.

Table 9 provides a comparison of key difference between imported and system originated water supplies. As discussed earlier, net new replacement supplies that provide system originated water will best match the benefits from Calero Reservoir. As such those projects might be considered the appropriate LCA for Calero Reservoir and therefore be the basis for benefit valuation of its water. However, as shown in both Tables 8 and 9, regional desalination is the least cost option available to Valley Water at an estimated unit cost of \$1,600 to \$1,800 per acre-foot.

Table 9: Valley Water Originated versus Imported Supply

Factor	System Originated	Imported
Management	Valley Water controlled	State/Federal
Supply Reliability	High (reclaimed/desal) to Medium (recharge)	Low – highly dependent on weather
Demand Competition	Limited	Medium to High – population growth
Long-Term Supply Risk	Very Limited	High – regulatory/environmental threats
Least Cost Alternative	Potable Reuse/Regional Desal = \$1,600 – \$1,800/af (a)	Los Vaqueros Expansion = \$950/af

Notes:

(a) Guadalupe BCA (2015) reclaimed water and Fords Pond recharge supply cost = \$1,660/af (\$2019) est.

af = acre-feet

Imported supplies (e.g., Los Vaqueros Expansion/Sites purchases) may offer a substantially less expensive water supply option and a lower cost alternative source. There is also sufficient existing capacity in the Cross Valley and Almaden Valley Pipelines to deliver the necessary additional imported water need to replace the Base Case water supply quantities.

At least during short to medium term (i.e. up to 20 year or 30 years), imported water can be purchased at a lower net cost. However, imported water will have the major disadvantage of its increased risk, uncertainty and susceptibility to availability, pricing and delivery cost fluctuations.

Finally, increased future Valley Water reliance on imported water supplies is also contrary to Valley Water's management principles and "Ensure Sustainability" strategy from its 2012 Water Supply and Infrastructure Master Plan (Valley Water 2012). Valley Water staff also expect major price increases in future imported water costs due to greater competing demand (from future population growth), increased delivery costs (from aging infrastructure) and likely reduced water supplies (from possible climate change effects) (Valley Water 2014).

Nonetheless, despite the considerations and disadvantages discussed above, the BCA uses \$950/acre-foot benefit value for Los Vaqueros Expansion and Sites imported supply as a conservative unit benefit value. Use of this unit benefit value rather than the system originated supply (\$1,600 per acre-foot) will ensure that the BCA will understate the actual benefits for water related use and that the BCA findings will consequently represent a conservative representation and evaluation of the BCA Alternatives.

7. Benefit Evaluation

Table 10 shows the benefit evaluation approaches used by the BCA for each benefit category and the specific benefit evaluation and findings for each benefit type are discussed below.

Table 10: Benefit Evaluation Approaches

Benefit Type	Evaluation Approach		
	Qualitative	Quantified	Monetized
Water Supply		X	X
Emergency Use		X	X
Water Reliability			
Operational Flexibility	X	X	
Operational Resilience	X		
Flood Reduction	X		
Water Rights	X	X	
Water Quality	No Change		
Habitat (Riparian + Wildlife)		X	X
Recreation		X	X

7.1 Water Supply Benefits

As previously discussed in Section 6.1, the average future system originated water supply yield of the BCA Alternatives would range from 302 acre-feet per year (Alternative 2) to 5,751 acre-feet per year (Base Case).

Table 11 shows the estimated annual benefit value of each BCA Alternative's expected average system originated water supply yield. Table 11 also shows the replacement water quantities and estimated minimum cost required under Alternatives 1 and 2 to meet the Base Case's system originated water supply conditions.

Table 11: Water Supply Benefits (2019\$)

Cost/Benefit Values	Base Case	Alternative 1	Alternative 2
System Originated Supply – Annual (Avg. Year)	5,751 af	2,206 af	302 af
<i>Water Supply Unit Benefit Value (a)</i>	<i>\$950/af</i>	<i>\$950/af</i>	<i>\$950/af</i>
System Originated Supply Value – Annual (a)	\$5.46M	\$2.10M	\$0.29M
Replacement Water Supply Need	0	3,545 af	5,448 af
Replacement Water Supply Cost – Annual (a)	\$0	\$3.37M	\$5.18M

Notes:

(a) Benefit value conservatively based on imported water supplies as a least cost alternative (see Section 6.6).

af = acre-feet

7.1.1 Base Case

Valley Water management is strongly committed to making full use of its in-system water sources to reduce its long-term reliance on imported water supplies. Valley Water's current Ensure Sustainability water supply strategy has three key elements: (1) secure existing supplies and facilities; (2) optimize the use of existing supplies and facilities; and (3) expand water use efficiency efforts. The Base Case alternative directly aligns with its secure existing supplies and facilities.

As the baseline condition, the Base Case's estimated average system-originated water supply yield of 5,751 acre-feet (adjusted for evaporation losses) represents the expected future water supply benefit conditions against which the other alternatives are evaluated. Consequently, as shown in Table 11, and discussed below both Alternative 1 and 2 will result in major reduction in system originated water supplies which would also incur additional water supply acquisition costs for replacement water to meet the Base Case's system originated water supply conditions.

7.1.2 Alternative 1

As shown in Table 11, Alternative 1's future system originated water supply yield is projected to average approximately 2,206 acre-feet annually which would result in an average net loss compared to the Base Case of 3,545 acre-feet in system originated annual water supply for Valley Water.

Alternative 1's average of 2,206 acre-foot per year of system originated water supply is projected to have an annual benefit value of approximately \$2.1 million based on a conservative benefit value of \$950 acre-foot based on imported water supplies as a potential replacement supply alternative (Valley Water 2019c).

Under Alternative 1, Valley Water also potentially incur a minimum of \$3.37 million per year additional water supply acquisition costs for the 3,545 acre-feet of replacement water necessary to meet the Base Case's system originated water supply conditions.

7.1.3 Alternative 2

As shown in Table 11, Alternative 2 would future water yield for groundwater recharge would average only 302 acre-feet per year which would result in an average net loss compared to the Base Case of 5,448 acre-feet in system originated annual water supply for Valley Water.

As shown in Table 11, Alternative 2's average of 302 acre-foot per year of system originated water supply is projected to have an annual benefit value of approximately \$0.3 million based on a conservative benefit value of \$950 acre-foot based on imported water supplies as a potential replacement supply alternative (Valley Water 2019c).

Under Alternative 2, Valley Water also potentially incur year additional water supply acquisition costs of at least \$3.37 million per year for the 5,448 acre-feet of replacement water necessary to meet the Base Case's system originated water supply conditions.

7.2 Emergency Water Supplies

As discussed previously in Section 6.4, ESR requirement averages 3,750 acre-feet over the entire year. The Base Case would maintain future availability of the full ESR while there would be no ESR supplies under Alternative 2.

The ESR supply benefits attributable in the BCA are limited to their expected actual future use (i.e. during an emergency event). The opportunity cost from the foregone use of the 3,750 acre-feet retained in the reservoir for the purpose of maintaining the ESR supply would be estimated to be nearly \$3.6 million year. However, per BCA accepted methodology, such opportunity costs cannot be included in BCA determinations.

Table 12 shows the estimated annual benefit value of each BCA Alternative's expected ESR quantities. As shown in Table 12 below the estimated benefit value of the ESR supply are conservatively assumed to be unchanged from the water supply use value (\$950 acre-feet per year) estimated for average water year conditions (see Section 6.6).

Table 12: Emergency Supply Reserve Benefits (2019\$)

Cost/Benefit Values	Base Case	Alternative 1	Alternative 2
Emergency Supply Reserve (Annual Average)	3,750 af	3,726 af	0 af
<i>Supply Use Benefit Value (a)</i>	<i>\$950/af</i>	<i>\$950/af</i>	<i>\$950/af</i>
ESR Value per Event (100% Use)	\$3.56M	\$3.54M	\$0
ESR Benefit Value – Annual (2% Incidence Rate)	\$0.071M	\$0.071M	\$0

Notes:

(a) Benefit value conservatively based on imported water supplies as a least cost alternative (see Section 6.6).

af = acre-feet

ESR = Emergency Supply Reserves

It is arguable the actual benefit value of the ESR supply could be substantially higher in the event of an emergency and severe water demand/shortage conditions. Recent infrastructure reliability analysis by Valley Water that its current water system should be able to restore and maintain sufficient water supply for its winter water supply needs under most of its anticipated potential emergency event. However, if the emergency event occurs during non-winter periods with higher water demand, there could a more prolonged period of water shortage conditions until supply operations would be able to meet its customer needs (Valley Water 2016). Nonetheless, for the purposes of the BCA no additional benefit premium was added in the benefit value attributed for ESR supply during a future emergency event.

For the purpose of the BCA, it was also assumed that: (1) the entire ESR water supply would be used in the event of an emergency; and (2) such emergency event might reasonably be expected to occur on average once every 50 years.

As a result, and as shown in Table 12, the ESR supply's benefit use value are estimated to total \$3.54 million in the event of their full use during an emergency which based on an expected 2 percent annual incidence rate results in a corresponding average annual benefit value of \$71,250.

7.2.1 Base Case

The Base Case would continue to maintain the current ESR supply availability which as shown in Table 12 and discussed above it expected to have an average ESR supply benefit of \$71,250 per year.

As discussed in Section 6.4.1, the Base Case would also provide up to 5,738 acre-feet of operational storage which would likely result in additional incidental ESR benefits for Valley Water. In the event of an emergency, any non-ESR water temporarily stored by Base Case's operations would be available as additional ESR supplies available for use in the event of an emergency.

The expected quantity of the additional non-ESR supplies would vary depending on Valley Water future scheduling of its storage and release. As a result, the expected average quantity of non-ESR water that would be available for ESR use cannot be estimated. However, even if only 25 percent of its maximum 5,738 acre-feet operational storage were in use at the time of an emergency, that 1,435 acre-feet of non-ESR water represent correspond to approximately a 38 percent increase in the Base Case's potential deliveries during an emergency which would be expected to corresponding result in up to an additional \$27,300 per year in additional incidental ESR benefits. However, given the limitations in quantifying Base Case's expected average quantities of non-ESR water supplies, no incidental emergency supply benefits from non-ESR stored water availability were included in the BCA.

In addition, the Base Case would also increase Calero Reservoir's current 50 cfs maximum delivery rate into Almaden Valley Pipeline to 150 cfs. Operating at its full capacity Calero Reservoir could deliver up to 298 acre-feet per day and distribute its entire 3,750 acre-feet of average ESR over a 12.6-day period. The Base Case's increased delivery capabilities will increase ESR availability by 300 percent which will also greatly increase the extent of its available ESR supplies which otherwise would need nearly 38 days to distribute.

7.2.2 Alternative 1

As discussed in Section 6.4.2 and shown in Table 12, Alternative 1's limited storage capacity and flood curve restriction requirements will result in ESR deficit conditions between December 1 and January 25. The maximum ESR supply decrease would be 220 acre-feet (equivalent to a 6.3 percent decrease in winter ESR available) between December 1 and 15. As a result, the annual average ESR supply availability under Alternative 1 would be very marginally reduced from the current and Base Case ESR conditions. Averaged over the entire year, Alternative 1's ESR reduction would result net reduction of 24 acre-foot (0.6 percent) in annual average ESR availability compared to the Base Case. As result and as shown in Table 12, Alternative 1's projected future ESR supply benefits are expected to be approximate the same as the Base Case and current conditions.

However, given its limited operational storage capacity, the potential for additional incidental ESR benefits from other non-ESR water temporarily stored by the reservoir's operations would correspondingly be very limited and would result in marginal additional benefits from its availability for emergency water supply use.

7.2.3 Alternative 2

No ESR supplies would be held in reserve under Alternative 2. As a result, no ESR benefits are attributed in the BCA to Alternative 2.

7.3 Water Supply Reliability

For the purposes of the BCA, the water supply reliability analysis below excludes both Water Supply (Section 7.1) and ESR supply (Section 7.2) which are evaluated separately. In addition, to aid the analysis a further distinction is made between Operational Flexibility (i.e. water system management for routine and planned system needs) and Operational Resilience (i.e. water system management for unplanned system needs).

The reservoir's storage capacity and its multiple interconnections with Valley Water's distribution provides system flexibility for Valley Water's system managers. In addition to its retention capabilities, the reservoir facilities enable imported water (especially State Water Project and Central Valley Project) to be transferred into Calero and held for later delivery. A primary benefit of the Calero's storage of these supplies are its proximity to use locations (either for groundwater recharge or as raw water supplies for the Santa Teresa Water Treatment Plant) and its gravity fed operations.

7.3.1 Operational Flexibility

The reservoir's operational flexibility basically consists of the operational uses of the reservoir facilities for: (1) imported water and carryover storage; and (2) water treatment plant secondary supply.

Differences between the operational flexibility performance of the BCA Alternatives are quantified below based on the expected future operations on an average water year basis. However, the economic value of the BCA Alternatives could be not be monetized for the BCA. This is due to the complexity and difficulty of both:

- Identifying system facilities and/or operations that would function as LCA "replacements" for the reduction (Alternative 1) or full loss (Alternative 2) in Calero's operational flexibility capacity and use;
- Estimating costs for the replacement facilities and/or operations both "as used" and for its service capacity.

Some components of Calero's operational flexibility could perhaps be replaced by improvements to other facilities to develop corresponding operational storage capacity to offset the Alternative 1 and 2 losses. Addition of a new interconnection between Lexington Reservoir and the Almaden Valley Pipeline was identified as on possible option.

Operational flexibility use and benefits are interconnected (for example when imported water is used to supply water treatment facilities). As a result, care is necessary when attributing benefits to avoid double-counting benefits. However, this is not at issue for the BCA since no monetized operation flexibility benefits are estimated.

Nonetheless, Calero Reservoir's use for operational flexibility purposes are a very important and valuable component of Valley Water's system-wide operations.

7.3.1.1 Imported Water and Carryover Storage

As discussed in Section 6.2, under the Base Case, Calero Reservoir's future imported water transfer operations are expected to be an average of 3,408 acre-feet (net of evaporation losses) per year during an average water year. This level of future use was conservatively projected for the BCA based on past reservoir operations. The full retrofit has the potential to increase facility utilization and/or system integration/coordination and correspondingly increase its potential benefits to Valley Water's system-wide operations.

Future winter carryover quantities under the Base Case are projected to average 458 acre-feet annually on an average water year basis. This level of future use was conservatively projected based on past reservoir operations, however Valley Water could potentially carryover up to 5,104 acre-feet of winter carryover during an average water year (see Section 6.3.3).

Alternative 1's future imported water transfer operations are expected to average 2,307 acre-feet per year (net of evaporation losses) during an average water year which would represent approximately a 1,100 acre-feet per year decrease. As shown in Table 6, under Alternative 1 the reservoir winter carryover storage would be lost, resulting in approximately a 458 acre-foot annual reduction in Valley Water's carryover storage operations compared to future Base Case conditions.

Alternative 2 would provide no operational flexibility which would result in loss of all imported water and carryover storage benefits otherwise obtained under the Base Case or Alternative 1.

7.3.1.2 Water Treatment Plant Secondary Supply

As shown in Table 6, Base Case deliveries for water treatment plant use are expected average of 3,206 acre-feet per year during an average water year. As discussed for the Base Case's imported water use, the full retrofit could increase the use and benefits of Calero as a water supply source for Valley Water's potable water treatment system.

Alternative 1's future water treatment plant operations are expected average of 1,712 acre-feet per year per year during an average water year, which would represent approximately a 1,494 acre-feet per year decrease.

Alternative 2 would provide no operational flexibility which would result in total loss of all water treatment plant secondary supply benefits otherwise obtained under the Base Case or Alternative 1.

7.3.2 Operational Resilience

Operational resilience represents the facility's support capabilities in response unplanned systemwide operational needs. As such, resiliency benefits especially difficult to quantify and estimate due to uncertainty of event occurrence, event severity, operational effects and response options. The reservoir's operational resilience use is generally represented by its ability to otherwise provide system redundancy and back-up services.

Calero Reservoir's operational resilience benefits for water supply are partly accounted for by its ESRs (see Section 7.2). However, in addition to its ESR storage capabilities, Calero Reservoir is the closest source of supply for all water treatment facilities. The reservoir's water delivery capabilities due to its location and interconnections to the Valley Water system are another important benefit. Past system-wide reliability studies have counted on the reservoir being available to provide supplies during disaster recovery. If Calero is not available as an emergency water supply source, this component of its utility would otherwise be required elsewhere in the system.

Due to its current poor conditions, the South Bay Aqueduct experiences frequent service outages which are expected to continue into the foreseeable future. As a result, the operational resilience benefits provided by Calero reservoir are more critical at this time. Calero will still be important to resiliency even after the South Bay Aqueduct is eventually rehabbed.

No operational resilience benefits are specifically quantified for the BCA, but the Base Case offers substantially greater resiliency benefits than Alternative 1 which has very limited operational storage and ability to modify its operations. Alternative 2 provides no resiliency benefits.

7.4 Water Rights

Valley Water currently has a total of 9,500 acre-feet of water rights associated with Calero Reservoir's facilities and operations. These water rights consist of 3,500 acre-feet of senior (1934) appropriative water rights for Calero Reservoir (i.e. from retention and use of natural in flows from the Calero watershed) and 6,000 acre-feet of senior (1934) appropriative water rights for Almaden-Calero Canal supplies (i.e. from retention and use of natural in flows from the Almaden watershed that otherwise would not be held by the Almaden Reservoir). The inability to convey Almaden-Calero Canal flows may also impact Almaden Reservoir's ability to more effectively utilize its own Water Rights (an additional 2,500 acre-feet).

While these water rights are only a small proportion of Valley Water's total system-wide water rights, they account for nearly half (49 percent) of the Guadalupe River watershed's total water rights. Water rights in California are regulated and adjudicated by the California State Water Resources Control Board (SWRCB). Transfer of Valley Water's current water rights would likely be highly problematic and unlikely to be successful. Consequently, the Alternative 1 storage capacity reduction or removal of the Calero

Reservoir would be expected to result in a similar permanent reduction or loss of Valley Water's current water rights for Calero Reservoir and/or the Almaden-Calero Canal.

In the absence of any open market for water right transfer sales, it is very difficult and potentially speculative to quantify the monetary value of Valley Water's water rights separate from its associated water supply. Nonetheless, possession of such water rights generally ensures greater supply reliability and represents an additional value premium over other water sources. Consideration of the water rights represents an additional benefit (incorporated in its estimated water supply benefit valuation) to the water use benefits that would be associated with use of imported water supply source that would offer no guarantee of future water availability to Valley Water.

Therefore, the separate independent value of Valley Water's water right component (i.e. distinct from the water's use value) for its system originated supplies was undetermined and therefore not incorporated in the BCA estimated benefits. This is due to the difficulty in apportioning its specific additional monetary especially since there is a lack of market/purchase data and existing analysis. Nonetheless, the potential differences in Valley Water future water rights under the BCA alternatives are quantified and qualitatively assessed below.

It should also be noted that due to its likely higher supply reliability, development of new local reuse/reclaimed replacement supply facilities could ensure equal or greater use benefits that those conferred by the seniority of Valley Water rights. As such, a higher benefit valuation based on one of these system controlled water supplies (see Section 6.6) as the replacement cost/value for the reservoir retained water supply would likely provide a more representative approximation of its full benefit value than that based use of low cost and less reliable imported water.

7.4.1 Base Case

The Base Case would restore the reservoir capabilities to make full beneficial use of its 9,500 acre-feet of appropriate water rights for both Calero Reservoir and the Almaden-Calero Canal. As a result, there would be no change in Valley Water's water rights from current conditions under the Base Case.

7.4.2 Alternative 1

As discussed in Section 7.4 above, Alternative 1's permanent decrease in beneficial use of Calero Creek run-off and/or Almaden-Calero Canal transfers could result in water right forfeitures if SWRCB does allow Valley Water to transfer and retain its of water rights.

In the absence of Valley Water's self-imposed ESR commitment at Calero Reservoir, full beneficial use of its 3,500 acre-foot water right for retention of Calero Creek would continue to be possible. However, due to the reservoir's reduced storage capabilities under Alternative 1, it is very unlikely that Valley Water could make beneficial use of its entire 6,000 acre-foot water rights for the Almaden-Calero Canal during its winter/spring entitlement period ending April 30. Under the likely strictest assessment of the reservoir's water transfer capabilities, Valley Water's Almaden-Calero Canal water rights could be reduced to 914 acre-feet (i.e. maximum reservoir capacity net of its Calero Creek rights).

In which case, Valley Water's water rights under Alternative 1 could be limited to a total of 4,414 acre-feet which would represent a potential loss of up to 5,086 acres in Valley Water's portfolio of water right if SWRCB does not allow full transfer of the affected water rights.

While this water right benefit loss cannot be monetized and included in the BCA, the lost water rights under Alternative 1 would represent a major (54 percent) decrease compared to the Base Case conditions.

7.4.3 Alternative 2

As discussed in Section 7.4 above, Alternative 2's permanent decreases in beneficial use of the Calero Creek run-off and/or Almaden-Calero Canal transfers could result in water right forfeitures if SWRCB does allow Valley Water to transfer and retain its of water rights.

Under Alternative 2, beneficial use of the Calero Creek surface water run-off would be expected to average of 302 acre-feet for winter and spring groundwater recharge due to the lack of any retention and storage facilities. In which case, Valley Water total water rights under Alternative 1 could be potentially limited to as little as 302 acre-feet. This could result in a potential loss of up to 9,198 acre-feet in Valley Water's portfolio of water right if SWRCB does not allow full transfer of the affected water rights.

While this water right benefit loss cannot be monetized and included in the BCA, the lost water rights would represent nearly an entire (97 percent) decrease compared to the Base Case conditions.

7.5 Flood Reduction

As discussed in Section 6.5, Valley Water primarily operates Calero Reservoir for the purpose of groundwater recharge and deliveries to water treatment plants, but the facility also currently results in incidental flood control benefits. Valley Water has implemented reservoir operating strategies at Calero Reservoir to provide flood storage and optimize its water supply function since 1997. The flood rule curve restrictions range from 1,134 acre-feet on December 1 to 314 acre-feet on March 31. No storage restrictions are required as of April 1.

Preliminary hydraulic (2D HEC-RAS) and flood damage modeling (F-RAM) analyses were performed to evaluate the potential flood risk increase under Alternative 2 if Calero Creek was permitted to run under its natural flow uncontrolled conditions (see Appendix B). The flood analysis projected the future flood damages expected from Arroyo Calero above Harry Road under both the Base Case and Alternative 2 during six storm events (2, 5, 10, 25, 50 and 100-year storms). The hydraulic and flood damage modeling was limited to upstream of Harry Road. As a result, flood damage analysis does not evaluate the potential for additional flooding and flood damages downstream from Harry Road which could adversely impact the Upper Guadalupe River Flood Protection Project. The Base Case flood analysis also conservatively assumed that the reservoir would be at near full capacity (94 percent).

The flood risk analysis estimated that there would nonetheless be a very low flood risk of \$15,000 in expected annual damages under both Base Case and Alternative 1. Under Alternative 2 (with unmanaged Calero Creek flows) expected annual damages from flooding would be expected to average \$1.36 million with and total estimated NPV of over \$31.6 million over the 50-year analysis period. The flood analysis is provided in Appendix B.

Based on these findings it was determined that construction of a small flood retention facility under Alternative 2 would likely be the LCA that Valley Water could implement to reduce the flood risk under Alternative 2 to its current levels. It was also determined that such a retention facility should be incorporated into the Alternative 2 facility design with a minimum of 1,134 acre-feet winter retention capacity to match the maximum December 1 flood curve requirement. This facility would also provide water quality protection benefits and was estimated to have a \$18.6 million NPV capital cost.

7.5.1 Base Case

As discussed in Section 6.5, the current flood rule curves would continue to be imposed on the Base Case future operations, but DSOD's dam safety restriction will be removed, which could increase future flood risk compared to Calero's recent and past operations with the safety restriction in place.

However, in addition Valley Water plans to operate the reservoir future operation of Calero Reservoir under the Base Case to "maximize retention potential" by typically drawing down the reservoir levels to approximately 4,000 acre-feet in December. This will ensure that the reservoir will have the capability to retain a minimum of 5,104 acre-feet of surface water during the winter season. After the flood rule curve

restrictions end after March 31, Calero Reservoir could potentially store up to 5,780 acre-feet of winter/spring water. Calero Reservoir would be expected to typically operate with substantial unused storage under its “maximize retention potential” operational approach. This will vary the reservoir’s incidental flood reduction capabilities, ranging from current conditions with the restrictions (most benefit), to either Alternative 1 or 2. For example, the reservoir in December would have significantly greater flood reduction capabilities than if it was full in March.

However, given the very low frequency of such high flow events, unknown timing of reservoir levels, and the very limited estimated flood risk under the flood curve requirements, the cost of the increased flood risk is expected to be low. There are also additional flood reduction benefits to downstream creeks that are difficult to quantify. As a result, no additional benefit was incorporated for Base Case additional increase in its incidental flood reduction in the BCA, but a qualitative benefit for the Base Case over Alternatives 1 and 2 is recognized.

7.5.2 Alternative 1

As discussed in Section 6.5, the current flood rule curves would continue to be imposed on Alternative 1’s future operations. Future flood risk would be higher compared to Calero’s recent and past operations due to its lack of additional storage currently provided by the restricted reservoir. As a result, under Alternative 1 there would be a reduction in future flood reduction performance compared to the current conditions.

7.5.3 Alternative 2

As previously discussed above in Section 7.5, Alternative 2 includes a retention facility to match the current flood rule curve requirements for minimum flood storage capacity and flood reduction benefits. As a result, under Alternative 2 there would be a reduction in future flood reduction performance to be recognized similar to Alternative 1.

7.6 Water Quality

Water quality impacts can result from changes in the water’s temperature, turbidity, and composition of dissolved or suspended materials. Avoided or reduced water treatment costs can be used to approximate the benefits or costs of project related water quality impacts for water supply use (water quality effects on fish habitat are analyzed separately as environmental impacts).

7.6.1 Base Case and Alternative 1

The Base Case and Alternative 1 would maintain the current water quality conditions, allowing water stored in Calero Reservoir to be used for mixing of any water entering the reservoir (e.g., imported water, water from Almaden Reservoir) to provide water of a quality most suitable for the treatment plants. Water routed to the water treatment plants and released downstream for groundwater recharge would presumably be of similar quality to existing conditions.

For the purposes of the BCA, future water quality conditions would be relatively unchanged from current conditions under both the Base Case and Alternative 1. Therefore, no net benefit changes will result, and no corresponding BCA benefits are estimated.

7.6.2 Alternative 2

Under Alternative 2, there would no longer be a reservoir and water would no longer be available to the treatment plants from the Calero facility, thus water quality costs or benefits to the treatment plants would not apply. Under this Alternative, water flowing downstream could still be used for groundwater recharge. Expected changes in water quality such as temperature or turbidity in the natural stream flows would have little to no effect on the quality of groundwater removed from the aquifer at a later time. As discussed in Section 2 the engineering design for Alternative 2 would include removal or

capping of any metals contaminated soils in the reservoir bed, which should reduce migration of contaminants downstream.

As a result, future water quality conditions under Alternative 2 would be relatively unchanged from current conditions and those under both the Base Case and Alternative 1. Therefore, no net benefit changes will result and therefore there will be no differences between the BCA Alternative's future water quality conditions and therefore no corresponding BCA benefits are estimated and incorporated in the BCA.

7.7 Habitat and Other Environmental Benefits

Both wildlife and creek habitat conditions will depend on water availability, water quality and access to the habitat. Lack of an adequate supply of water will reduce and/or alter vegetation growth and can affect the wildlife and fish populations that can be supported. Reduced creek water flows can result in higher water temperatures, lower dissolved oxygen levels, and reduced habitat suitability for fish.

Calero Dam also limits passage of anadromous⁴ steelhead to upstream habitat areas and potential benefits to this species are important to the benefit analysis. Central California Coast steelhead (*Oncorhynchus mykiss*, referred to hereafter simply as steelhead) are classified as a threatened species under the federal Endangered Species Act (ESA) (62 Federal Register 43937 August 18 1997). The non-anadromous form of *O. mykiss* (called rainbow trout) that occurs above impassable barriers is not listed under the federal ESA; however, in Santa Clara Valley, native populations of rainbow trout above barriers are genetically similar to steelhead (Garza and Pearse 2008). Steelhead are present in the Guadalupe River Watershed, which drains approximately 170 square miles and contains approximately 70 miles of perennial channel (NMFS 2016), however the size of the historical steelhead run in the Guadalupe River Watershed be limited by arid conditions in the watershed (NMFS 2016). Designated critical habitat for steelhead occurs in the Guadalupe River Watershed but it is limited to the Guadalupe River downstream of Lake Almaden. Calero Dam is located on Arroyo Calero upstream of the critical habitat area.

Steelhead require freshwater streams with adequate flow for migration, spawning, and rearing, and cool temperatures corresponding to specific life-stage requirements. Steelhead migrate from the ocean and spawn in suitable habitat from December through April. Juvenile steelhead typically rear in freshwater for 1 to 3 years before beginning their migration to the ocean in March through June. Because juvenile steelhead remain in creeks year-round, suitable rearing habitat consisting of perennial pools or stream reaches with adequate flows, water temperatures, and cover (e.g., large woody debris, undercut banks, or surface vegetation) is necessary to sustain steelhead populations. In addition, floodplains, side channels, and other backwater areas are valuable food production habitats for rearing juvenile steelhead. Quantity and quality of summer rearing habitat with cool water pools and extensive cover for juvenile steelhead is often a limiting factor for steelhead in California streams.

The alternatives' potential natural resource value benefits were assessed to determine if the future effects on downstream flows and/or expected opportunities for upstream fish passage enhancement can be adequately determined. Site specific data on the area's existing habitat condition is necessary for quantifying the type, quality and extent of its future habitat enhancement potential. Much if this specific data is lacking for the watershed and therefore consideration in this section is largely qualitative.

Table 13 shows the projected environmental benefits under each of the BCA Alternatives. Unlike the benefits estimated for the other project benefits which occur and are estimated on an annual and average water year bases, the environmental benefits are instead a one-time establishment benefits achieved in 2030 when project construction is completed.

⁴ Anadromous refers to the life cycle of fish that move from the ocean to freshwater to spawn.

Table 13: Environmental Benefits (2019\$)

Benefits	Base Case	Alternative 1	Alternative 2
Riparian Habitat			
Increased Upstream Riparian Habitat (miles) (a)	0	0	5.1
Increased Reservoir Channel Riparian Habitat (miles) (a)	0	0	2.0
<i>Estimated Unit Benefit Value (\$M/mile)</i>	<i>\$0</i>	<i>\$0</i>	<i>\$3.6</i>
Est. Reservoir Channel Restoration Cost	\$0	\$0	\$7.1
Total Net Riparian Habit Value (\$M)	\$0	\$0	\$18.2
Wildlife Habitat			
Potential Increased Wildlife Habitat (acres)	0	0	325
<i>Estimated Unit Benefit Value (\$/acre)</i>	<i>\$0</i>	<i>\$0</i>	<i>\$21,239</i>
Total Wildlife Habit Value (\$M)	\$0	\$0	\$6.9
Riparian and Wildlife Habitat			
Total Environmental Benefits (2030) (\$M)	\$0	\$0	\$25.1

Note:

(a) Habitat benefits are based on potential newly accessible or restored riparian habitat for Steelhead.

7.7.1 Downstream Arroyo Calero Habitat Potential

Current Calero Reservoir operations result in water releases are generally maintained throughout the summer, providing downstream flows to Arroyo Calero through the dry season. Historically, Arroyo Calero⁵ was an intermittent creek, with portions likely drying out during the dry season due to lack of flows from the upper watershed. Operation of Calero Reservoir has increased summer flows and somewhat stabilized to the creek from deliveries of its captured and imported water to the downstream percolation ponds. As a result, Arroyo Calero downstream of Calero Dam has become a perennial stream that supports riparian habitat, with fish and other wildlife species.

O. mykiss are known to be present downstream of Calero Reservoir, in Arroyo Calero, and have sometimes been reported as steelhead (Leidy et al. 2005, NMFS 2016). Electrofishing surveys conducted in Arroyo Calero by Valley Water staff in October 2018 documented presence of *O. mykiss* at all three sites sampled. Foraging, rearing, or dispersing juvenile steelhead originating in Alamitos Creek, Guadalupe Creek, Los Gatos Creek, or the Guadalupe River could occur in Arroyo Calero as far upstream as Calero Dam when conditions are suitable. Spawning could potentially occur in Arroyo Calero, although suitable spawning habitat for steelhead may be limited.

7.7.1.1 Base Case and Alternative 1

The Base Case alternative would maintain the past flow regime and conditions within Arroyo Calero. It is also expected that Alternative 1's future operations would also generally maintain the past downstream flow regime. The Base Case and Alternative 1 would maintain the benefit of cold water releases below the dam that are part of the current operations and any benefits to downstream fisheries would continue to be realized. No downstream habitat benefit changes are expected under either the Base Case or Alternative 1.

⁵ Note that typically the Creek is referred to as Arroyo Calero downstream of the Dam, and Calero Creek upstream of the reservoir.

7.7.1.2 Alternative 2

Alternative 2 would return Arroyo Calero to its historically intermittent nature and result in the loss of controlled downstream releases and all minimum summertime stream flow benefits provided under the Base Case and Alternative 1. Alternative 2 would be expected to result in dry creek conditions during the summer in many water years. This may impair certain current beneficial uses of the reach downstream of the dam. Arroyo Calero may be less suitable or unsuitable for fish at certain times of the year and flows contributed to Alamitos Creek and the Guadalupe River downstream may be reduced, potentially adversely affecting fish (primarily steelhead) in those reaches of the system.

Valley Water has not finalized its Fisheries and Aquatic Habitat Collaborative Effort agreement, that would provide agreed-upon rule curves for operating the reservoir to maintain conditions beneficial to steelhead in downstream areas. Under the dam removal alternative, operating rules would no longer be applicable and consequently Valley Water would need to negotiate terms without the reservoir in place. This may be as simple as removing Calero reservoir from the negotiations, but the likely outcome of any resulting negotiations is currently speculative and their impacts cannot be projected. Any such negotiations would require commitment of additional Valley Water staff time and resources to resolve.

Alternative 2 could also have incidental water quality effects. The return to intermittent flow conditions could potentially cause water temperatures in the remaining flow or in pools cut off from flows under dry conditions to become elevated during the dry season and reduce dissolved oxygen levels, further reducing benefits for fish in downstream areas.

The existing reservoir impounds sediment that has elevated mercury concentrations resulting from historic mining in the Calero watershed. As a result, adverse water quality effects could occur over the long term from the dam removal alternative if sediment were to be transported downstream. Consequently, it is assumed that for the Alternative 2, sediment would be removed and if necessary transported off-site for disposal or capped and stabilized if any were left on-site. The costs for sediment retention removal and disposal or stabilization necessary to ensure no downstream water quality impacts are included as cost components of Alternative 2.

The mitigation benefits from a water retention facility (primarily to reduce flood risks) would help to reduce sediment loads in future downstream releases to Arroyo Calero, similar to the current reservoir but on a much smaller scale. In addition, the exposed reservoir bed and the Calero Creek streambed upstream of the dam would be restored using establish revegetation and stream restoration techniques that would reduce erosion and maintain water quality in the creek flows. To maintain the fish passage benefit identified in Section 7.8.1 any flow retention facility would need to incorporate some type of upstream fish passage.

Quantification and monetization of such effects would require watershed specific hydrological data to predict the future water flow conditions, temperatures, and sediment transport characteristics. Currently, no suitable baseline data is available and its quantification is beyond the scope of this BCA.

7.7.2 Calero Reservoir Area Habitat Potential

7.7.2.1 Base Case and Alternative 1

Calero Reservoir currently has a maximum surface area of 346 acres with approximately 9 miles of shoreline. Calero dam would continue to inundate this existing reservoir area under the Base Case. Based on its reduced capacity, Alternative 1's maximum inundation area would be approximately 280 acres with approximately 8 miles of shoreline. Reclamation and future restoration of the reservoir area would only occur under Alternative 2. Consequently, only Alternative 2 has the potential to result in any new wildlife habitat benefits within the reservoir area.

There is no historical data on the original site and habitat conditions of the land currently inundated by the reservoir. However, it is reasonable to expect that it was similar to that of the surrounding areas and region. For purposes of this assessment, it is assumed that for Alternative 1 that the habitat around its reduced pool would be restored to the surrounding area's natural and wildlife habitat conditions. However,

the area that would be reclaimed and restored would be very limited and consequently is not considered a significant benefit warranting quantification and inclusion in the BCA.

7.7.2.2 Alternative 2

It is assumed under Alternative 2 that the Calero Creek channel would be restored to stream with riparian habitat. However, as discussed above, past sedimentation has potentially resulted in the accumulation of mercury bearing sediment that would need to be managed to prevent future erosion and downstream migration. This has been considered in the overall engineering costs provide in Section 5.0.

Under Alternative 2, it is conservatively estimated that up to 325 acres of new vegetation habitat could be created within the approximately 346 acres of formerly inundated by the reservoir. The estimated habitat area is net of the area required for the retention facility that would be constructed to ensure that the future water quality and flood risk conditions under Alternative 2 are unchanged from their current conditions and are equal to those under both the Base Case and Alternative 1.

This restored habitat is expected to primarily consist of California Annual Grassland habitat as defined by the Santa Clara Valley Habitat Plan (SCVHA 2012). Using an average habitat value of \$21,239 per acre consistent with the current Santa Clara Valley Habitat Agency fee schedule, the potential future benefit value of the added habitat acreage would total approximately \$6.9 million (NPV).

7.7.3 Upstream Calero Creek Habitat Potential

Calero dam would continue to limit fish passage to the upstream creek areas under both the Base Case and Alternative 1. Unimpeded fish passage to the creek areas upstream of the reservoir would only be possible under Alternative 2, which would also include restoration of habitat currently inundated by the reservoir. Consequently, only Alternative 2 would have the potential to result in new upstream habitat benefits for fish, provided natural water supplies are adequate at critical times for spawning, rearing, and outmigration and any water retention facility to provide flood control benefits were designed to allow for fish passage.

Calero Dam is a barrier to fish passage, and steelhead are absent from Calero Reservoir and tributaries to the reservoir. Although resident *O. mykiss* (rainbow trout) are present upstream of other dams in the Guadalupe River watershed (including nearby Almaden Reservoir [Leidy et al. 2005, Garza and Pearse 2008]), *O. mykiss* records from Calero Reservoir (Valley Water 2017) or its tributaries were not identified in readily available literature and *O. mykiss* also are not known known anecdotally from upstream of Calero Dam.

There is very little reported data on current habitat conditions of areas upstream of Calero Dam. Above the reservoir, Calero and Cherry Canyon Creeks contribute water mainly during winter and spring storm events in the Alamos Creek sub-watershed of the Guadalupe River watershed. Both of these Creeks, although they may have some flows during the dry season, are considered to be “flashy”, with water levels rising and falling rapidly due to storm events. The hydrology of the sub-watersheds upstream of Calero Reservoir suggests that both Calero Creek and Cherry Canyon Creek run dry most years and consequently they may be expected to have limited habitat potential for steelhead. In which case, the future potential habitat value for these areas could be limited to their vegetation and other wildlife benefits.

AECOM conducted limited field reconnaissance surveys in 2018 and 2019 to assess upstream habitat conditions in Calero and Cherry Canyon creeks during a dry season period (November) and subsequent wet period (March). These limited surveys found many elements of suitable steelhead habitat are present upstream of Calero Dam, particularly in Cherry Canyon Creek. Habitat features such as large woody debris, root wads, and overhead cover are present. Gravels that may be suitable for *O. mykiss* spawning are present in some locations, but in general sediments are poorly sorted, and sometimes angular, presumably due to the low intensity of typical streamflow. Field observations for specific stream reaches were compared to general steelhead habitat requirements and to habitat predictions generated from the National Oceanic and Atmospheric Administration (NOAA) Intrinsic Potential (IP) model (NOAA 2017). This model was originally developed to be used in the watersheds of the Coast Range in Oregon, so the habitat suitability curves are based on data from Oregon streams. When applying the NOAA IP model to California streams, the model may overestimate the amount of summer rearing habitat in California because California streams experiences greater drops in summer streamflow than Oregon streams.

Based on the field results and the IP model, a total 5.1 miles⁶ of low to moderate habitat was considered to be present upstream of Calero Reservoir. Although impediments to fish movement were uncommon in the upstream areas, based on the limited hydrologic data, streamflow appears to be most limiting for steelhead in tributaries of Calero Reservoir.

Removal of the dam and restoration of fish passage to upstream areas might be used in negotiations with regulators such as the National Marine Fisheries Service regarding potential fisheries impacts of other Valley Water dams, however, that would require a system-wide assessment of effects and how removal of Calero Dam might mitigate those effects and is beyond the scope of this assessment.

7.7.3.1 Base Case and Alternative 1

No riparian or wildlife habitat resource changes would occur under the Base Case or Alternative 1. Calero Dam would remain a barrier to potential upstream steelhead migration.

7.7.3.2 Alternative 2

By removing a portion of Calero Dam, Alternative 2 could provide access for steelhead to up to 5.1 miles of low to moderate suitability upstream habitat. However, this would be dependent on the ability to design a facility to retain water to moderate flood flows and reduce flood risk, while still providing passage to fish. The ability of this newly accessible habitat to provide viable, productive habitat for steelhead would be dependent on adequate flows throughout the year and consistent enough flows on a year to year basis to sustain a population. As described above, annual streamflow and the relatively low suitability of the habitat may be limiting.

In order for steelhead to reach the existing habitat upstream of Calero reservoir, approximately 2 miles of streambed that is currently inundated by the reservoir would need to be restored using established methods for stream and riparian vegetation restoration. Costs for the removal of a portion of Calero Dam and grading the reservoir bed and removing contaminated sediments in the reservoir bed after draining the reservoir have been factored into the overall construction cost. Costs for restoring the streambed and riparian habitat in the area currently inundated by the reservoir can vary widely depending on the stream type, size, topography, hydrology and other factors, and can often range from \$1 million to over \$10 million per restored mile. For purposes of this BCA, we have used the current Santa Clara Valley Habitat Agency mitigation fee schedule for stream habitat (\$675 per linear foot or \$3.56 million per mile; SCVHA 2019) as an approximate cost for restoration of the stream habitat.

The imputed benefit value for Alternative 2's potential total 7.1-mile increase in future fish habitat would could total up to approximately \$25.3 million NPV (based on current mitigation fees of \$3.56 million per mile). However, this value would be reduced by the construction costs of the restoration of 2 miles of stream habitat through the reservoir bed, estimated at \$7.1 million, bringing the total NPV to \$18.2 million. However, Calero Creek's upstream area's suitability and long-term viability for future fish habitat is currently uncertain. As described in Section 7.7.1, removal of the dam would return Arroyo Calero to intermittent conditions that may adversely affect current downstream fish populations that depend on summer flows in Arroyo Calero. If portions of Arroyo Calero become dry some years, fish would not be able to access the upstream habitat or juveniles may become stranded in upstream pools that may not be suitable. If the upstream areas opened to future fish passage result in little increase in productivity, then the actual future benefits to steelhead attained under Alternative 2 would be greatly reduced.

7.8 Recreation

Changes in current or future visitor use of the facility for recreational purposes could result in positive or adverse future project-related impacts. The magnitude of the potential impacts would depend on the magnitude and type of the change in Calero Reservoir's future recreational use.

⁶ The IP model also provides weighting to consider the ratio of low to moderate potential habitat. This value is the unweighted habitat miles and is conservative because much of the habitat upstream of Calero Reservoir was considered of low potential suitability in the limited reconnaissance survey.

Calero Reservoir is surrounded by Calero County Park, which is owned and operated by Santa Clara County Department of Parks and Recreation. Calero Reservoir provides year-around opportunities for a variety of water-based recreational uses, including power boating, sailing, fishing, waterskiing, jet-skiing, kayaking/canoeing, and paddle boarding. Fishing is only available on a catch and release basis due to the high levels of mercury in the reservoir. Swimming at the reservoir is also prohibited. The surrounding Calero County Park offers several miles of trails for hiking, biking, equestrian use and picnicking.

Calero Reservoir's recreation use benefits were estimated using standard unit values for recreation use by visitors applied to the projected future annual recreation use by activity type. Table 14 shows the estimated recreation benefit findings for each BCA Alternatives. Recreation use benefits were quantified using unit day values from the Recreation Use Values Database for North America (Rosenberger 2016). The average recreation benefit unit value of \$82 per visitor day is the weighted average of the expected future motorized boating, non-motorized boating and fishing use consistent with current recreational use at Calero Reservoir. The analysis also does not include any future growth in recreation demand and increase future use over the future 2030 to 2079 analysis period despite a very reasonable expectation of continued population growth over that period. As a result, the recreation benefit estimates shown in Table 14 are very conservative and underestimate the future reservoir recreational benefits under the Base Case and Alternative 1. The supporting recreation benefit analysis is provided in Appendix D.

Table 14: Recreation Benefits (2019\$)

Benefits	Base Case	Alternative 1	Alternative 2
Projected Annual Recreation Use (Visitor Days)	17,914	13,755	0
<i>Average Recreation Benefit Unit Value (\$/visitor day)</i>	<i>\$82</i>	<i>\$82</i>	<i>\$0</i>
Recreation Use Benefit – Annual	\$1.48M	\$1.13M	\$0

These recreational use benefits represent the benefit specifically from use of Calero's facilities and are appropriate for the BCA. However, the availability of similar local recreational opportunities could result recreational use substitution effects either drawn from those locations (e.g. under the Base Case) or relocation of use displaced from Calero Reservoir (Alternative 2). In which case, the net benefit change for local residents may be less than that estimated in Table 14 if most of the increase or decrease in recreation use is simply relocated but still retained with the local area.

7.8.1 Base Case

Future recreation use under the Base Case was projected to average over 17,900 visitor days annually. This level of use is approximately 30 percent higher than the reservoir's recent recreation use levels under to the current DSOD operating restriction. The Base Case's higher future recreational use levels are expected due to its larger surface area conditions which is expected to average 337 acres which can accommodate and are expected to attract greater future recreational use. In recent years, due the DSOD restrictions, lower reservoir levels have decreased its average surface area to 210 acres which is more than 37% less than the Base Case conditions. This small reservoir surface level is expected to continue under Alternative 1.

As shown in Table 14, future recreation under the Base Case is projected to have an average annual benefit value of approximately \$1.5 million.

7.8.2 Alternative 1

Future recreational use under Alternative 1 future recreation use was projected to remain unchanged from the reservoir's recent use levels under the DSOD restrictions and average approximately 13,750 visitor days per year. As shown in Table 14, future recreation under Alternative 1 is consequently projected to have an average annual benefit value of approximately \$1.1 million.

7.8.3 Alternative 2

Alternative 2 could possibly result in increased open space areas but future habitat restoration efforts for wildlife habitat are expected to limit the reclaimed area's future recreational use potential. Especially in the absence of any new visitor parking or other facility development occurring no significant increase in non-water recreational is expected while all the water based recreational use of Calero Reservoir under either the Base Case or Alternative 2 would be displaced.

As a result, as shown in Table 14, no future recreational use and recreational benefits are projected to occur under Alternative 2 which would be expected to result in a net loss of approximately \$1.1 million in annual recreation use benefits compared to the current conditions.

7.9 Total Annual Benefits

Table 15 shows the estimated annual benefits by benefit type for each alternative. The one-time benefit for Alternative 2's environmental improvements in 2030 are shown as an annualized value to allow direct comparison with the other benefit value estimates. As previously shown in Table 10 (and discussed further in their respective sections of Chapter 7) no project-related water reliability or water rights benefits were estimated for the BCA. In addition, current water quality conditions are projected to remain unchanged under all the BCA Alternatives. The current flood reduction performance could remain unchanged under the Base Case but Alternatives 1 and 2's flood reduction capabilities would be reduced from the reservoir's current levels. For Alternative 2 this would be achieved the small retention facility incorporated into its design. Given the and consequently a zero value is shown in the Table 15.

Table 15: Benefit Summary and Comparison

Benefit Type	Annual Benefits (\$M, 2019\$)		
	Base Case	Alternative 1	Alternative 2
Water Supply	\$5.46	\$2.10	\$0.29
Emergency Use	\$0.07	\$0.07	\$0
Water Reliability (a) (d)	Extensive	Limited	None
Flood Reduction	No Change	Reduced	Reduced
Water Rights (a) (e)	No Change	Major Loss Potential	Near Full Loss Potential
Water Quality (b)	\$0	\$0	\$0
Habitat (Riparian + Wildlife)	\$0	\$0	\$0.98 (c)
Recreation	\$1.48	\$1.13	\$0
Total Benefits	\$7.01	\$3.30	\$1.27

Notes:

- (a) Benefits quantified but no monetized benefit estimation.
- (b) All alternatives maintain existing conditions and consequently no projected benefit change.
- (c) Annualized value of Alternative 2's estimated \$25.1 million total environmental benefits in 2030.
- (d) Non-supply benefits from both operational flexibility (i.e. water system management for routine and planned system needs) and operational resilience (i.e. water system management for unplanned system needs).
- (e) Senior appropriate entitlements (based on historical use) for surface water retained by Calero facilities.

8. Benefit-Cost Analysis Findings

For each project alternative, the specific cost and benefit value estimates from the previous analysis have been converted into current (2019) NPV. The Net Benefits and BCR findings for each alternative are also

provided below. The levelized unit economic cost of the Base Case's system originated water supply was also estimated and is discussed below. Lastly the requirements and costs for Valley Water to achieve the future Base Case's water supply conditions under Alternatives 1 and 2 are estimated and discussed.

8.1 Net Present Value Estimation

A 50-year future lifecycle period was used for the proposed project. The future schedule of costs and benefits over the time period was determined based on discussions with Valley Water and its consulting engineers GEI. All future monetary values are reported in current (2019) dollar term values and Valley Water's standard discount rate of 2.5 percent was used to discount future project benefits and expenditures into corresponding 2019 NPV terms.

Table 16 shows the estimate NPV of the annual benefits monetized and shown above in Table 15. Over its projected 50-year lifespan, the Base Case's future operations are estimated to result in total benefits with a \$155.4 million NPV. During the same period, Alternative 1's total benefits would have a \$73.1 million NPV and Alternative 2 would result in \$25.5 million NPV of future benefits.

Table 16: Total Benefit Summary (2030 to 2079) and Comparison

Benefit Type	Total Benefits (2030 to 2079) (\$M, 2019\$)		
	Base Case	Alternative 1	Alternative 2
Net Present Value (2019)			
Water Supply	\$121.0	\$46.4	\$6.4
Emergency Use	\$1.6	\$1.6	\$0
Habitat (Riparian + Wildlife)	\$0	\$0	\$19.1
Recreation	\$32.7	\$25.1	\$0
Total Benefit Value	\$155.4	\$73.1	\$25.5

8.2 Net Benefits and Benefit-Cost Ratios

The Net Benefits and BCRs for each BCA Alternative are shown in Table 17. These results are based the total lifecycle cost and total benefits previously determined for each alternative.

Table 17: Net Benefit and Benefit-Cost Ratio Comparison

Factor	Net Present Value (\$M, 2019\$)		
	Base Case	Alternative 1	Alternative 2
Total Development Cost	\$107.7	\$51.6	\$52.9
Total O&M Cost	\$7.8	\$7.8	\$5.5
Total Lifecycle Cost	\$115.5	\$59.3	\$58.5
Total Benefit Value	\$155.4	\$73.1	\$25.5
Net Benefits	\$39.9	\$13.8	(\$33.0)
Benefit-Cost Ratio	1.35	1.23	0.44

Notes:

O&M = operating and maintenance

The results of the BCA clearly show that the Base Case would be most economically beneficial option for Valley Water since it would be expected to result in future net benefits over the 50-year analysis with a total NPV of approximately \$40 million. The Base Case is also the most economically efficient alternative since its BCR of 1.35 is the highest. This indicates that Base Case will generate more benefits per dollar invested than Alternative 1 which has only a 1.23 BCR.

Alternative 1 would also be economically beneficial but would result in total net benefits with only a \$13.8 million NPV which would be more than \$26 million less than the Base Case.

Alternative 2 is projected to result a \$33.0 million (NPV) net benefit loss (i.e. net cost) and have a BCR of 0.44. The magnitude of the projected net benefit loss and low BCR indicate that Alternative 2 would be a costly undertaking for the Valley Water that would not be expected to yield sufficient future benefits to offset its expense.

8.3 Levelized Annual Economic Unit Supply Cost

Table 18 shows a preliminary estimated future unit cost of the Base Case's future water supply based on its estimated total development cost, annual O&M expenses and expected average annual water supply. This estimate represents the average annual unit economic cost levelized to a single nominal cost held constant over a 50-year operating and repayment period at a 2.5 percent real interest rate. The Base Case's levelized annual economic unit supply cost is estimated to be \$906 per acre-foot which is slightly less (5 percent) than the estimated unit supply cost (and benefit value) for imported Los Vaqueros Expansion water and \$694 (43 percent) less expensive than the cost of the LCA source for system originated supplies from regional desalination (see Section 6.6).

Table 18: Estimated Levelized Water Supply Cost – Base Case (2019\$)

Cost Item	Est. Cost
Total Development Cost (NPV) (\$M)	\$107.7
Annual Capital Repayment Cost (50 years 3% real interest rate) (\$M/yr)	\$4.86
Annual Water Supply O&M (\$M/yr)	\$0.35
Annual Total Water Supply Cost (\$M/yr)	\$5.21
Est. Levelized Water Supply Cost (\$/af)	\$906

Notes:

\$/af = dollars per acre foot

\$M/yr = million dollars per year

NPV = Net Present Value

O&M = operating and maintenance

In addition, the levelized economic cost estimated in Table 18 is a high estimate of Base Case's water supply cost since the reservoir's entire development cost is attributed solely to its surface water retention operations. As discussed above in Chapter 7, the Base Case would also provide numerous additional operational benefits (e.g. imported water storage/transfer, ESR storage) and facility benefits (e.g. recreation) which consequently should share some of the project's annual total cost. Any such cost sharing/assignment would correspondingly decrease the levelized water supply unit cost shown in Table 18 above.

It should also be noted that under higher interest assumptions, annual capital repayment costs would be greater and result in higher annual water supply costs and imputed water supply benefits.

The levelized water supply unit cost is an *economic* valuation. As such it does not represent either the financial cost or the future ratepayer cost of Base Case's future supplied water. Determination of the actual financial costs to Valley Water and/or its ratepayers requires inclusion of numerous other considerations and factors is beyond the scope of this BCA.

Any such financial and ratepayer cost analysis would require more extensive and detailed projections and assumptions of the Valley Water's current financial conditions and forecasting approach. Specific factors that would be included in any such financial/ratepayer analysis would include (but not limited to): future debt and repayment terms (including pay-as-you-go versus loan funding percentages); bond market terms (e.g. 30 year maximum loan period); long term escalation factors (both for Valley Water costs and imported water sources); and facility useful life and depreciation. The factors used for any such financial or ratepaying analysis would also need to be consistent with Valley Water's standard financial analysis procedures to enable accurate comparison with its other capital projects and budget projections.

8.4 Total Replacement Supply Cost

Table 19 shows the replacement water quantity needed under Alternative 1 and 2 to offset the net loss in Water Valley's system originated supplies if the Base Case is not developed. It also shows the additional cost for Valley Water to replace that foregone local supply of water.

Table 19: Supply Replacement Costs (2019\$)

Cost/Benefit Values	Base Case	Alternative 1	Alternative 2
System Originated Supply – Annual (Avg. Year) (af)	5,751 af	2,206 af	302 af
System Originated Supply Value – Annual (a) (\$M/yr)	\$5.46	\$2.10	\$0.29
Estimated Average Cost of Supply – Total (\$M/yr)	\$5.21	\$2.68	\$2.64
Estimated Average Cost of Supply – Unit (\$/af)	\$906	\$1,214	\$8,737 (b)
Replacement Water Quantity (af)	0 af	3,545 af	5,448 af
Replacement Water Supply Cost – Annual (a) (\$M/yr)	\$0	\$3.37	\$5.18
Replacement Water Supply Cost – NPV (\$M)	\$0	\$86.6	\$133.0
Total Water Supply Cost (Base Case Quantity) (\$M/yr)	\$5.21	\$6.05	\$7.82
Total Water Supply Cost (Base Case Quantity) – NPV (\$M)	\$115.5	\$145.9	\$191.5

Notes:

- (a) Benefit value of \$950/acre-foot conservatively based on imported Los Vaqueros Expansion water as a least cost alternative.
- (b) Water supply is not a primary purpose of Alternative 2 and its estimated water supply cost has not been adjusted for cost-sharing with its other non-supply purposes. As a result, its estimated water supply cost is overstated.

\$/af = dollars per acre foot

af = acre-feet

\$M/yr = million dollars per year

NPV = Net Present Value

It should also be noted that these replacement cost values and estimates are very approximate and are provided for illustrative purpose to illustrate the additional cost that Valley Water would incur to otherwise match the Base Case's water supply performance if Alternative 1 or 2 was developed instead. Most importantly, these estimates do not include any cost allocation/sharing between the Alternatives' other benefit purposes. Any such cost sharing would correspondingly decrease the Alternative's water supply unit costs from those shown in Table 19 above.

9. Summary

The key BCA factors and findings are summarized below:

9.1 Costs

- Construction costs (nominal) for alternatives range from \$119.6 million for the Base Case to approximately \$58.5 million for both Alternatives 1 and 2. The Base Case's estimated development cost (i.e. construction and interest during cost) is \$125.1 million.
- Future O&M costs for the alternatives are comparable and range from \$250,000 (Alternative 2) to \$350,000 per year (Base Case and Alternative 1).
- NPV of the total lifecycle costs (i.e. development, repayment and O&M) range from \$58.5 million (Alternative 2) to \$115.5 million (Base Case).

9.2 Benefits

- System originated water supplies obtained from Calero watershed surface water run-off retention and Almaden Calero transfer storage are the largest benefit category.
 - Base Case: 5,751 acre-feet/year with total future benefits of \$121 million (NPV)
 - Alternative 1: 2,206 acre-feet/year with total future benefits of \$46.4 million (NPV)
 - Alternative 2: 302 acre-feet/year with total future benefits of \$6.4 million (NPV)
- Replacement water that would be needed to offset the system originated water supply loss compared to the Base Case ranges from 3,545 acre-feet/year (Alternative 1) to 5,548 acre-feet/year (Alternative 2)
- Calero Reservoir's operational flexibility and resiliency benefits could be not be monetized for the BCA but are an important component of Valley Water's system-wide operations. Base Case would fully restore Calero Reservoir's capabilities to provide: (1) Imported Water and Carryover Storage; (2) Secondary Supply for water treatment plants; and (3) system redundancy for unplanned outages.
 - The Base Case use is conservatively projected for the BCA based on past reservoir operations. Re-operation potential for increased facility utilization and/or system integration/coordination.
 - Alternative 1's storage capacity loss (cf. Base Case) eliminates carryover storage and reduces its imported water use by 1,101 acre-feet/yr.
 - Alternative 2 provides no operational flexibility use.
- Emergency water supply reserves at Calero would be unchanged (Base Case), minimally reduced (Alternative 1) or eliminated (Alternative 2).
- Water rights benefits could be not be monetized, but Base Case would maintain Valley Water's current 9,500 acre-feet of water rights. However, there is potential risk of water right forfeitures and losses ranging from up to 5,086 acre-feet (Alternative 1) and 9,198 acre-feet (Alternative 2).
- Recreation use and benefits would be highest under the Base Case (\$32.7 million NPV) and slightly lower under Alternative 1 (\$25.1 million NPV). No recreation benefits would be realized under Alternative 2.

- No changes in current flood risk or water quality conditions would be expected under any of the BCA Alternatives.
- Alternative 2's habitat benefits were estimated to be \$25.5 million (NPV) but is uncertain that the riparian benefits \$18.2 million (NPV) would be obtained due potential insufficient stream flow conditions for successful steelhead habitat.

9.3 Overall

Base Case

- Restores Calero Reservoir to its previous operational capacity and performance levels.
- Highest net benefits (\$39.9 million NPV) and most cost-effective (BCR = 1.35).
- Highest level of operational flexibility, recreation, and ESR benefits.
- Maintains existing water rights, flood reduction, habitat and water quality conditions.
- Provides greatest flood risk reduction capabilities and benefits of the alternatives.

Alternative 1

- Reduced storage capacity greatly limits future operational performance and benefits.
- Positive net benefits (\$13.8 million NPV) and relatively cost-effective (BCR = 1.23). However, the DSOD would have to approve the assumed limited dam modifications will meet their seismic standards.
- Estimated minimum \$3.4 million/year cost of replacement water cost compared to the Base Case.
- Operational flexibility use and benefits greatly decreased from Base Case levels.
- Potential risk of loss of up to 5,086 acre-feet of water rights.
- Flood reduction capabilities are less than Base Case but would meet current flood damage curve requirements.
- Maintains existing (current) recreation, habitat and water quality conditions and comparable ESRs.

Alternative 2

- Loss of reservoir storage eliminates or severely reduces future water supply, operational flexibility, water rights, water recreation, and emergency water reserves availability for Valley Water's water system.
- Net cost (\$33.0 million NPV) and BCR less than 1 (BCR = 0.44), indicating this Alternative is not cost effective.
- Estimated minimum \$5.2 million/year replacement water cost compared to the Base Case
- Maintains existing water quality conditions.
- Flood reduction capabilities are less than Base Case but would meet current flood damage curve requirements
- May provide some limited environmental benefit through restoration of steelhead passage to low-to moderately-suitable upstream habitat. However, this would be highly dependent on flows in Calero Creek, which would return to its natural state as an intermittent stream with limited upstream habitat for overwintering juvenile steelhead.

10. Qualifications

The BCA findings for both the Base Case and Alternative 1 should be recognized as conservative representation of their full economic benefit value for Valley Water. This is due to a number of factors:

- Water supply benefits were based on future availability and use of imported water as a viable and dependable replacement option.
- No water supply reliability benefits were monetized for the Base Case and Alternative 1 operations. The future operational flexibility projected under the Base Case is substantially greater than that expected for Alternative 1, given its very limited operational storage capabilities.
- Both the Base Case and Alternative 1's projected future operations were predominantly based on past operational benefits and does not include any reoperation to optimize use of the facility.
- The operations and benefit valuations used for the BCA are based on expected average water year conditions and performance levels. As such, this approach is appropriate for the purposes of the BCA and comparative analysis of the BCA Alternatives.
 - The “average water year” analysis may not fully represent the reservoir's performance if there are significant/disproportionate differences between wet and dry water year operations and/or conditions (e.g. drought demand/value premiums and availability).
 - More precise evaluation of the BCA Alternatives' dry and wet water year performance would require more extensive analysis of their corresponding supply operation, water use and benefit values under wet and dry year conditions.
 - However, the BCA's central finding that the Base Case represents Valley Water's most beneficial and cost-effective development option for Calero Reservoir would not be changed by any such further analysis given the magnitude, nature, and scope of the Base Case's economic benefit advantages identified by the BCA.
- It was conservatively assumed that the reservoir facilities would have no undepreciated and residual value at the end of the 50-year analysis period in 2080.
- The analysis period for the BCA was limited to 50 years. If the reservoir facilities actual useful operating life extends beyond that period, any subsequent benefits (net of its O&M expenses) would contribute additional net benefits and improve the BCR from that currently estimated.

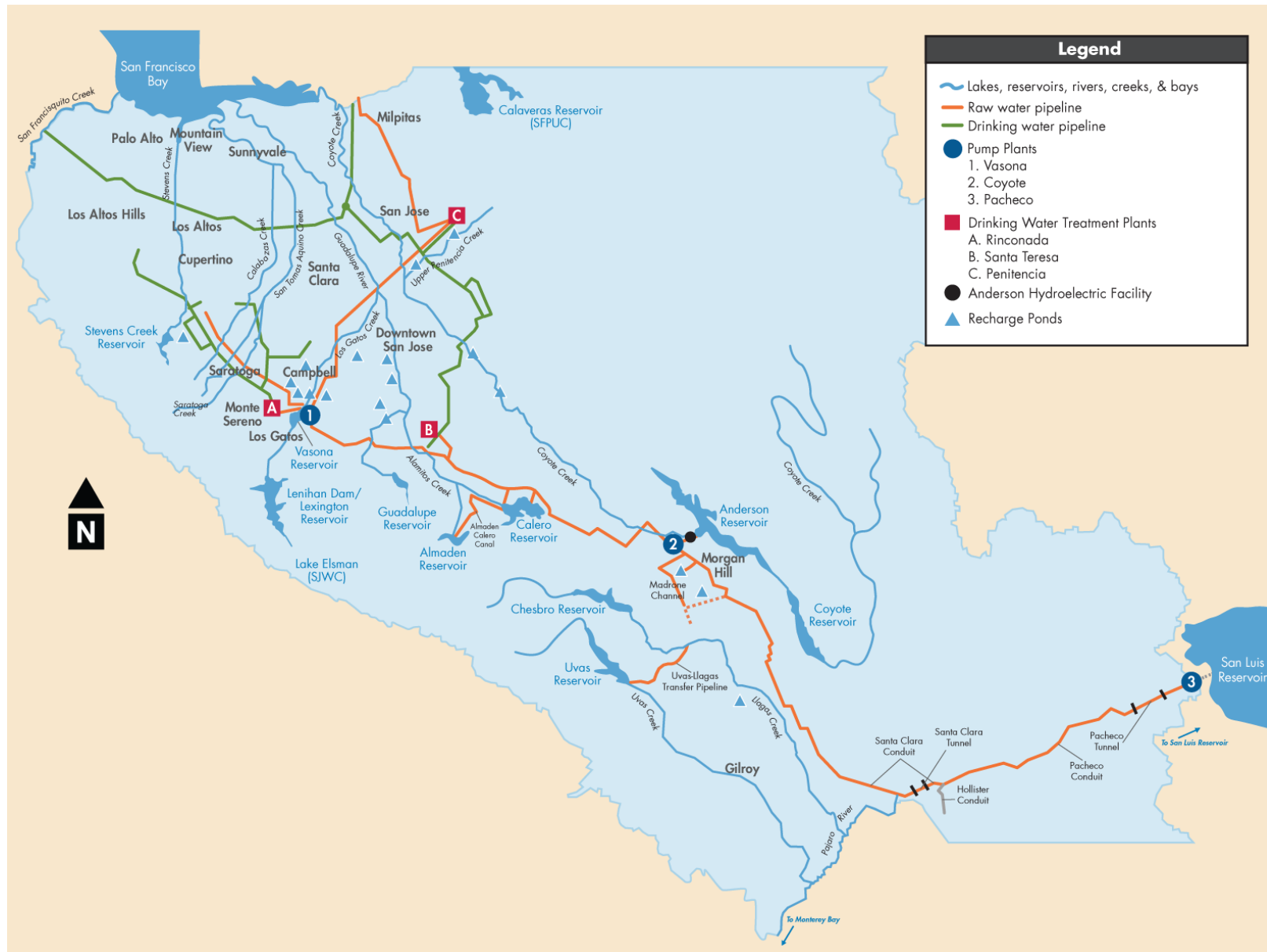
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- Valley Water. 2019b. Calero Dam Cost Benefit Analysis-Calero Flood Risk Reduction Rule Curves.xlsx. Obtained from Eric Olson, Raw Water Operations Unit, Valley Water. August 13, 2019.
- Valley Water. 2019c. Water Storage Exploratory Committee Meeting Summary for May 20, 2019. Table 1. May 28, 2019.

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FIGURES

Figure 1: Valley Water Supply System Facilities



Source: Valley Water 2010.

OVERALL SITE PLAN
SCALE: 1" = 200'

NOTE:
BASE CASE (FULL RETROFIT) INCLUDES 60% PROJECT DESIGN BY HDR FOR COMPARISON WITH ALT. 1 - SPILLWAY NOTCH (FIGS. 2 & 3), AND ALT. 2 - DAM NOTCH (FIG. 4).

REV	DESCRIPTION	DATE	APPR.	REFERENCE INFORMATION AND NOTES
1	60% PLANS NOT FOR CONSTRUCTION 3/19/2019	3/19/2019		

DATE	ENGINEERING CERTIFICATION
3/19/2019	
DESIGN	
D. JABBOUR	
DRAWN	
A. JACKSON	
CHECKED	

Santa Clara Valley Water District

ACCEPTED BY DISTRICT

PROJECT NAME AND SHEET DESCRIPTION:
**CALERO DAM
SEISMIC RETROFIT PROJECT**
OVERALL PLAN VIEW

SCALE:
1" = 200'
VERIFY SCALES
0 1" 200'

PROJECT NUMBER: 91874004
SHEET CODE: C-02
SHEET NUMBER: OF

Figure 3: Lowered Spillway with Partial Buttress

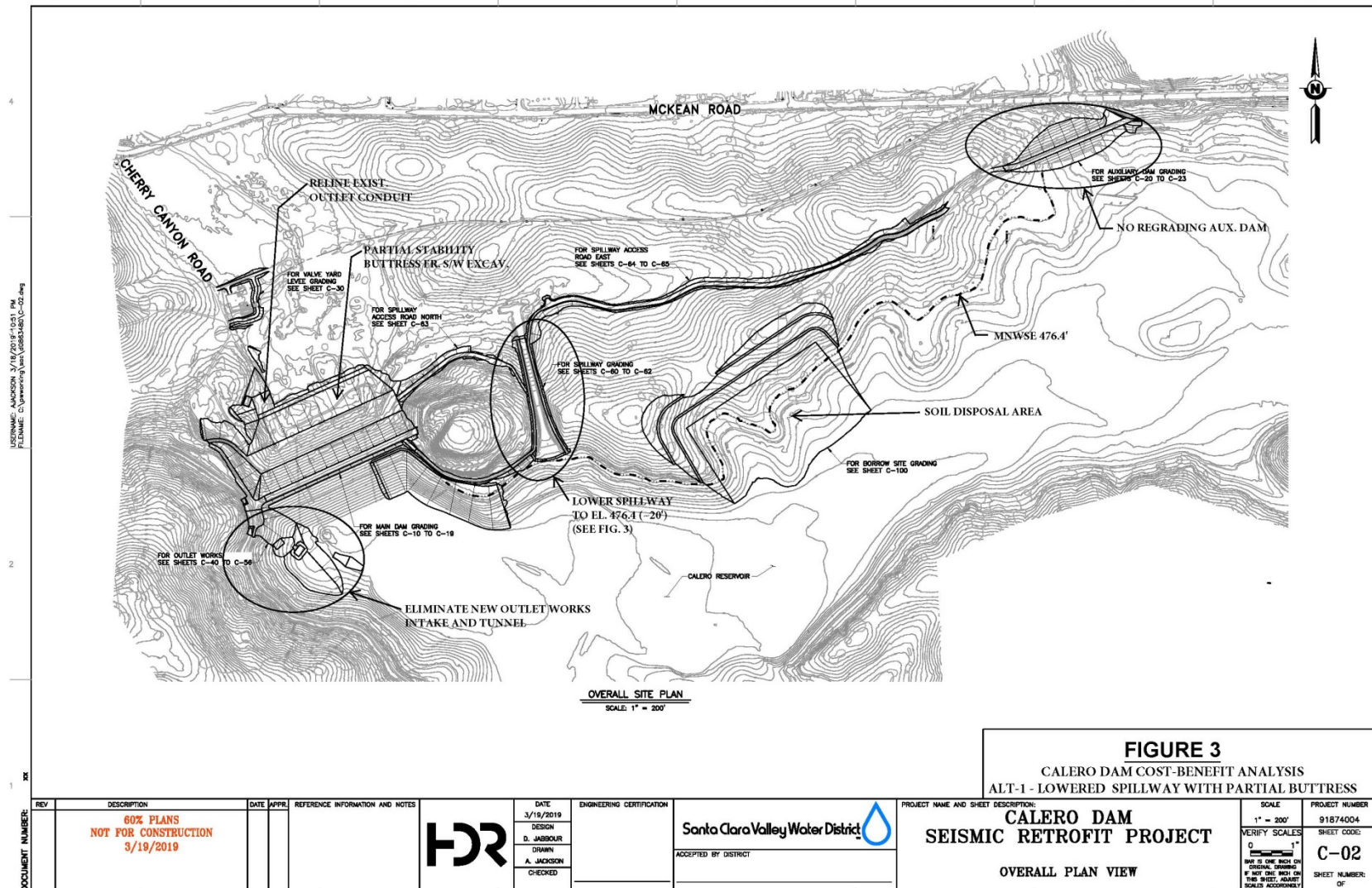


Figure 4: Lowered Spillway Profile

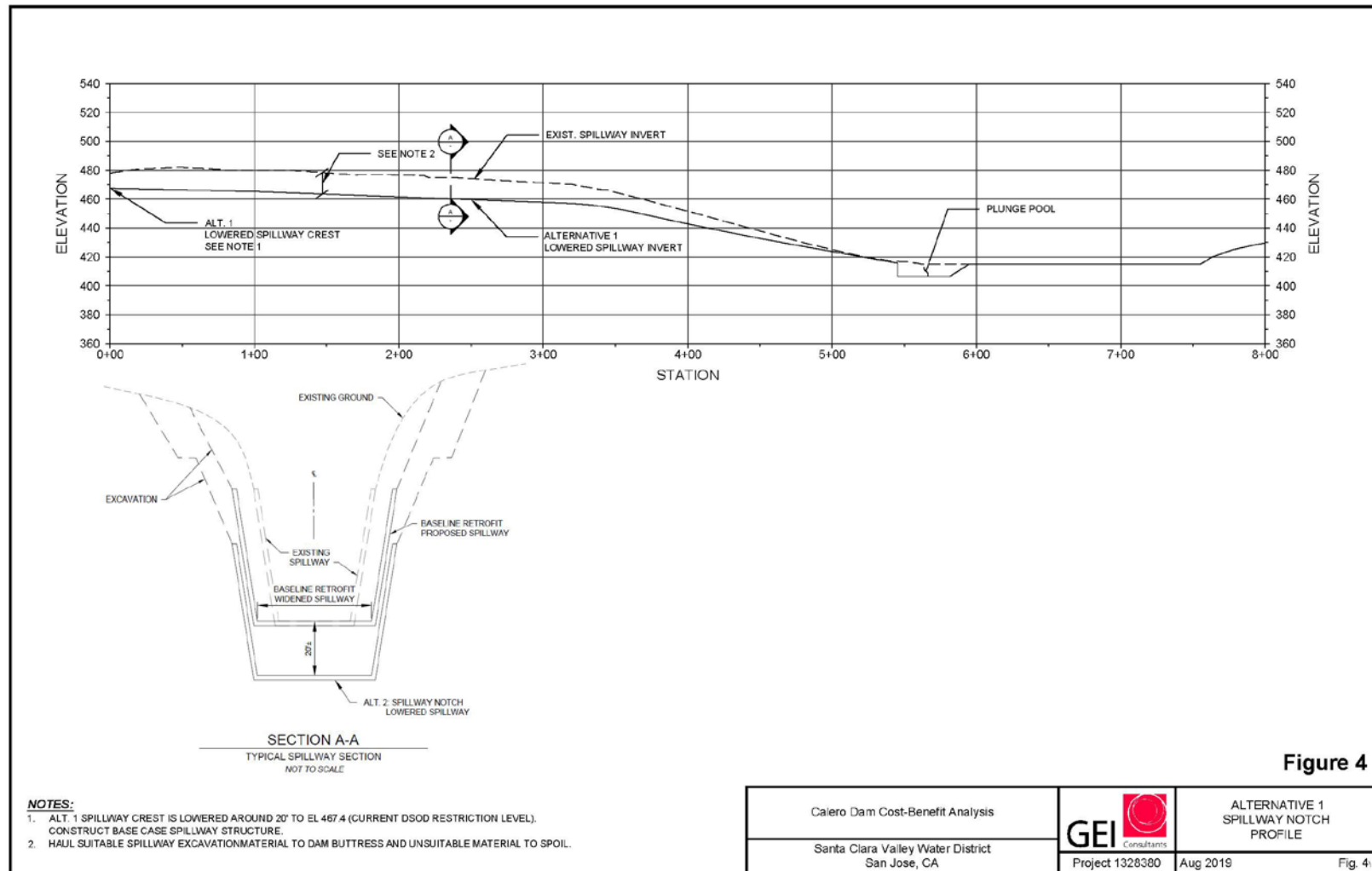


Figure 5: Dam Notch and Stream Restoration

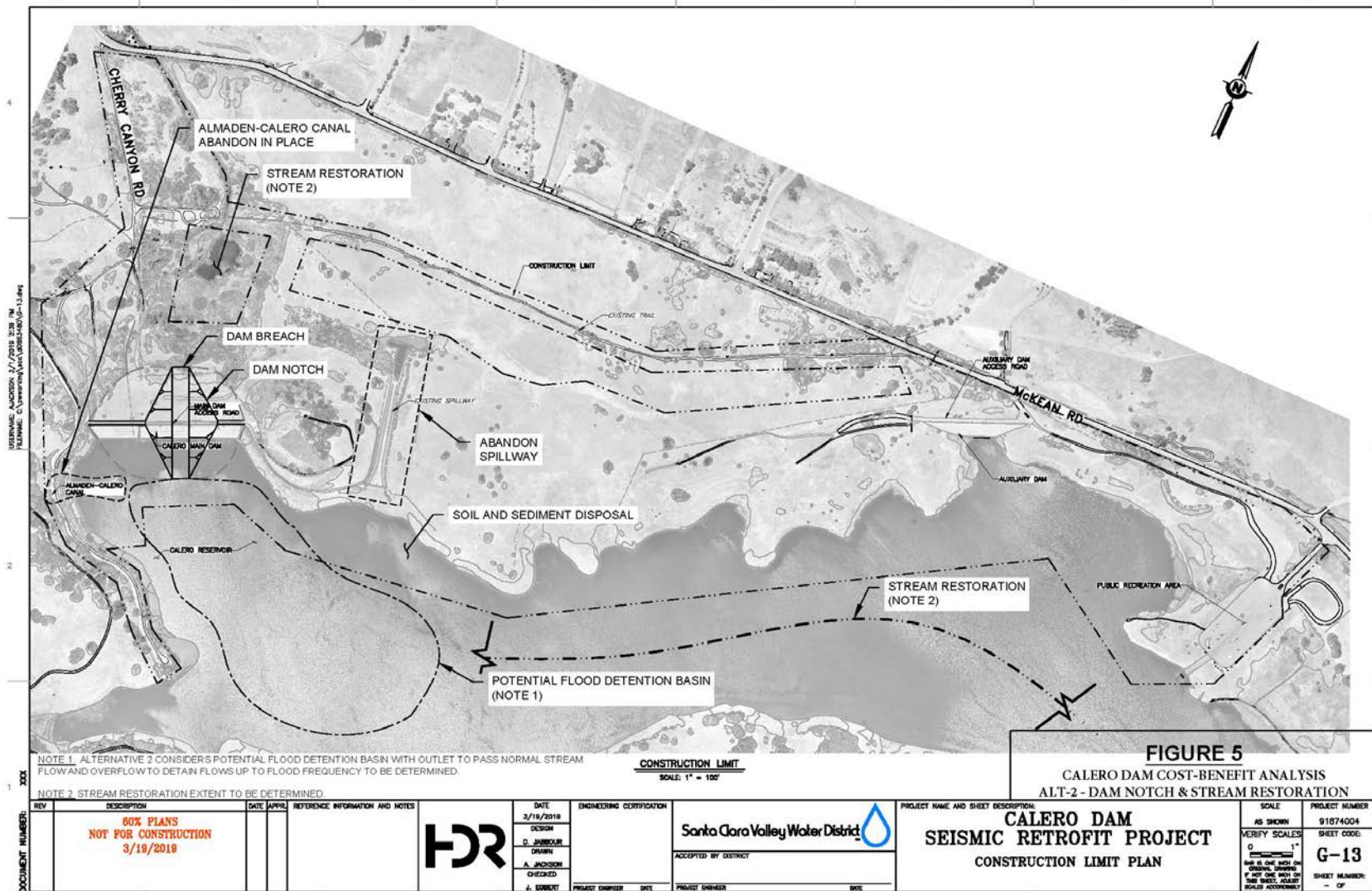


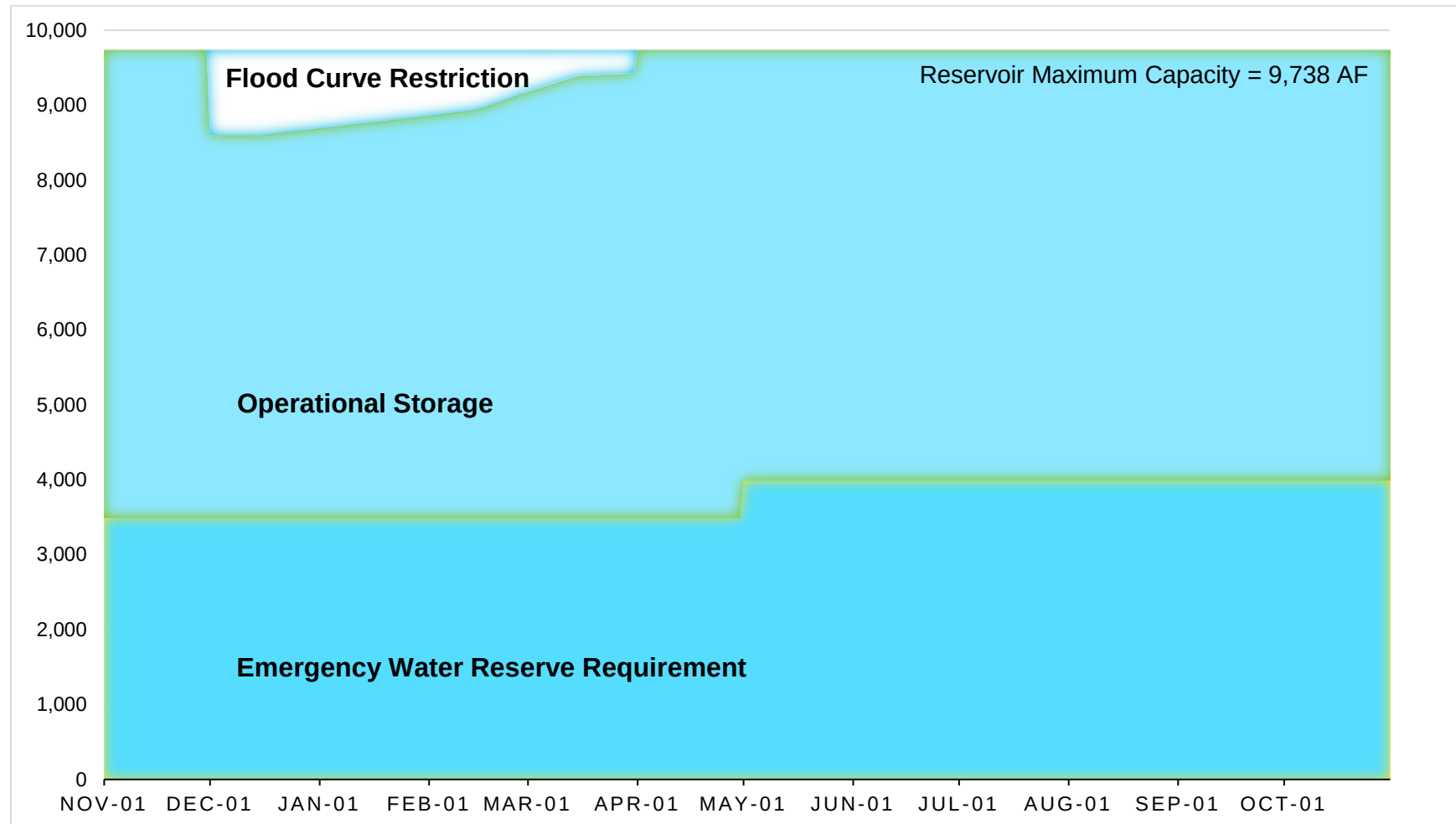
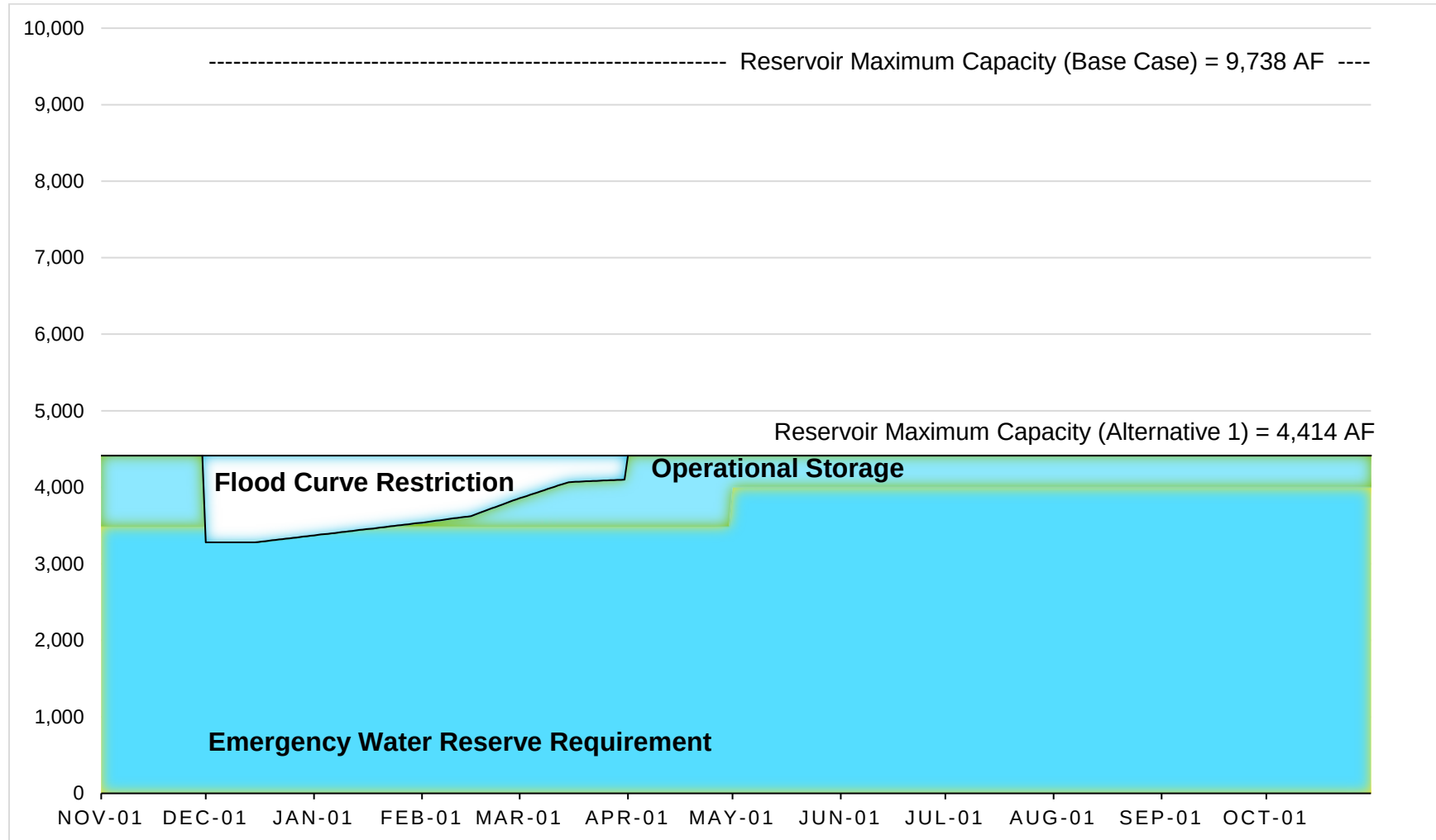
Figure 6: Calero Reservoir Storage Availability – Base Case

Figure 7: Calero Reservoir Storage Availability – Alternative 1

APPENDIX A

COST ESTIMATES

**CALERO DAM RETROFIT ALTERNATIVES
COMPARATIVE COST-BENEFIT ANALYSIS**

Revised: August 26, 2019
Prepared by: H. Velasquez | Checked by: M. Freitas

ALTERNATIVE TOTAL COST				Baseline: Retrofit \$119,624,231		Alt. 1: Spillway Notch \$58,280,877		Alt. 2: Dam Notch \$58,511,846	
Item No.	Description	Unit	Developed Unit Price	Quantity	OPCC	Quantity	OPCC	Quantity	OPCC
Embankment Modifications									
1	Site Preparation								
1.01	Clearing and Grubbing	LS	\$183,922.39	1	\$183,922	70%	\$128,746	70%	\$128,746
1.02	Stripping	CY	\$11.18	20,000	\$223,600	14,000	\$156,520	14,000	\$156,520
1.03	Development of Site Access, Staging, and Haul Roads	LS	\$149,769.80	1	\$149,770	70%	\$104,839	70%	\$104,839
1.04	Demolition	LS	\$1,304,604.61	1	\$1,304,605	70%	\$913,223	70%	\$913,223
1.05	Relocation of Bailey House	LS	\$1,652,677.95	1	\$1,652,678	0	\$0	0	\$0
1.06	Abandon Existing Instruments	LS	\$8,194.53	1	\$8,195	70%	\$5,736	70%	\$5,736
1.07	Topsoil Replacement from Stockpile	CY	\$16.31	20,000	\$326,200	14,000	\$228,340	14,000	\$228,340
1.08	Instrumentation	LS	\$688,615.77	1	\$688,616	70%	\$482,031	0	\$0
Subtotal Site Preparation				\$4,537,585		\$2,019,435		\$1,537,404	
2	Main Dam Construction								
2.01	Main Dam Excavation to Stockpile (Select Granular and General Backfill)	CY	\$10.44	84,350	\$880,614	84,350	\$880,614	112,000	\$1,169,280
2.02	Main Dam Excavation to Waste	CY	\$10.44	55,650	\$580,986	55,650	\$580,986	-	\$0
2.03	Dam Foundation Preparation	SF	\$1.72	270,000	\$464,400	270,000	\$464,400	189,000	\$325,080
2.04	Filter Layer	CY	\$126.64	63,000	\$7,978,320	63,000	\$7,978,320	-	\$0
2.05	Drain Layer	CY	\$122.84	18,000	\$2,211,120	18,000	\$2,211,120	-	\$0
2.06	Embankment from Stockpile (Select Granular)	CY	\$12.33	34,850	\$429,701	95,000	\$1,171,350	-	\$0
2.07	Embankment from Borrow (Select Granular)	CY	\$13.72	258,350	\$3,544,562	-	\$0	-	\$0
2.08	Roadway Embankment from Stockpile (General Backfill)	CY	\$15.27	16,200	\$247,374	-	\$0	-	\$0
2.09	Grout Curtain	SQFT	\$43.75	42,000	\$1,837,500	29,400	\$1,286,250	-	\$0
2.10	Excavation Dewatering	LS	\$710,210.76	1	\$710,211	70%	\$497,148	1	\$710,211
2.11	Drain Piping	LF	\$69.56	1,500	\$104,340	1,050	\$73,038	-	\$0
2.12	Seepage Vault	LS	\$35,255.75	1	\$35,256	70%	\$24,679	-	\$0
Subtotal Main Dam Construction				\$19,024,383		\$15,167,905		\$2,204,571	

**CALERO DAM RETROFIT ALTERNATIVES
COMPARATIVE COST-BENEFIT ANALYSIS**

ALTERNATIVE TOTAL COST				Baseline: Retrofit \$119,624,231		Alt. 1: Spillway Notch \$58,280,877		Alt. 2: Dam Notch \$58,511,846	
Item No.	Description	Unit	Developed Unit Price	Quantity	OPCC	Quantity	OPCC	Quantity	OPCC
3	Auxiliary Dam Construction								
3.01	Aux Dam Excavation to Stockpile (Select Granular and General Backfill)	CY	\$12.52	9,200	\$115,184	N/A		N/A	
3.02	Aux Dam Excavation to Waste (Select Granular)	CY	\$12.52	4,350	\$54,462				
3.03	Filter Layer	CY	\$138.40	4,000	\$553,600				
3.04	Aux Dam Embankment from Stockpile (Select Granular)	CY	\$14.09	9,200	\$129,628				
3.05	Aux Dam Embankment from Borrow (Select Granular)	CY	\$15.85	3,800	\$60,230				
3.06	Filter Layer at Upstream Panels	CY	\$177.26	1,000	\$177,260				
3.07	Drainage Layer at Upstream Panels	CY	\$151.33	1,000	\$151,330				
3.08	Upstream Slope Protection Panels and Plinth	SF	\$63.81	26,500	\$1,690,965				
	Subtotal Auxiliary Dam Construction			\$2,932,659		N/A		N/A	
4	Upstream Seepage Blanket								
4.01	Upstream Seepage Blanket Excavation to Waste	CY	\$18.33	19,500	\$357,435	N/A		N/A	
4.02	Upstream Sepage Blanket Fill form Borrow (Select Granular)	CY	\$54.35	25,500	\$1,385,925				
4.03	Filter Layer at Seepage Blanket	CY	\$172.31	4,200	\$723,702				
4.04	Drainage Layer at Seepage Blanket	CY	\$146.83	4,200	\$616,686				
4.05	Concrete Panels (Main Dam and Upstream Blanket)	SF	\$57.04	114,000	\$6,502,560				
	Subtotal Upstream Seepage Blanket			\$9,586,308		N/A		N/A	
5	Valve Yard Levee								
5.01	Levee Fill from Stockpile (General Backfill)	CY	\$24.01	1,800	\$43,218	1,800	\$43,218	1,800	\$43,218
5.02	Chain Link Fencing	LF	\$41.32	780	\$32,230	780	\$32,230	780	\$32,230
5.03	Chain Link Gate	EA	\$3,443.08	1	\$3,443	1	\$3,443	1	\$3,443
Subtotal Valve Yard Levee				\$78,891		\$78,891		\$78,891	
Total Embankment Modifications				\$36,159,826		\$17,266,230		\$3,820,865	

**CALERO DAM RETROFIT ALTERNATIVES
COMPARATIVE COST-BENEFIT ANALYSIS**

ALTERNATIVE TOTAL COST				Baseline: Retrofit \$119,624,231		Alt. 1: Spillway Notch \$58,280,877		Alt. 2: Dam Notch \$58,511,846	
Item No.	Description	Unit	Developed Unit Price	Quantity	OPCC	Quantity	OPCC	Quantity	OPCC
Spillway Modifications									
6	Spillway Modifications								
6.01	Spillway Excavation to Stockpile (General Backfill)	CY	\$19.46	33,025	\$642,667	95,000	\$1,848,700	N/A	
6.02	Spillway Excavation to Waste	CY	\$15.56	5,175	\$80,523	17,000	\$264,520		
6.03	Spillway Foundation Preparation	SF	\$7.81	36,000	\$281,160	36,000	\$281,160		
6.04	Spillway Underdrains/Wall Drains & Trench (8" Perforated SCH 80 PVC)	LF	\$113.29	2,085	\$236,210	2,085	\$236,210		
6.05	Spillway Underdrain/Wall Drain Collector/Cleanout Pipes (8" Solid SCH 80 PVC)	LF	\$45.59	1,715	\$78,187	1,715	\$78,187		
6.06	Spillway Underdrains Collector and Outfall Pipes (12" Solid SCH 80 PVC)	LF	\$53.22	2,355	\$125,333	2,355	\$125,333		
6.07	Spillway Anchors (40 FT Long - 4" DIA Pressure Grouted Hole)	EA	\$3,305.36	211	\$697,431	211	\$697,431		
6.08	Reinforced Concrete Spillway Slabs (including Shear Key Joints)	CY	\$1,529.40	2,585	\$3,953,499	2,585	\$3,953,499		
6.09	Reinforced Concrete Spillway Walls (including walkways and wingwalls at ogee)	CY	\$2,357.20	1,045	\$2,463,274	1,045	\$2,463,274		
6.10	Reinforced Concrete Ogee Crest Structure	CY	\$934.66	1,030	\$962,700	1,030	\$962,700		
6.11	Reinforced Concrete Flip Bucket Structure	CY	\$786.61	375	\$294,979	375	\$294,979		
6.12	Spillway Fill from Borrow (Select Granular)	CY	\$66.24	6,700	\$443,808	6,700	\$443,808		
6.13	Spillway Fill from Stockpile (General Backfill)	CY	\$66.24	10,900	\$722,016	10,900	\$722,016		
6.14	Steel Guardrail - Along Spillway Walls	LF	\$151.85	1,290	\$195,887	1,290	\$195,887		
6.15	Secant Pile Cutoff Wall at Flip Bucket	LF	\$501.12	4,664	\$2,337,224	4,664	\$2,337,224		
6.16	Log Boom	LF	\$157.35	350	\$55,073	350	\$55,073		
Total Spillway Modification				\$13,569,968		\$14,959,999		N/A	

**CALERO DAM RETROFIT ALTERNATIVES
COMPARATIVE COST-BENEFIT ANALYSIS**

				ALTERNATIVE TOTAL COST		Baseline: Retrofit \$119,624,231		Alt. 1: Spillway Notch \$58,280,877		Alt. 2: Dam Notch \$58,511,846	
Item No.	Description	Unit	Developed Unit Price	Quantity	OPCC	Quantity	OPCC	Quantity	OPCC		
Outlet Works Replacement											
7	Inlet Shaft										
7.01	Shaft Site Excavation and Preparation	LS	\$33,352.42	1	\$33,352	N/A		N/A			
7.02	Secant Pile Installation at Shaft	DVF	\$662.96	4107	\$2,722,777						
7.03	Interior Shaft Excavation	VLF	\$9,221.94	111	\$1,023,635						
7.04	Shaft CIP Final Lining	LS	\$2,193,272	1	\$2,193,272						
7.05	6' X 10' Box Culvert at Alameden Canal	LS	\$542,481.86	1	\$542,482						
Subtotal Inlet Shaft				\$6,515,518		N/A		N/A			
8	Temporary Diversion and Control of Water										
8.01	Cofferdam and Bypass System	LS	\$348,639.28	1	\$348,639	1	\$348,639	1	\$348,639		
8.02	Use of Existing Outlet as Temporary Diversion	LS	\$157,110.44	1	\$157,110	1	\$157,110	1	\$157,110		
8.03	Celluary Grout Backfill of Existing Conduit	LF	\$465.93	200	\$93,186	0	\$0	800	\$372,744		
8.04	Outlet Slip-lining	LF	\$500	0	\$0	800	\$400,000	0	\$0		
Subtotal Temporary Diversion and Control of Water				\$598,936		\$905,750		\$878,494			
9	Intake Control House, Vertical Intake Structure & Valves										
9.01	VSIS Fill Slope and Upstream Buttress	CY	\$4.15	34000	\$141,100	N/A		N/A			
9.02	Intake Control House	LS	\$457,351.05	1	\$457,351						
9.03	Intake Control House Appurtenances	LS	\$68,861.58	1	\$68,862						
9.04	78" Dia Microtunneled Steel Casing	LF	\$7,901.80	683	\$5,396,929						
9.05	54" Dia Earthquake Resistant Ductile Iron Pipe	LF	\$2,239.38	60	\$134,363						
9.06	44" Dia Earthquake Resistant Ductile Iron Pipe	LF	\$1,010.86	695	\$702,548						
9.07	10" Dia Earthquake Resistant Ductile Iron Pipe	LF	\$264.43	405	\$107,094						
9.08	Pipe Specials (Including Bends, Tees, Flanges)	LS	\$220,341.90	1	\$220,342						
9.09	Excavation and Temporary Support - 3 Intakes	LS	\$299,959.65	1	\$299,960						
9.10	Reinforced Concrete Intake Structures (Upper and Middle Intakes)	CY	\$1,308.37	717	\$938,101						
9.11	Reinforced Concrete Intake Structure (Lower Intake)	CY	\$1,408.91	224	\$315,596						
9.12	42" Compact Knife Gate Valves w/ Electric Actuators	EA	\$145,434.27	3	\$436,303						
9.13	10" Gate Valve w/ Electric Actuator	EA	\$5,519.94	1	\$5,520						
9.14	Furnish and Install Trash Racks and Bulkheads	LB	\$9.64	15000	\$144,600						
9.15	24" Manway	EA	\$10,203.91	1	\$10,204						
Subtotal Intake Control House, Vertical Intake Structure & Valves				\$9,378,872		N/A		N/A			

**CALERO DAM RETROFIT ALTERNATIVES
COMPARATIVE COST-BENEFIT ANALYSIS**

ALTERNATIVE TOTAL COST				Baseline: Retrofit \$119,624,231		Alt. 1: Spillway Notch \$58,280,877		Alt.2: Dam Notch \$58,511,846	
Item No.	Description	Unit	Developed Unit Price	Quantity	OPCC	Quantity	OPCC	Quantity	OPCC
10	Tunnel and Portal Construction								
10.01	Outlet Valve House Excavation to Waste	CY	\$8.43	9000	\$75,870	N/A	N/A	N/A	N/A
10.02	Tunnel Subcontractor Mobilization	LS	\$484,099.64	1	\$484,100				
10.03	Tunnel Subcontractor Demobilization and Punchlist	LS	\$179,971.11	1	\$179,971				
10.04	Tunnel Downstream Portal Excavation and Support	LS	\$864,324.35	1	\$864,324				
10.05	Horseshoe Tunnel Excavation and Support Type 1	LF	\$12,871.61	192	\$2,471,349				
10.06	Horseshoe Tunnel Excavation and Support Type 2	LF	\$12,136.16	287	\$3,483,078				
10.07	Tunnel Pre-Excavation Grouting	LS	\$458,764.09	1	\$458,764				
10.08	Tunnel Contact Grouting	LF	\$497.18	479	\$238,149				
10.09	Tunnel Filling Shotcrete	LF	\$2,002.49	479	\$959,193				
10.10	Smoothing Shotcrete and Geodrain	LF	\$318.14	479	\$152,389				
10.11	Demob Tunnel Drive	LS	\$64,031.63	1	\$64,032				
10.12	Install Invert Waterproofing/Drainage	LS	\$131,619.26	1	\$131,619				
10.13	Tunnel CIP Final Invert	LF	\$2,507.94	479	\$1,201,303				
10.14	Tunnel Arch Waterproofing	LS	\$308,546.69	1	\$308,547				
10.15	Final Tunnel Cleanup	LS	\$273,212.44	1	\$273,212				
10.16	Tunnel Crown CIP Arch Construction	LF	\$4,418.16	479	\$2,116,299				
10.17	Final Tunnel Cleanup	LS	\$37,599.80	1	\$37,600				
10.18	Tunnel Downstream Portal Backfill from Borrow	CY	\$36.14	5000	\$180,700				
10.19	Precast Concrete Saddle Pipe Supports	LS	\$195,842.33	1	\$195,842				
10.20	Tunnel 54" Dia Steel Pipe, Polyurethane Lined & Coated	LF	\$1,189.93	552	\$656,841				
10.21	Tunnel 10" Dia Earthquake Resistant Ductile Iron Pipe	LF	\$297.48	570	\$169,564				
Subtotal Tunnel and Portal Construction				\$14,702,746		N/A		N/A	
11	Outlet Conduits - Cut & Cover								
11.01	Tunnel Cut and Cover Invert	LS	\$107,261.55	1	\$107,262	N/A	N/A	N/A	N/A
11.02	Tunnel Cut and Cover Arch	LS	\$270,785.76	1	\$270,786				
11.03	Outlet Furnish and Install 54" Dia Steel Pipe, Polyurethane Lined & Coated	LF	\$1,391.00	110	\$153,010				
11.04	Outlet Furnish and Install 10" Dia Earthquake Resistant Ductile Iron Pipe	LF	\$395.27	350	\$138,345				
11.05	Outlet Reinforced Concrete Pipe Encasement	LF	\$2,364.71	210	\$496,589				
Subtotal Outlet Conduits - Cut & Cover				\$1,165,991		N/A		N/A	

**CALERO DAM RETROFIT ALTERNATIVES
COMPARATIVE COST-BENEFIT ANALYSIS**

ALTERNATIVE TOTAL COST				Baseline: Retrofit \$119,624,231		Alt. 1: Spillway Notch \$58,280,877		Alt.2: Dam Notch \$58,511,846	
Item No.	Description	Unit	Developed Unit Price	Quantity	OPCC	Quantity	OPCC	Quantity	OPCC
12	Valve House, Valves, Miscellaneous								
12.01	10" Gate Valve w/ Electric Actuator	EA	\$4,258.40	1	\$4,258	N/A	N/A		
12.02	10" Flowmeter	EA	\$3,509.19	1	\$3,509				
12.03	54" Fixed Cone Valve w/ Electric Actuator and Dissipator	EA	\$867,553.96	1	\$867,554				
12.04	54" Compact Knife Gate Valve w/ Electric Actuators	EA	\$280,273.51	1	\$280,274				
12.05	54" Flowmeter	EA	\$40,197.26	1	\$40,197				
12.06	24" Manway	EA	\$10,203.91	1	\$10,204				
12.07	Outlet Pipe Thrust Block	CY	\$1,101.79	114	\$125,604				
12.08	Reinforced Concrete Outlet Structure Building	CY	\$1,364.84	538	\$734,284				
12.09	Outlet Valve House Appurtenances	LS	\$137,723.15	1	\$137,723				
12.10	Energy Dissipation Structure at FVC	CY	\$1,676.09	300	\$502,827				
Subtotal Outlet Valve House, Valves & Misc				\$2,706,434		N/A		N/A	
Total Outlet Works Replacement				\$35,068,497		\$905,750		\$878,494	

**CALERO DAM RETROFIT ALTERNATIVES
COMPARATIVE COST-BENEFIT ANALYSIS**

ALTERNATIVE TOTAL COST				Baseline: Retrofit \$119,624,231		Alt. 1: Spillway Notch \$58,280,877		Alt. 2: Dam Notch \$58,511,846	
Item No.	Description	Unit	Developed Unit Price	Quantity	OPCC	Quantity	OPCC	Quantity	OPCC
Miscellaneous									
13	Dewatering and Control of Water								
13.01	Site Dewatering and Control of Water	LS	\$232,265	1	\$232,265	1	\$232,265	1	\$232,265
13.02	Fellows Dike Excavation	CY	\$11.80	2,600	\$30,680	0	\$0	0	\$0
13.03	Fellows Dike Rock Slope Protection	Ton	\$82.73	3,000	\$248,190	0	\$0	0	\$0
Subtotal Dewatering and Control of Water				\$511,135		\$232,265		\$232,265	
14	General								
14.01	Erosion Protection & Sediment Control	LS	\$452,500	1	\$452,500	1	\$452,500	1	\$452,500
14.02	Disputes Review Board	CS	\$137,723	1	\$137,723	1	\$137,723	1	\$137,723
14.03	Professional Faciliated Project Partnering	CS	\$137,723	1	\$137,723	1	\$137,723	1	\$137,723
14.04	Dam Crest and Roadway Aggregate Surfacing	Ton	\$41	4,000	\$163,320	4,000	\$163,320	4,000	\$163,320
14.05	General Site Restoration	AC	\$5,884	30	\$176,506	30	\$176,506	30	\$176,506
14.06	Mobilization, bonds & Insurance	LS	\$4,239,241	1	\$4,239,241	5%	\$1,656,599	5%	\$234,968
14.07	HVAC, Lighting, controls, Electrical - Total Project	LS	\$688,616	1	\$688,616	1	\$688,616	1	\$688,616
General Subtotal				\$5,995,630		\$3,412,987		\$1,991,356	
Total Miscellaneous				\$6,506,764		\$3,645,252		\$2,223,621	
Environmental Restoration									
15	Environmental Restoration								
15.01	Creek Detention Facility	LS	\$20,000,000	N/A		N/A		1	\$20,000,000
15.02	Creek Restoration	LS	\$5,000,000					1	\$5,000,000
15.03	Sediment Removal and Disposal	LS	\$5,000,000					1	\$5,000,000
Total Environmental Restoration				\$0		\$0		\$30,000,000	
SUBTOTAL - ITEMS 1 THROUGH 15				\$91,305,055		\$36,777,231		\$36,922,980	
Escalation to Mid Point of Construction		LS	%	6%	\$5,478,303	6%	\$2,206,634	6%	\$2,215,379
Miscellaneous Unlisted items		LS	%	3%	\$2,903,501	15%	\$5,847,580	15%	\$5,870,754
Design, Bid, and Post-award Contingency		LS	%	20%	\$19,937,372	30%	\$13,449,433	30%	\$13,502,734
TOTAL				\$119,624,231		\$58,280,877		\$58,511,846	

APPENDIX B

BCA SUPPORT TABLES

Table B-1: Projected Annual Development Costs, OM&R and Residual Net Value Benefits - Base Case

Year	Schedule	Construction Cost		Development Cost					OM&R		Total Cost	
		Total	NPV (2.5%)	Principal	Interest	Payment	Balance (12/31)	Development NPV	Nominal	NPV (2.5%)	Nominal	NPV (2.5%)
2025	0%	\$0	\$0		\$0		\$0					
2026	0%	\$0	\$0	\$0	\$0	\$0	\$0					
2027	30%	\$35,887,269	\$29,454,353	\$0	\$538,309	\$0	\$36,425,578					
2028	40%	\$47,849,692	\$38,314,606	\$36,425,578	\$1,810,513	\$0	\$86,085,783					
2029	30%	\$35,887,269	\$28,035,077	\$86,085,783	\$3,120,883	\$0	\$125,093,935					
2030				\$125,093,935	\$3,752,818	\$4,861,838	\$123,984,916	\$3,705,424	\$350,000	\$266,751	\$5,211,838	\$3,972,175
2031				\$123,984,916	\$3,719,547	\$4,861,838	\$122,842,626	\$3,615,048	\$350,000	\$260,245	\$5,211,838	\$3,875,293
2032				\$122,842,626	\$3,685,279	\$4,861,838	\$121,666,067	\$3,526,876	\$350,000	\$253,897	\$5,211,838	\$3,780,773
2033				\$121,666,067	\$3,649,982	\$4,861,838	\$120,454,211	\$3,440,855	\$350,000	\$247,705	\$5,211,838	\$3,688,559
2034				\$120,454,211	\$3,613,626	\$4,861,838	\$119,206,000	\$3,356,931	\$350,000	\$241,663	\$5,211,838	\$3,598,594
2035				\$119,206,000	\$3,576,180	\$4,861,838	\$117,920,342	\$3,275,055	\$350,000	\$235,769	\$5,211,838	\$3,510,824
2036				\$117,920,342	\$3,537,610	\$4,861,838	\$116,596,115	\$3,195,176	\$350,000	\$230,018	\$5,211,838	\$3,425,194
2037				\$116,596,115	\$3,497,883	\$4,861,838	\$115,232,160	\$3,117,245	\$350,000	\$224,408	\$5,211,838	\$3,341,653
2038				\$115,232,160	\$3,456,965	\$4,861,838	\$113,827,288	\$3,041,214	\$350,000	\$218,935	\$5,211,838	\$3,260,149
2039				\$113,827,288	\$3,414,819	\$4,861,838	\$112,380,269	\$2,967,038	\$350,000	\$213,595	\$5,211,838	\$3,180,633
2040				\$112,380,269	\$3,371,408	\$4,861,838	\$110,889,839	\$2,894,671	\$350,000	\$208,385	\$5,211,838	\$3,103,057
2041				\$110,889,839	\$3,326,695	\$4,861,838	\$109,354,697	\$2,824,070	\$350,000	\$203,303	\$5,211,838	\$3,027,372
2042				\$109,354,697	\$3,280,641	\$4,861,838	\$107,773,500	\$2,755,190	\$350,000	\$198,344	\$5,211,838	\$2,953,534
2043				\$107,773,500	\$3,233,205	\$4,861,838	\$106,144,867	\$2,687,990	\$350,000	\$193,506	\$5,211,838	\$2,881,497
2044				\$106,144,867	\$3,184,346	\$4,861,838	\$104,467,375	\$2,622,429	\$350,000	\$188,787	\$5,211,838	\$2,811,216
2045				\$104,467,375	\$3,134,021	\$4,861,838	\$102,739,559	\$2,558,468	\$350,000	\$184,182	\$5,211,838	\$2,742,650
2046				\$102,739,559	\$3,082,187	\$4,861,838	\$100,959,908	\$2,496,066	\$350,000	\$179,690	\$5,211,838	\$2,675,756
2047				\$100,959,908	\$3,028,797	\$4,861,838	\$99,126,868	\$2,435,186	\$350,000	\$175,307	\$5,211,838	\$2,610,494
2048				\$99,126,868	\$2,973,806	\$4,861,838	\$97,238,836	\$2,375,792	\$350,000	\$171,031	\$5,211,838	\$2,546,823
2049				\$97,238,836	\$2,917,165	\$4,861,838	\$95,294,164	\$2,317,846	\$350,000	\$166,860	\$5,211,838	\$2,484,705
2050				\$95,294,164	\$2,858,825	\$4,861,838	\$93,291,151	\$2,261,313	\$350,000	\$162,790	\$5,211,838	\$2,424,103
2051				\$93,291,151	\$2,798,735	\$4,861,838	\$91,228,048	\$2,206,159	\$350,000	\$158,820	\$5,211,838	\$2,364,978
2052				\$91,228,048	\$2,736,841	\$4,861,838	\$89,103,052	\$2,152,350	\$350,000	\$154,946	\$5,211,838	\$2,307,296
2053				\$89,103,052	\$2,673,092	\$4,861,838	\$86,914,305	\$2,099,854	\$350,000	\$151,167	\$5,211,838	\$2,251,021
2054				\$86,914,305	\$2,607,429	\$4,861,838	\$84,659,897	\$2,048,638	\$350,000	\$147,480	\$5,211,838	\$2,196,118
2055				\$84,659,897	\$2,539,797	\$4,861,838	\$82,337,856	\$1,998,671	\$350,000	\$143,883	\$5,211,838	\$2,142,554
2056				\$82,337,856	\$2,470,136	\$4,861,838	\$79,946,154	\$1,949,923	\$350,000	\$140,373	\$5,211,838	\$2,090,296
2057				\$79,946,154	\$2,398,385	\$4,861,838	\$77,482,701	\$1,902,364	\$350,000	\$136,950	\$5,211,838	\$2,039,313
2058				\$77,482,701	\$2,324,481	\$4,861,838	\$74,945,345	\$1,855,965	\$350,000	\$133,609	\$5,211,838	\$1,989,574
2059				\$74,945,345	\$2,248,360	\$4,861,838	\$72,331,867	\$1,810,697	\$350,000	\$130,351	\$5,211,838	\$1,941,048
2060				\$72,331,867	\$2,169,956	\$4,861,838	\$69,639,986	\$1,766,534	\$350,000	\$127,171	\$5,211,838	\$1,893,705
2061				\$69,639,986	\$2,089,200	\$4,861,838	\$66,867,348	\$1,723,448	\$350,000	\$124,070	\$5,211,838	\$1,847,517
2062				\$66,867,348	\$2,006,020	\$4,861,838	\$64,011,530	\$1,681,412	\$350,000	\$121,044	\$5,211,838	\$1,802,456
2063				\$64,011,530	\$1,920,346	\$4,861,838	\$61,070,039	\$1,640,402	\$350,000	\$118,091	\$5,211,838	\$1,758,494

2064				\$61,070,039	\$1,832,101	\$4,861,838	\$58,040,302	\$1,600,393	\$350,000	\$115,211	\$5,211,838	\$1,715,604
2065				\$58,040,302	\$1,741,209	\$4,861,838	\$54,919,674	\$1,561,359	\$350,000	\$112,401	\$5,211,838	\$1,673,760
2066				\$54,919,674	\$1,647,590	\$4,861,838	\$51,705,426	\$1,523,277	\$350,000	\$109,660	\$5,211,838	\$1,632,936
2067				\$51,705,426	\$1,551,163	\$4,861,838	\$48,394,751	\$1,486,124	\$350,000	\$106,985	\$5,211,838	\$1,593,108
2068				\$48,394,751	\$1,451,843	\$4,861,838	\$44,984,756	\$1,449,877	\$350,000	\$104,376	\$5,211,838	\$1,554,252
2069				\$44,984,756	\$1,349,543	\$4,861,838	\$41,472,461	\$1,414,514	\$350,000	\$101,830	\$5,211,838	\$1,516,344
2070				\$41,472,461	\$1,244,174	\$4,861,838	\$37,854,797	\$1,380,013	\$350,000	\$99,346	\$5,211,838	\$1,479,360
2071				\$37,854,797	\$1,135,644	\$4,861,838	\$34,128,604	\$1,346,355	\$350,000	\$96,923	\$5,211,838	\$1,443,278
2072				\$34,128,604	\$1,023,858	\$4,861,838	\$30,290,624	\$1,313,517	\$350,000	\$94,559	\$5,211,838	\$1,408,076
2073				\$30,290,624	\$908,719	\$4,861,838	\$26,337,505	\$1,281,480	\$350,000	\$92,253	\$5,211,838	\$1,373,732
2074				\$26,337,505	\$790,125	\$4,861,838	\$22,265,793	\$1,250,224	\$350,000	\$90,003	\$5,211,838	\$1,340,227
2075				\$22,265,793	\$667,974	\$4,861,838	\$18,071,929	\$1,219,731	\$350,000	\$87,807	\$5,211,838	\$1,307,538
2076				\$18,071,929	\$542,158	\$4,861,838	\$13,752,249	\$1,189,981	\$350,000	\$85,666	\$5,211,838	\$1,275,647
2077				\$13,752,249	\$412,567	\$4,861,838	\$9,302,979	\$1,160,957	\$350,000	\$83,576	\$5,211,838	\$1,244,534
2078				\$9,302,979	\$279,089	\$4,861,838	\$4,720,231	\$1,132,641	\$350,000	\$81,538	\$5,211,838	\$1,214,179
2079				\$4,720,231	\$141,607	\$4,861,838	\$0	\$1,105,016	\$350,000	\$79,549	\$5,211,838	\$1,184,565
2080				\$0								
Residual Value	\$0	\$0	\$0									
Total	100%	\$119,624,231	\$95,804,036		\$123,467,651	\$243,091,882		\$107,721,756	\$17,500,000	\$7,754,807	\$260,591,882	\$115,476,563

Table B-2: Projected Annual Development Costs, OM&R and Residual Net Value Benefits - Alternative 1

Year	Schedule	Construction Cost		Development Cost					OM&R		Total Cost	
		Total	NPV (2.5%)	Principal	Interest	Payment	Balance (12/31)	Development NPV	Nominal	NPV (2.5%)	Nominal	NPV (2.5%)
2025	0%	\$0	\$0		\$0		\$0					
2026	0%	\$0	\$0	\$0	\$0	\$0	\$0					
2027	0%	\$0	\$0	\$0	\$0	\$0	\$0					
2028	40%	\$23,312,351	\$18,666,860	\$0	\$349,685	\$0	\$23,662,036					
2029	60%	\$34,968,526	\$27,317,357	\$23,662,036	\$1,234,389	\$0	\$59,864,951					
2030				\$59,864,951	\$1,795,949	\$2,326,681	\$59,334,219	\$1,773,268	\$350,000	\$266,751	\$2,676,681	\$2,040,018
2031				\$59,334,219	\$1,780,027	\$2,326,681	\$58,787,564	\$1,730,017	\$350,000	\$260,245	\$2,676,681	\$1,990,262
2032				\$58,787,564	\$1,763,627	\$2,326,681	\$58,224,510	\$1,687,822	\$350,000	\$253,897	\$2,676,681	\$1,941,719
2033				\$58,224,510	\$1,746,735	\$2,326,681	\$57,644,565	\$1,646,655	\$350,000	\$247,705	\$2,676,681	\$1,894,360
2034				\$57,644,565	\$1,729,337	\$2,326,681	\$57,047,221	\$1,606,493	\$350,000	\$241,663	\$2,676,681	\$1,848,156
2035				\$57,047,221	\$1,711,417	\$2,326,681	\$56,431,957	\$1,567,310	\$350,000	\$235,769	\$2,676,681	\$1,803,079
2036				\$56,431,957	\$1,692,959	\$2,326,681	\$55,798,234	\$1,529,083	\$350,000	\$230,018	\$2,676,681	\$1,759,101
2037				\$55,798,234	\$1,673,947	\$2,326,681	\$55,145,500	\$1,491,788	\$350,000	\$224,408	\$2,676,681	\$1,716,197
2038				\$55,145,500	\$1,654,365	\$2,326,681	\$54,473,185	\$1,455,403	\$350,000	\$218,935	\$2,676,681	\$1,674,338
2039				\$54,473,185	\$1,634,196	\$2,326,681	\$53,780,699	\$1,419,906	\$350,000	\$213,595	\$2,676,681	\$1,633,501
2040				\$53,780,699	\$1,613,421	\$2,326,681	\$53,067,439	\$1,385,274	\$350,000	\$208,385	\$2,676,681	\$1,593,659
2041				\$53,067,439	\$1,592,023	\$2,326,681	\$52,332,781	\$1,351,487	\$350,000	\$203,303	\$2,676,681	\$1,554,789
2042				\$52,332,781	\$1,569,983	\$2,326,681	\$51,576,084	\$1,318,524	\$350,000	\$198,344	\$2,676,681	\$1,516,868
2043				\$51,576,084	\$1,547,283	\$2,326,681	\$50,796,686	\$1,286,365	\$350,000	\$193,506	\$2,676,681	\$1,479,871
2044				\$50,796,686	\$1,523,901	\$2,326,681	\$49,993,905	\$1,254,990	\$350,000	\$188,787	\$2,676,681	\$1,443,777
2045				\$49,993,905	\$1,499,817	\$2,326,681	\$49,167,041	\$1,224,380	\$350,000	\$184,182	\$2,676,681	\$1,408,562
2046				\$49,167,041	\$1,475,011	\$2,326,681	\$48,315,372	\$1,194,517	\$350,000	\$179,690	\$2,676,681	\$1,374,207
2047				\$48,315,372	\$1,449,461	\$2,326,681	\$47,438,152	\$1,165,383	\$350,000	\$175,307	\$2,676,681	\$1,340,690
2048				\$47,438,152	\$1,423,145	\$2,326,681	\$46,534,616	\$1,136,959	\$350,000	\$171,031	\$2,676,681	\$1,307,990
2049				\$46,534,616	\$1,396,038	\$2,326,681	\$45,603,973	\$1,109,228	\$350,000	\$166,860	\$2,676,681	\$1,276,088
2050				\$45,603,973	\$1,368,119	\$2,326,681	\$44,645,411	\$1,082,174	\$350,000	\$162,790	\$2,676,681	\$1,244,964
2051				\$44,645,411	\$1,339,362	\$2,326,681	\$43,658,093	\$1,055,779	\$350,000	\$158,820	\$2,676,681	\$1,214,599
2052				\$43,658,093	\$1,309,743	\$2,326,681	\$42,641,155	\$1,030,029	\$350,000	\$154,946	\$2,676,681	\$1,184,975
2053				\$42,641,155	\$1,279,235	\$2,326,681	\$41,593,708	\$1,004,906	\$350,000	\$151,167	\$2,676,681	\$1,156,073
2054				\$41,593,708	\$1,247,811	\$2,326,681	\$40,514,839	\$980,396	\$350,000	\$147,480	\$2,676,681	\$1,127,876
2055				\$40,514,839	\$1,215,445	\$2,326,681	\$39,403,603	\$956,484	\$350,000	\$143,883	\$2,676,681	\$1,100,367
2056				\$39,403,603	\$1,182,108	\$2,326,681	\$38,259,030	\$933,155	\$350,000	\$140,373	\$2,676,681	\$1,073,529
2057				\$38,259,030	\$1,147,771	\$2,326,681	\$37,080,120	\$910,395	\$350,000	\$136,950	\$2,676,681	\$1,047,345
2058				\$37,080,120	\$1,112,404	\$2,326,681	\$35,865,843	\$888,190	\$350,000	\$133,609	\$2,676,681	\$1,021,800
2059				\$35,865,843	\$1,075,975	\$2,326,681	\$34,615,137	\$866,527	\$350,000	\$130,351	\$2,676,681	\$996,878
2060				\$34,615,137	\$1,038,454	\$2,326,681	\$33,326,910	\$845,392	\$350,000	\$127,171	\$2,676,681	\$972,564
2061				\$33,326,910	\$999,807	\$2,326,681	\$32,000,037	\$824,773	\$350,000	\$124,070	\$2,676,681	\$948,843
2062				\$32,000,037	\$960,001	\$2,326,681	\$30,633,357	\$804,657	\$350,000	\$121,044	\$2,676,681	\$925,700
2063				\$30,633,357	\$919,001	\$2,326,681	\$29,225,677	\$785,031	\$350,000	\$118,091	\$2,676,681	\$903,122

2064				\$29,225,677	\$876,770	\$2,326,681	\$27,775,766	\$765,884	\$350,000	\$115,211	\$2,676,681	\$881,095
2065				\$27,775,766	\$833,273	\$2,326,681	\$26,282,358	\$747,204	\$350,000	\$112,401	\$2,676,681	\$859,605
2066				\$26,282,358	\$788,471	\$2,326,681	\$24,744,148	\$728,979	\$350,000	\$109,660	\$2,676,681	\$838,639
2067				\$24,744,148	\$742,324	\$2,326,681	\$23,159,791	\$711,199	\$350,000	\$106,985	\$2,676,681	\$818,184
2068				\$23,159,791	\$694,794	\$2,326,681	\$21,527,904	\$693,853	\$350,000	\$104,376	\$2,676,681	\$798,228
2069				\$21,527,904	\$645,837	\$2,326,681	\$19,847,060	\$676,930	\$350,000	\$101,830	\$2,676,681	\$778,759
2070				\$19,847,060	\$595,412	\$2,326,681	\$18,115,791	\$660,419	\$350,000	\$99,346	\$2,676,681	\$759,765
2071				\$18,115,791	\$543,474	\$2,326,681	\$16,332,584	\$644,311	\$350,000	\$96,923	\$2,676,681	\$741,234
2072				\$16,332,584	\$489,978	\$2,326,681	\$14,495,881	\$628,597	\$350,000	\$94,559	\$2,676,681	\$723,156
2073				\$14,495,881	\$434,876	\$2,326,681	\$12,604,076	\$613,265	\$350,000	\$92,253	\$2,676,681	\$705,518
2074				\$12,604,076	\$378,122	\$2,326,681	\$10,655,517	\$598,307	\$350,000	\$90,003	\$2,676,681	\$688,310
2075				\$10,655,517	\$319,666	\$2,326,681	\$8,648,502	\$583,714	\$350,000	\$87,807	\$2,676,681	\$671,522
2076				\$8,648,502	\$259,455	\$2,326,681	\$6,581,276	\$569,477	\$350,000	\$85,666	\$2,676,681	\$655,143
2077				\$6,581,276	\$197,438	\$2,326,681	\$4,452,033	\$555,588	\$350,000	\$83,576	\$2,676,681	\$639,164
2078				\$4,452,033	\$133,561	\$2,326,681	\$2,258,913	\$542,037	\$350,000	\$81,538	\$2,676,681	\$623,575
2079				\$2,258,913	\$67,767	\$2,326,681	\$0	\$528,816	\$350,000	\$79,549	\$2,676,681	\$608,366
2080				\$0								
Residual Value	\$0	\$0	\$0									
Total	100%	\$58,280,877	\$45,984,217		\$58,053,169	\$116,334,046		\$51,551,321	\$17,500,000	\$7,754,807	\$133,834,046	\$59,306,129

Table B-3: Projected Annual Development Costs, OM&R and Residual Net Value Benefits - Alternative 2

Year	Schedule	Construction Cost		Development Cost					OM&R		Total Cost	
		Total	NPV (2.5%)	Principal	Interest	Payment	Balance (12/31)	Development NPV	Nominal	NPV (2.5%)	Nominal	NPV (2.5%)
2025	0%	\$0	\$0		\$0		\$0					
2026	0%	\$0	\$0	\$0	\$0	\$0	\$0					
2027	35%	\$20,479,146	\$16,808,189	\$0	\$307,187	\$0	\$20,786,333					
2028	45%	\$26,330,331	\$21,083,443	\$20,786,333	\$1,018,545	\$0	\$48,135,209					
2029	20%	\$11,702,369	\$9,141,872	\$48,135,209	\$1,619,592	\$0	\$61,457,170					
2030				\$61,457,170	\$1,843,715	\$2,388,563	\$60,912,322	\$1,820,431	\$250,000	\$190,536	\$2,638,563	\$2,010,967
2031				\$60,912,322	\$1,827,370	\$2,388,563	\$60,351,128	\$1,776,030	\$250,000	\$185,889	\$2,638,563	\$1,961,919
2032				\$60,351,128	\$1,810,534	\$2,388,563	\$59,773,099	\$1,732,712	\$250,000	\$181,355	\$2,638,563	\$1,914,068
2033				\$59,773,099	\$1,793,193	\$2,388,563	\$59,177,728	\$1,690,451	\$250,000	\$176,932	\$2,638,563	\$1,867,383
2034				\$59,177,728	\$1,775,332	\$2,388,563	\$58,564,497	\$1,649,221	\$250,000	\$172,616	\$2,638,563	\$1,821,837
2035				\$58,564,497	\$1,756,935	\$2,388,563	\$57,932,868	\$1,608,996	\$250,000	\$168,406	\$2,638,563	\$1,777,402
2036				\$57,932,868	\$1,737,986	\$2,388,563	\$57,282,291	\$1,569,752	\$250,000	\$164,299	\$2,638,563	\$1,734,051
2037				\$57,282,291	\$1,718,469	\$2,388,563	\$56,612,197	\$1,531,465	\$250,000	\$160,291	\$2,638,563	\$1,691,757
2038				\$56,612,197	\$1,698,366	\$2,388,563	\$55,921,999	\$1,494,113	\$250,000	\$156,382	\$2,638,563	\$1,650,494
2039				\$55,921,999	\$1,677,660	\$2,388,563	\$55,211,096	\$1,457,671	\$250,000	\$152,568	\$2,638,563	\$1,610,239
2040				\$55,211,096	\$1,656,333	\$2,388,563	\$54,478,866	\$1,422,118	\$250,000	\$148,847	\$2,638,563	\$1,570,964
2041				\$54,478,866	\$1,634,366	\$2,388,563	\$53,724,668	\$1,387,432	\$250,000	\$145,216	\$2,638,563	\$1,532,648
2042				\$53,724,668	\$1,611,740	\$2,388,563	\$52,947,845	\$1,353,592	\$250,000	\$141,674	\$2,638,563	\$1,495,267
2043				\$52,947,845	\$1,588,435	\$2,388,563	\$52,147,717	\$1,320,578	\$250,000	\$138,219	\$2,638,563	\$1,458,797
2044				\$52,147,717	\$1,564,432	\$2,388,563	\$51,323,585	\$1,288,369	\$250,000	\$134,848	\$2,638,563	\$1,423,216
2045				\$51,323,585	\$1,539,708	\$2,388,563	\$50,474,729	\$1,256,945	\$250,000	\$131,559	\$2,638,563	\$1,388,504
2046				\$50,474,729	\$1,514,242	\$2,388,563	\$49,600,408	\$1,226,288	\$250,000	\$128,350	\$2,638,563	\$1,354,638
2047				\$49,600,408	\$1,488,012	\$2,388,563	\$48,699,857	\$1,196,378	\$250,000	\$125,219	\$2,638,563	\$1,321,598
2048				\$48,699,857	\$1,460,996	\$2,388,563	\$47,772,289	\$1,167,198	\$250,000	\$122,165	\$2,638,563	\$1,289,364
2049				\$47,772,289	\$1,433,169	\$2,388,563	\$46,816,895	\$1,138,730	\$250,000	\$119,186	\$2,638,563	\$1,257,916
2050				\$46,816,895	\$1,404,507	\$2,388,563	\$45,832,838	\$1,110,956	\$250,000	\$116,279	\$2,638,563	\$1,227,235
2051				\$45,832,838	\$1,374,985	\$2,388,563	\$44,819,260	\$1,083,860	\$250,000	\$113,443	\$2,638,563	\$1,197,302
2052				\$44,819,260	\$1,344,578	\$2,388,563	\$43,775,275	\$1,057,424	\$250,000	\$110,676	\$2,638,563	\$1,168,100
2053				\$43,775,275	\$1,313,258	\$2,388,563	\$42,699,970	\$1,031,633	\$250,000	\$107,976	\$2,638,563	\$1,139,610
2054				\$42,699,970	\$1,280,999	\$2,388,563	\$41,592,405	\$1,006,471	\$250,000	\$105,343	\$2,638,563	\$1,111,814
2055				\$41,592,405	\$1,247,772	\$2,388,563	\$40,451,614	\$981,923	\$250,000	\$102,773	\$2,638,563	\$1,084,697
2056				\$40,451,614	\$1,213,548	\$2,388,563	\$39,276,599	\$957,974	\$250,000	\$100,267	\$2,638,563	\$1,058,241
2057				\$39,276,599	\$1,178,298	\$2,388,563	\$38,066,334	\$934,609	\$250,000	\$97,821	\$2,638,563	\$1,032,430
2058				\$38,066,334	\$1,141,990	\$2,388,563	\$36,819,761	\$911,813	\$250,000	\$95,435	\$2,638,563	\$1,007,249
2059				\$36,819,761	\$1,104,593	\$2,388,563	\$35,535,790	\$889,574	\$250,000	\$93,108	\$2,638,563	\$982,682
2060				\$35,535,790	\$1,066,074	\$2,388,563	\$34,213,301	\$867,877	\$250,000	\$90,837	\$2,638,563	\$958,714

2061				\$34,213,301	\$1,026,399	\$2,388,563	\$32,851,137	\$846,709	\$250,000	\$88,621	\$2,638,563	\$935,331
2062				\$32,851,137	\$985,534	\$2,388,563	\$31,448,107	\$826,058	\$250,000	\$86,460	\$2,638,563	\$912,518
2063				\$31,448,107	\$943,443	\$2,388,563	\$30,002,987	\$805,910	\$250,000	\$84,351	\$2,638,563	\$890,261
2064				\$30,002,987	\$900,090	\$2,388,563	\$28,514,514	\$786,254	\$250,000	\$82,294	\$2,638,563	\$868,547
2065				\$28,514,514	\$855,435	\$2,388,563	\$26,981,386	\$767,077	\$250,000	\$80,286	\$2,638,563	\$847,363
2066				\$26,981,386	\$809,442	\$2,388,563	\$25,402,264	\$748,368	\$250,000	\$78,328	\$2,638,563	\$826,696
2067				\$25,402,264	\$762,068	\$2,388,563	\$23,775,769	\$730,115	\$250,000	\$76,418	\$2,638,563	\$806,533
2068				\$23,775,769	\$713,273	\$2,388,563	\$22,100,478	\$712,307	\$250,000	\$74,554	\$2,638,563	\$786,861
2069				\$22,100,478	\$663,014	\$2,388,563	\$20,374,929	\$694,934	\$250,000	\$72,736	\$2,638,563	\$767,669
2070				\$20,374,929	\$611,248	\$2,388,563	\$18,597,614	\$677,984	\$250,000	\$70,962	\$2,638,563	\$748,946
2071				\$18,597,614	\$557,928	\$2,388,563	\$16,766,979	\$661,448	\$250,000	\$69,231	\$2,638,563	\$730,679
2072				\$16,766,979	\$503,009	\$2,388,563	\$14,881,425	\$645,315	\$250,000	\$67,542	\$2,638,563	\$712,857
2073				\$14,881,425	\$446,443	\$2,388,563	\$12,939,305	\$629,576	\$250,000	\$65,895	\$2,638,563	\$695,471
2074				\$12,939,305	\$388,179	\$2,388,563	\$10,938,920	\$614,220	\$250,000	\$64,288	\$2,638,563	\$678,508
2075				\$10,938,920	\$328,168	\$2,388,563	\$8,878,525	\$599,239	\$250,000	\$62,720	\$2,638,563	\$661,959
2076				\$8,878,525	\$266,356	\$2,388,563	\$6,756,317	\$584,624	\$250,000	\$61,190	\$2,638,563	\$645,814
2077				\$6,756,317	\$202,690	\$2,388,563	\$4,570,443	\$570,365	\$250,000	\$59,697	\$2,638,563	\$630,062
2078				\$4,570,443	\$137,113	\$2,388,563	\$2,318,993	\$556,453	\$250,000	\$58,241	\$2,638,563	\$614,695
2079				\$2,318,993	\$69,570	\$2,388,563	\$0	\$542,881	\$250,000	\$56,821	\$2,638,563	\$599,702
2080				\$0								
Residual Value	\$0	\$0	\$0									
Total	100%	\$58,511,846	\$47,033,504		\$60,916,319	\$119,428,165		\$52,922,424	\$12,500,000	\$5,539,148	\$131,928,165	\$58,461,572

Table B-4: Projected Annual Benefits - Base Case

Year	Water Supply		Emergency Supply		Recreation		Environmental		Total Benefits	
	Total	NPV (2.5%)	Total	NPV (2.5%)	Total	NPV (2.5%)	Total	NPV (2.5%)	Nominal Value	NPV (2.5%)
2025	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2026	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2027	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2028	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2029	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2030	\$5,463,254	\$4,163,791	\$71,250	\$54,303	\$1,477,000	\$1,125,688	\$0	\$0	\$7,011,504	\$5,343,782
2031	\$5,463,254	\$4,062,235	\$71,250	\$52,978	\$1,477,000	\$1,098,232			\$7,011,504	\$5,213,445
2032	\$5,463,254	\$3,963,156	\$71,250	\$51,686	\$1,477,000	\$1,071,446			\$7,011,504	\$5,086,288
2033	\$5,463,254	\$3,866,494	\$71,250	\$50,426	\$1,477,000	\$1,045,313			\$7,011,504	\$4,962,232
2034	\$5,463,254	\$3,772,189	\$71,250	\$49,196	\$1,477,000	\$1,019,818			\$7,011,504	\$4,841,202
2035	\$5,463,254	\$3,680,184	\$71,250	\$47,996	\$1,477,000	\$994,944			\$7,011,504	\$4,723,124
2036	\$5,463,254	\$3,590,424	\$71,250	\$46,825	\$1,477,000	\$970,677			\$7,011,504	\$4,607,926
2037	\$5,463,254	\$3,502,853	\$71,250	\$45,683	\$1,477,000	\$947,002			\$7,011,504	\$4,495,538
2038	\$5,463,254	\$3,417,417	\$71,250	\$44,569	\$1,477,000	\$923,904			\$7,011,504	\$4,385,890
2039	\$5,463,254	\$3,334,065	\$71,250	\$43,482	\$1,477,000	\$901,370			\$7,011,504	\$4,278,917
2040	\$5,463,254	\$3,252,747	\$71,250	\$42,421	\$1,477,000	\$879,386			\$7,011,504	\$4,174,554
2041	\$5,463,254	\$3,173,412	\$71,250	\$41,387	\$1,477,000	\$857,937			\$7,011,504	\$4,072,735
2042	\$5,463,254	\$3,096,011	\$71,250	\$40,377	\$1,477,000	\$837,012			\$7,011,504	\$3,973,400
2043	\$5,463,254	\$3,020,499	\$71,250	\$39,392	\$1,477,000	\$816,597			\$7,011,504	\$3,876,488
2044	\$5,463,254	\$2,946,828	\$71,250	\$38,432	\$1,477,000	\$796,680			\$7,011,504	\$3,781,940
2045	\$5,463,254	\$2,874,954	\$71,250	\$37,494	\$1,477,000	\$777,249			\$7,011,504	\$3,689,697
2046	\$5,463,254	\$2,804,833	\$71,250	\$36,580	\$1,477,000	\$758,291			\$7,011,504	\$3,599,704
2047	\$5,463,254	\$2,736,423	\$71,250	\$35,688	\$1,477,000	\$739,796			\$7,011,504	\$3,511,907
2048	\$5,463,254	\$2,669,681	\$71,250	\$34,817	\$1,477,000	\$721,753			\$7,011,504	\$3,426,251
2049	\$5,463,254	\$2,604,567	\$71,250	\$33,968	\$1,477,000	\$704,149			\$7,011,504	\$3,342,683
2050	\$5,463,254	\$2,541,041	\$71,250	\$33,139	\$1,477,000	\$686,975			\$7,011,504	\$3,261,155
2051	\$5,463,254	\$2,479,064	\$71,250	\$32,331	\$1,477,000	\$670,219			\$7,011,504	\$3,181,614
2052	\$5,463,254	\$2,418,599	\$71,250	\$31,543	\$1,477,000	\$653,872			\$7,011,504	\$3,104,014
2053	\$5,463,254	\$2,359,609	\$71,250	\$30,773	\$1,477,000	\$637,924			\$7,011,504	\$3,028,306
2054	\$5,463,254	\$2,302,057	\$71,250	\$30,023	\$1,477,000	\$622,365			\$7,011,504	\$2,954,445
2055	\$5,463,254	\$2,245,910	\$71,250	\$29,290	\$1,477,000	\$607,185			\$7,011,504	\$2,882,385
2056	\$5,463,254	\$2,191,131	\$71,250	\$28,576	\$1,477,000	\$592,376			\$7,011,504	\$2,812,083
2057	\$5,463,254	\$2,137,689	\$71,250	\$27,879	\$1,477,000	\$577,928			\$7,011,504	\$2,743,496
2058	\$5,463,254	\$2,085,550	\$71,250	\$27,199	\$1,477,000	\$563,832			\$7,011,504	\$2,676,581
2059	\$5,463,254	\$2,034,683	\$71,250	\$26,536	\$1,477,000	\$550,080			\$7,011,504	\$2,611,299
2060	\$5,463,254	\$1,985,057	\$71,250	\$25,888	\$1,477,000	\$536,663			\$7,011,504	\$2,547,609
2061	\$5,463,254	\$1,936,641	\$71,250	\$25,257	\$1,477,000	\$523,574			\$7,011,504	\$2,485,472
2062	\$5,463,254	\$1,889,406	\$71,250	\$24,641	\$1,477,000	\$510,804			\$7,011,504	\$2,424,851
2063	\$5,463,254	\$1,843,323	\$71,250	\$24,040	\$1,477,000	\$498,345			\$7,011,504	\$2,365,708
2064	\$5,463,254	\$1,798,364	\$71,250	\$23,454	\$1,477,000	\$486,191			\$7,011,504	\$2,308,008
2065	\$5,463,254	\$1,754,501	\$71,250	\$22,882	\$1,477,000	\$474,332			\$7,011,504	\$2,251,715
2066	\$5,463,254	\$1,711,708	\$71,250	\$22,324	\$1,477,000	\$462,763			\$7,011,504	\$2,196,795
2067	\$5,463,254	\$1,669,959	\$71,250	\$21,779	\$1,477,000	\$451,476			\$7,011,504	\$2,143,215
2068	\$5,463,254	\$1,629,229	\$71,250	\$21,248	\$1,477,000	\$440,465			\$7,011,504	\$2,090,941
2069	\$5,463,254	\$1,589,491	\$71,250	\$20,730	\$1,477,000	\$429,722			\$7,011,504	\$2,039,943
2070	\$5,463,254	\$1,550,723	\$71,250	\$20,224	\$1,477,000	\$419,241			\$7,011,504	\$1,990,188
2071	\$5,463,254	\$1,512,901	\$71,250	\$19,731	\$1,477,000	\$409,015			\$7,011,504	\$1,941,647
2072	\$5,463,254	\$1,476,001	\$71,250	\$19,250	\$1,477,000	\$399,039			\$7,011,504	\$1,894,289

2073	\$5,463,254	\$1,440,001	\$71,250	\$18,780	\$1,477,000	\$389,307			\$7,011,504	\$1,848,087
2074	\$5,463,254	\$1,404,879	\$71,250	\$18,322	\$1,477,000	\$379,811			\$7,011,504	\$1,803,012
2075	\$5,463,254	\$1,370,613	\$71,250	\$17,875	\$1,477,000	\$370,548			\$7,011,504	\$1,759,036
2076	\$5,463,254	\$1,337,184	\$71,250	\$17,439	\$1,477,000	\$361,510			\$7,011,504	\$1,716,133
2077	\$5,463,254	\$1,304,570	\$71,250	\$17,014	\$1,477,000	\$352,693			\$7,011,504	\$1,674,276
2078	\$5,463,254	\$1,272,751	\$71,250	\$16,599	\$1,477,000	\$344,090			\$7,011,504	\$1,633,440
2079	\$5,463,254	\$1,241,708	\$71,250	\$16,194	\$1,477,000	\$335,698			\$7,011,504	\$1,593,600
2080										
Total	\$273,162,724	\$121,047,104	\$3,562,500	\$1,578,657	\$73,850,000	\$32,725,287	\$0	\$0	\$350,575,224	\$155,351,048

Exhibit 12



Resulting Groundwater production charges for FY 2011

	2010	2011
Zone W-2		
Groundwater		
M&I	\$520.00	\$520.00
AG	\$16.50	\$16.50
Treated Water Surcharge	\$100.00	\$100.00
Surface Water Surcharge	\$11.75	\$11.75
Zone W-5		
Groundwater		
M&I	\$275.00	\$275.00
AG	\$16.50	\$16.50
Surface Water Surcharge	\$11.75	\$11.75
Recycled Water		
M&I	\$275.00	\$275.00
AG	\$41.50	\$41.50

Table B-5: Projected Annual Benefits - Alternative 1

Year	Water Supply		Emergency Supply		Recreation		Environmental		Total Benefits	
	Total	NPV (2.5%)	Total	NPV (2.5%)	Total	NPV (2.5%)	Total	NPV (2.5%)	Nominal Value	NPV (2.5%)
2025	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2026	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2027	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2028	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2029	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2030	\$2,095,288	\$1,596,913	\$70,796	\$53,957	\$1,134,000	\$864,272	\$0	\$0	\$3,300,084	\$2,515,142
2031	\$2,095,288	\$1,557,964	\$70,796	\$52,641	\$1,134,000	\$843,192			\$3,300,084	\$2,453,797
2032	\$2,095,288	\$1,519,965	\$70,796	\$51,357	\$1,134,000	\$822,627			\$3,300,084	\$2,393,948
2033	\$2,095,288	\$1,482,892	\$70,796	\$50,104	\$1,134,000	\$802,563			\$3,300,084	\$2,335,560
2034	\$2,095,288	\$1,446,724	\$70,796	\$48,882	\$1,134,000	\$782,988			\$3,300,084	\$2,278,595
2035	\$2,095,288	\$1,411,438	\$70,796	\$47,690	\$1,134,000	\$763,891			\$3,300,084	\$2,223,019
2036	\$2,095,288	\$1,377,013	\$70,796	\$46,527	\$1,134,000	\$745,259			\$3,300,084	\$2,168,799
2037	\$2,095,288	\$1,343,427	\$70,796	\$45,392	\$1,134,000	\$727,082			\$3,300,084	\$2,115,902
2038	\$2,095,288	\$1,310,661	\$70,796	\$44,285	\$1,134,000	\$709,348			\$3,300,084	\$2,064,294
2039	\$2,095,288	\$1,278,693	\$70,796	\$43,205	\$1,134,000	\$692,047			\$3,300,084	\$2,013,946
2040	\$2,095,288	\$1,247,506	\$70,796	\$42,151	\$1,134,000	\$675,168			\$3,300,084	\$1,964,825
2041	\$2,095,288	\$1,217,079	\$70,796	\$41,123	\$1,134,000	\$658,701			\$3,300,084	\$1,916,902
2042	\$2,095,288	\$1,187,394	\$70,796	\$40,120	\$1,134,000	\$642,635			\$3,300,084	\$1,870,149
2043	\$2,095,288	\$1,158,433	\$70,796	\$39,142	\$1,134,000	\$626,961			\$3,300,084	\$1,824,535
2044	\$2,095,288	\$1,130,179	\$70,796	\$38,187	\$1,134,000	\$611,669			\$3,300,084	\$1,780,034
2045	\$2,095,288	\$1,102,613	\$70,796	\$37,255	\$1,134,000	\$596,750			\$3,300,084	\$1,736,619
2046	\$2,095,288	\$1,075,720	\$70,796	\$36,347	\$1,134,000	\$582,195			\$3,300,084	\$1,694,262
2047	\$2,095,288	\$1,049,483	\$70,796	\$35,460	\$1,134,000	\$567,995			\$3,300,084	\$1,652,939
2048	\$2,095,288	\$1,023,886	\$70,796	\$34,595	\$1,134,000	\$554,142			\$3,300,084	\$1,612,623
2049	\$2,095,288	\$998,913	\$70,796	\$33,752	\$1,134,000	\$540,626			\$3,300,084	\$1,573,291
2050	\$2,095,288	\$974,550	\$70,796	\$32,928	\$1,134,000	\$527,440			\$3,300,084	\$1,534,918
2051	\$2,095,288	\$950,780	\$70,796	\$32,125	\$1,134,000	\$514,576			\$3,300,084	\$1,497,481
2052	\$2,095,288	\$927,590	\$70,796	\$31,342	\$1,134,000	\$502,025			\$3,300,084	\$1,460,957
2053	\$2,095,288	\$904,966	\$70,796	\$30,577	\$1,134,000	\$489,781			\$3,300,084	\$1,425,324
2054	\$2,095,288	\$882,894	\$70,796	\$29,831	\$1,134,000	\$477,835			\$3,300,084	\$1,390,560
2055	\$2,095,288	\$861,360	\$70,796	\$29,104	\$1,134,000	\$466,180			\$3,300,084	\$1,356,644
2056	\$2,095,288	\$840,351	\$70,796	\$28,394	\$1,134,000	\$454,810			\$3,300,084	\$1,323,555
2057	\$2,095,288	\$819,855	\$70,796	\$27,702	\$1,134,000	\$443,717			\$3,300,084	\$1,291,273
2058	\$2,095,288	\$799,858	\$70,796	\$27,026	\$1,134,000	\$432,895			\$3,300,084	\$1,259,779
2059	\$2,095,288	\$780,349	\$70,796	\$26,367	\$1,134,000	\$422,336			\$3,300,084	\$1,229,053
2060	\$2,095,288	\$761,317	\$70,796	\$25,724	\$1,134,000	\$412,035			\$3,300,084	\$1,199,076
2061	\$2,095,288	\$742,748	\$70,796	\$25,096	\$1,134,000	\$401,986			\$3,300,084	\$1,169,830
2062	\$2,095,288	\$724,632	\$70,796	\$24,484	\$1,134,000	\$392,181			\$3,300,084	\$1,141,297
2063	\$2,095,288	\$706,958	\$70,796	\$23,887	\$1,134,000	\$382,616			\$3,300,084	\$1,113,461
2064	\$2,095,288	\$689,715	\$70,796	\$23,304	\$1,134,000	\$373,284			\$3,300,084	\$1,086,303
2065	\$2,095,288	\$672,893	\$70,796	\$22,736	\$1,134,000	\$364,179			\$3,300,084	\$1,059,808
2066	\$2,095,288	\$656,481	\$70,796	\$22,181	\$1,134,000	\$355,297			\$3,300,084	\$1,033,959
2067	\$2,095,288	\$640,469	\$70,796	\$21,640	\$1,134,000	\$346,631			\$3,300,084	\$1,008,741
2068	\$2,095,288	\$624,848	\$70,796	\$21,113	\$1,134,000	\$338,177			\$3,300,084	\$984,137
2069	\$2,095,288	\$609,608	\$70,796	\$20,598	\$1,134,000	\$329,928			\$3,300,084	\$960,134
2070	\$2,095,288	\$594,739	\$70,796	\$20,095	\$1,134,000	\$321,881			\$3,300,084	\$936,716
2071	\$2,095,288	\$580,233	\$70,796	\$19,605	\$1,134,000	\$314,031			\$3,300,084	\$913,869
2072	\$2,095,288	\$566,081	\$70,796	\$19,127	\$1,134,000	\$306,371			\$3,300,084	\$891,580
2073	\$2,095,288	\$552,275	\$70,796	\$18,660	\$1,134,000	\$298,899			\$3,300,084	\$869,834

2074	\$2,095,288	\$538,804	\$70,796	\$18,205	\$1,134,000	\$291,609			\$3,300,084	\$848,618
2075	\$2,095,288	\$525,663	\$70,796	\$17,761	\$1,134,000	\$284,496			\$3,300,084	\$827,920
2076	\$2,095,288	\$512,842	\$70,796	\$17,328	\$1,134,000	\$277,557			\$3,300,084	\$807,727
2077	\$2,095,288	\$500,333	\$70,796	\$16,905	\$1,134,000	\$270,788			\$3,300,084	\$788,027
2078	\$2,095,288	\$488,130	\$70,796	\$16,493	\$1,134,000	\$264,183			\$3,300,084	\$768,806
2079	\$2,095,288	\$476,225	\$70,796	\$16,091	\$1,134,000	\$257,740			\$3,300,084	\$750,055
2080										
Total	\$104,764,408	\$46,424,446	\$3,539,813	\$1,568,604	\$56,700,000	\$25,125,576	\$0	\$0	\$165,004,222	\$73,118,626

Exhibit 12



Resulting Groundwater production charges for FY 2011

	2010	2011
Zone W-2		
Groundwater		
M&I	\$520.00	\$520.00
AG	\$16.50	\$16.50
Treated Water Surcharge	\$100.00	\$100.00
Surface Water Surcharge	\$11.75	\$11.75
Zone W-5		
Groundwater		
M&I	\$275.00	\$275.00
AG	\$16.50	\$16.50
Surface Water Surcharge	\$11.75	\$11.75
Recycled Water		
M&I	\$275.00	\$275.00
AG	\$41.50	\$41.50

Table B-6: Projected Annual Benefits - Alternative 2

Year	Water Supply		Emergency Supply		Recreation		Environmental		Total Benefits	
	Total	NPV (2.5%)	Total	NPV (2.5%)	Total	NPV (2.5%)	Total	NPV (2.5%)	Nominal Value	NPV (2.5%)
2025	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2026	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2027	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2028	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2029	\$0	\$0	\$0	\$0	\$0	\$0			\$0	\$0
2030	\$287,244	\$218,922	\$0	\$0	\$0	\$0	\$25,107,075	\$19,135,226	\$25,394,319	\$19,354,148
2031	\$287,244	\$213,582	\$0	\$0	\$0	\$0			\$287,244	\$213,582
2032	\$287,244	\$208,373	\$0	\$0	\$0	\$0			\$287,244	\$208,373
2033	\$287,244	\$203,291	\$0	\$0	\$0	\$0			\$287,244	\$203,291
2034	\$287,244	\$198,332	\$0	\$0	\$0	\$0			\$287,244	\$198,332
2035	\$287,244	\$193,495	\$0	\$0	\$0	\$0			\$287,244	\$193,495
2036	\$287,244	\$188,776	\$0	\$0	\$0	\$0			\$287,244	\$188,776
2037	\$287,244	\$184,171	\$0	\$0	\$0	\$0			\$287,244	\$184,171
2038	\$287,244	\$179,679	\$0	\$0	\$0	\$0			\$287,244	\$179,679
2039	\$287,244	\$175,297	\$0	\$0	\$0	\$0			\$287,244	\$175,297
2040	\$287,244	\$171,021	\$0	\$0	\$0	\$0			\$287,244	\$171,021
2041	\$287,244	\$166,850	\$0	\$0	\$0	\$0			\$287,244	\$166,850
2042	\$287,244	\$162,781	\$0	\$0	\$0	\$0			\$287,244	\$162,781
2043	\$287,244	\$158,810	\$0	\$0	\$0	\$0			\$287,244	\$158,810
2044	\$287,244	\$154,937	\$0	\$0	\$0	\$0			\$287,244	\$154,937
2045	\$287,244	\$151,158	\$0	\$0	\$0	\$0			\$287,244	\$151,158
2046	\$287,244	\$147,471	\$0	\$0	\$0	\$0			\$287,244	\$147,471
2047	\$287,244	\$143,874	\$0	\$0	\$0	\$0			\$287,244	\$143,874
2048	\$287,244	\$140,365	\$0	\$0	\$0	\$0			\$287,244	\$140,365
2049	\$287,244	\$136,942	\$0	\$0	\$0	\$0			\$287,244	\$136,942
2050	\$287,244	\$133,602	\$0	\$0	\$0	\$0			\$287,244	\$133,602
2051	\$287,244	\$130,343	\$0	\$0	\$0	\$0			\$287,244	\$130,343
2052	\$287,244	\$127,164	\$0	\$0	\$0	\$0			\$287,244	\$127,164
2053	\$287,244	\$124,062	\$0	\$0	\$0	\$0			\$287,244	\$124,062
2054	\$287,244	\$121,036	\$0	\$0	\$0	\$0			\$287,244	\$121,036
2055	\$287,244	\$118,084	\$0	\$0	\$0	\$0			\$287,244	\$118,084
2056	\$287,244	\$115,204	\$0	\$0	\$0	\$0			\$287,244	\$115,204
2057	\$287,244	\$112,394	\$0	\$0	\$0	\$0			\$287,244	\$112,394
2058	\$287,244	\$109,653	\$0	\$0	\$0	\$0			\$287,244	\$109,653
2059	\$287,244	\$106,979	\$0	\$0	\$0	\$0			\$287,244	\$106,979
2060	\$287,244	\$104,369	\$0	\$0	\$0	\$0			\$287,244	\$104,369
2061	\$287,244	\$101,824	\$0	\$0	\$0	\$0			\$287,244	\$101,824
2062	\$287,244	\$99,340	\$0	\$0	\$0	\$0			\$287,244	\$99,340
2063	\$287,244	\$96,917	\$0	\$0	\$0	\$0			\$287,244	\$96,917
2064	\$287,244	\$94,553	\$0	\$0	\$0	\$0			\$287,244	\$94,553
2065	\$287,244	\$92,247	\$0	\$0	\$0	\$0			\$287,244	\$92,247
2066	\$287,244	\$89,997	\$0	\$0	\$0	\$0			\$287,244	\$89,997
2067	\$287,244	\$87,802	\$0	\$0	\$0	\$0			\$287,244	\$87,802
2068	\$287,244	\$85,661	\$0	\$0	\$0	\$0			\$287,244	\$85,661
2069	\$287,244	\$83,572	\$0	\$0	\$0	\$0			\$287,244	\$83,572
2070	\$287,244	\$81,533	\$0	\$0	\$0	\$0			\$287,244	\$81,533
2071	\$287,244	\$79,545	\$0	\$0	\$0	\$0			\$287,244	\$79,545
2072	\$287,244	\$77,604	\$0	\$0	\$0	\$0			\$287,244	\$77,604

2073	\$287,244	\$75,712	\$0	\$0	\$0	\$0			\$287,244	\$75,712
2074	\$287,244	\$73,865	\$0	\$0	\$0	\$0			\$287,244	\$73,865
2075	\$287,244	\$72,063	\$0	\$0	\$0	\$0			\$287,244	\$72,063
2076	\$287,244	\$70,306	\$0	\$0	\$0	\$0			\$287,244	\$70,306
2077	\$287,244	\$68,591	\$0	\$0	\$0	\$0			\$287,244	\$68,591
2078	\$287,244	\$66,918	\$0	\$0	\$0	\$0			\$287,244	\$66,918
2079	\$287,244	\$65,286	\$0	\$0	\$0	\$0			\$287,244	\$65,286
2080										
Total	\$14,362,219	\$6,364,357	\$0	\$0	\$0	\$0	\$25,107,075	\$19,135,226	\$39,469,294	\$25,499,583

Exhibit 12

 Resulting Groundwater production charges for FY 2011

	2010	2011
Zone W-2		
Groundwater		
M&I	\$520.00	\$520.00
AG	\$16.50	\$16.50
Treated Water Surcharge	\$100.00	\$100.00
Surface Water Surcharge	\$11.75	\$11.75
Zone W-5		
Groundwater		
M&I	\$275.00	\$275.00
AG	\$16.50	\$16.50
Surface Water Surcharge	\$11.75	\$11.75
Recycled Water		
M&I	\$275.00	\$275.00
AG	\$41.50	\$41.50

APPENDIX C
CALERO RESERVOIR FLOOD RISK
ASSESSMENT

Calero Reservoir: Flood Risk Assessment

Background

The Valley Water operates Calero Reservoir for the primary purpose of water supply deliveries (predominantly for groundwater recharge). The Reservoir also provides flood protection benefits through its retention of storm runoff which reduces downstream flows to Arroyo Calero Creek.

There have been 14 recorded major flood events within the Valley Water District since 1950. However, flooding at Arroyo Calero Creek has reportedly to have previously occurred only during the 1978 and 1995 floods (Valley Water 2016). Valley Water staff also reported no known previous cases of overtopping occurring at the Reservoir, indicating that there was limited flood risk immediately downstream of the Reservoir at Arroyo Calero creek under pre-Division of Safety of Dams (DSOD) operating conditions.

Since 1997, Valley Water has implemented operating strategies to manage the Reservoir's water supply function to ensure flood storage capacity. If the Reservoir's storage approaches full capacity early in the wet season, operations will release water to increase the reservoir storage capacity to reduce the risk potential and magnitude for overtopping in the event of high intensity rainfall events (Valley Water 2010). These flood curve storage restrictions ranges from a maximum 1,134 AF freeboard requirement (December 1) to 314 AF on March 31. No freeboard restrictions are required after March 31.

Analysis Overview

This analysis was performed to develop planning level estimates of the net change in flood risk between the project alternatives. Under both the Base Case (i.e., Dam rehabilitation to pre-DSOD conditions) and Alternative 1 (i.e., lower spillway), it is assumed that Valley Water's current flood curve storage restrictions would continue to be implemented unchanged. As a result, the Base Case and Alternative 1's future flood reduction effects are similarly expected to remain unchanged from past performance levels. As a result, future flood risk changes are only expected under Alternative 2 (i.e., future removal of Calero Dam) which would lack any flood retention capabilities.

All Base Case findings will also represent corresponding findings for Alternative 1. As a result, while the following discussion predominantly focuses on Alternative 2 and the Base Case the findings and analyses for the Base Case are equally and interchangeably applicable to Alternative 1.⁷

A data search did not identify flood maps⁸ or existing analysis that could be reliably used to determine the project alternatives' expected net flood risk changes. However future floodplain conditions were modeled using a 2D hydraulic model based on data provided by Valley Water staff projecting peak inflow and outflow inputs at Calero Reservoir for various storm events. The modeled floodplains were digitized and overlaid on Santa Clara County Assessor Parcel records in geographic information system (GIS) to identify properties at-risk for each of the storm events modeled. Economic damages were then estimated for the identified at-risk properties using industry standard methodologies to account for direct damages to structures and their contents, as well as indirect damages (e.g. temporary housing, relocation assistance and other potential emergency costs).

The expected net flood risk changes under Alternative 2 were estimated for the areas adjacent to Arroyo Calero Creek upstream of Harry Road. The future flood risk to the more densely populated areas downstream of Harry Road would also be expected to increase under Alternative 2, however the flood risk impacts to those downstream areas were not analyzed.

⁷ Based on further discussion with Valley Water, when taking into consideration Reservoir operations, the Base Case would likely result in less flood risk than Alternative 1 given additional incidental inflow capture potential that would not be available for Alternative 1 due to emergency supply requirements and the smaller volume of the Reservoir.

⁸ Identified flood maps included Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FEMA 2009) and a GEI Study (GEI 2015). The FEMA maps were limited to the 100-year and 500-year floodplains and did not include any expected depth of flooding data, which is an important input for economic damage estimation. The GEI study evaluated impacts of spillway and overtopping flows along the spillway and immediate downstream of Calero Dam (specifically the spillway discharge channel, Calero Valve Yard, proposed embankment buttress and the Almaden-Calero Canal). However, its floodplain mapping was limited to south of McKean Road and as a result excluded the downstream residential areas along Arroyo Calero Creek.

Floodplain Modeling

A 2D HEC-RAS hydraulic model was developed to simulate flood conditions from peak discharge events into Calero Creek for the Alternative 2 (i.e. removal of Calero Dam) and the Base Case. Alternative 2 was assumed to have zero detention capacity. Consequently, future downstream flows to Arroyo Calero Creek would be equal to the projected flows into the Reservoir. The Base Case was also simulated to estimate the net flood risk change if Calero Dam is removed (Alternative 2).

The model was based on terrain data from the 2006 Valley Water District LiDAR and the 2016 National Land Cover Database (NLCD). Reaches of the Arroyo Calero Creek that were not well represented in the terrain data (e.g., due to vegetation coverage in the LiDAR) were manually cut into the terrain. A model mesh was developed that started at the face of Calero Dam and extended downstream to the mouth of Guadalupe River at San Francisco Bay.⁹ Breaklines were inserted into the model mesh along the channel banks and at roadway crossing that served as local barriers to flow to ensure that they were appropriately represented in the model.

Numerous storm event scenarios, ranging from the two-year storm to the 100-year storm,¹⁰ were simulated to project the flood conditions under both Alternative 2 and the Base Case. Design flows were obtained from Valley Water (see Table C-1).¹¹ These values provide peak inflow into Calero Reservoir for select storm events and corresponding peak outflows from Calero Reservoir for both Alternative 2 and the Base Case. The Base Case assumed the reservoir was 94% full which resulted in the outflow reductions from those under Alternative 2. The model was run for a three-day period using the design flows for each storm conditions and the flow was applied at the face of Calero Dam for the duration of the model run. The water depth estimates were extracted from the domain once a steady state flow was achieved throughout the creek, which occurred about 1.5 days into the simulation.

As shown in Table C-1, during a two-year storm event, Arroyo Calero's peak flow conditions under Alternative 2 would be expected to exceed those from a 100-year storm event under the Base Case and Alternative 1. During a five-year flood event, Alternative 2's peak flow conditions would exceed those from a 500-year storm event under the Base Case. These values demonstrate the substantial flood risk increase that would result if Alternative 2 is implemented.

Table C-1. Storm Event Flow Conditions

Location	Peak Flow (cfs)							
Storm Event Type	2-year	5-year	10-year	25-year	50-year	100-year	200-year	500-year
<i>Incidence Rate</i>	<i>50%</i>	<i>20%</i>	<i>10%</i>	<i>4%</i>	<i>2%</i>	<i>1%</i>	<i>0.5%</i>	<i>0.2%</i>
Inflow to Calero Reservoir								
Calero Creek at Calero Dam	450	860	1,070	1,360	1,580	1,810	2,020	2,260
Outflow from Calero Reservoir								
Base Case/Alternative 1	190	190	190	200	260	390	520	730
Alternative 2	450	860	1,070	1,360	1,580	1,810	2,020	2,260
<i>Note: Design storm peak flows calculated for reservoir at 94% capacity which exceeds current flood curve restriction</i>								
<i>cfs = cubic feet per second</i>								

Figure C-1 and Figure C-2 below show the modeled floodplain for the Base Case and Alternative 1 and Alternative 2, respectively. The floodplain extent is limited to the area between the Reservoir and Harry Road, as this was determined to be the direct and primary zone of impact for the economic analysis. Arroyo Calero Creek reportedly has the capacity to manage peak flows up to 200 cfs (Valley Water 2019d). As a result, under the Base Case, no flood damages would be to occur during two-year, five-year, ten-year and 25-year storm events.

⁹ The BCA conservatively limits its flood damage analysis to the flood zone downstream to Harry Road.

¹⁰ The 100-year storm event was chosen as the upper bound scenario for the BCA and consequently the flood damages of 200-year and 500-year storm events are not included in the flood damage estimates.

¹¹ No contributing flows from nearby tributaries such as Santa Teresa Creek were included.

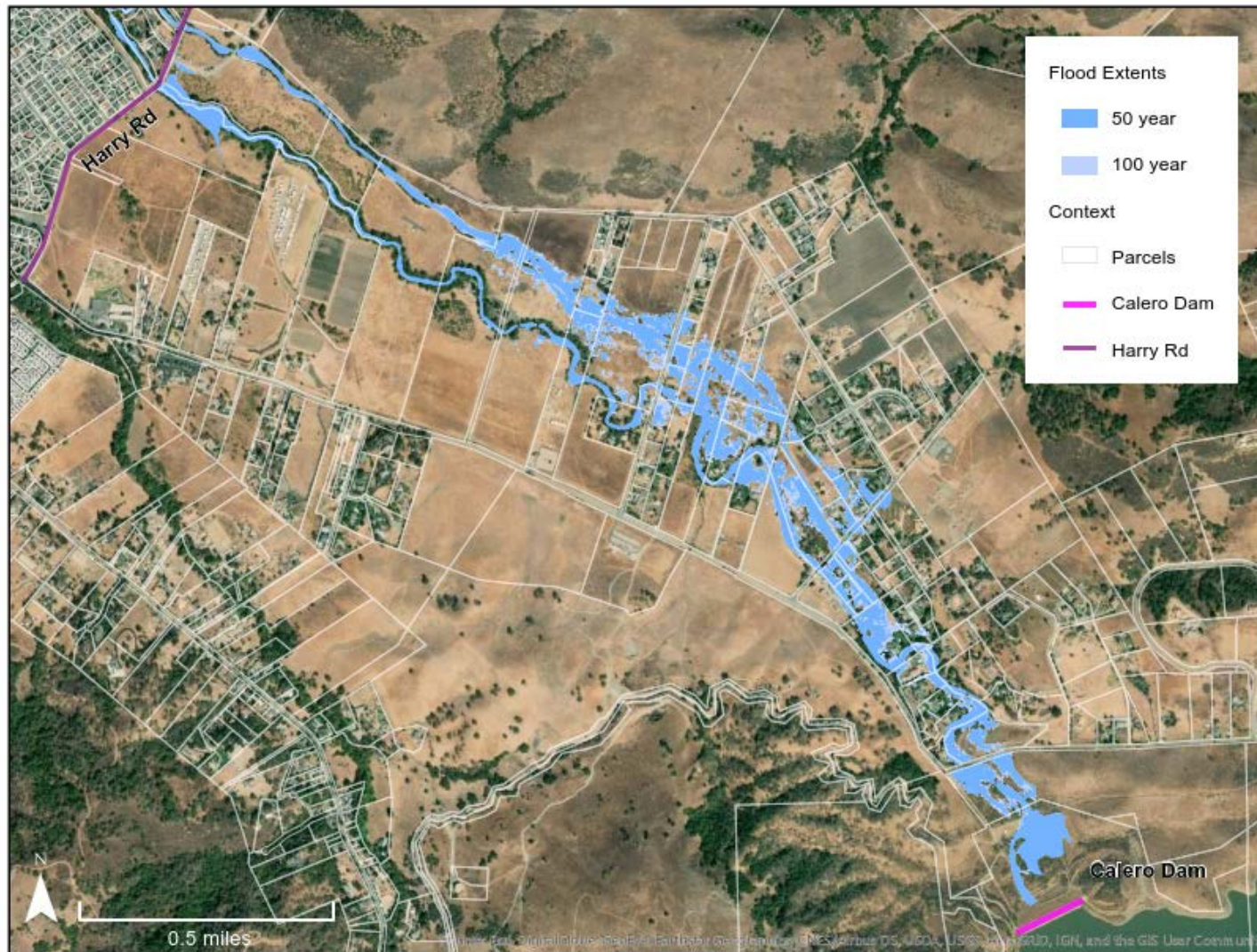


Figure C-1. Flood Zone by Storm Event Type – Base Case and Alternative 1

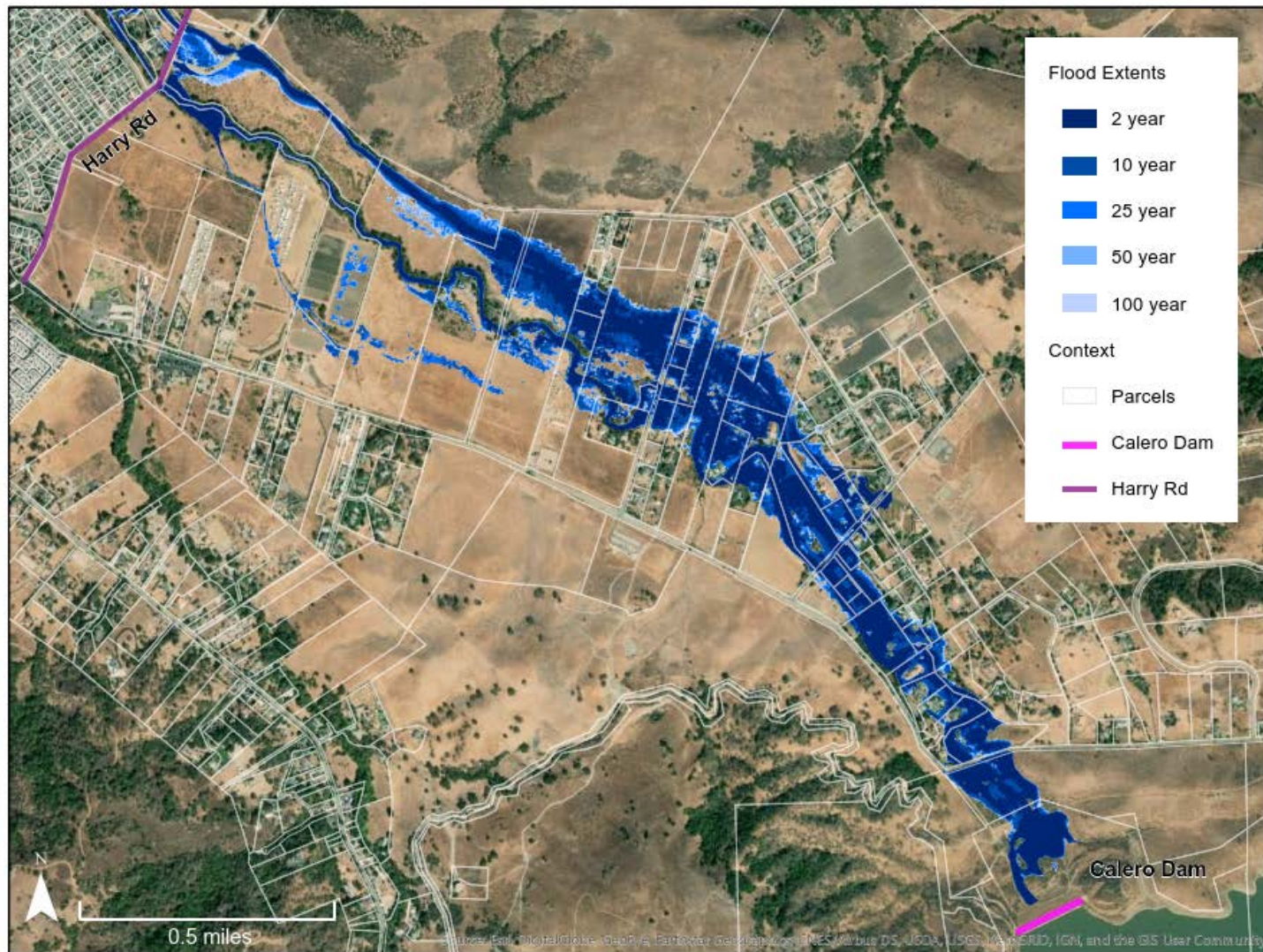


Figure C-2. Flood Zone by Storm Event Type – Alternative 2

Economic Modeling

The economic damages for each of the modeled storm event conditions under the Base Case and Alternative 2 were estimated using standard flood risk analysis methodologies and inputs obtained that underpin the Flood Rapid Assessment Method (F-RAM). This method was developed for California Department of Water Resources to provide an efficient and standardized approach to evaluate flood risk management measures in a benefit-cost analysis (BCA) framework.

The primary steps of the flood risk analysis include:

1. Identifying property exposed to the modeled storm events;
2. Estimating the amount of economic damages for exposed property, accounting for direct damages to structures and their contents, and also indirect damages (e.g., cleanup costs, temporary housing, relocation assistance and other potential emergency costs) for each storm event type.
3. Converting the results for the modeled storm events into estimates of equivalent annual damages (EAD). The EAD is calculated by accounting for the annual likelihood of the modeled storm events occurring and thereby reflects the amount of damage that could be expected in any given year.
4. Calculating cumulative net present damages by discounting the EAD in each analysis year of the 50-year study period and summing the annual values. Cumulative net present damages are then annualized to represent the average annual damages that could be expected.

Direct Damages

Storm-induced flooding can result in direct damages to exposed structures and their contents. The HEC-RAS modeled floodplains were overlaid in GIS on Santa Clara County Assessor Parcel records to estimate the extent of direct damages under the project alternatives. Parcels that intersected with the modeled floodplains were identified for further analysis. Since the direct damage assessment is focused on estimating impacts to structures and their contents, building footprint shapefiles were joined with exposed parcels, and additional GIS analysis was performed to identify the expected flooding depths at the at-risk structures.

Depth damage curves establish a relationship between the flood depth at a building and the potential damage to the affected structure and its contents. As a result, Depth damage curves are fundamental for assessment of each flood event's direct damages. Depth damage curves for different building types (e.g., residential, commercial, industrial) were obtained from F-RAM. These curves, which were developed by the U.S. Army Corps of Engineers based on a historical evaluation of flood damages, were then applied to the at-risk buildings' estimated replacement values. Information on structure size and type¹² were applied to F-RAM unit cost factors to develop building replacement value estimates. All replacement costs were discounted to account for structure depreciation¹³ and then escalated to constant 2019 dollars using historical construction cost indices. Structure and content damages were only estimated for buildings where the modeled flood depth was greater than or equal to one-half foot to account for the first floor elevation since it is conservatively assumed that only nominal damage to occur from flooding below this threshold.

Indirect Damages

Indirect damages to account for cleanup costs, temporary housing, relocation assistance and other potential emergency costs were modeled as a proportion of direct damages (i.e. the sum of structure and content damages). Indirect flood damage costs were estimated in accordance with standard F-RAM values to be 25 percent of the direct flood damages.

¹² The Santa Clara County Assessor's publicly available parcel records had limited data attribution. As a result, UrbanFootprint's parcel database was used

¹³ Depreciated structure value is generally considered a more accurate metric for estimating potential flood damage than full replacement value. No information was identified on the condition of exposed structures, resulting in the use of a 25% constant depreciation rate for all structures. A constant depreciation rate was used based on the assumption that annual maintenance spending and the annual rate of depreciation are equal.

Equivalent Annual Damages

After estimating the total economic damages (i.e., the sum of direct and indirect damages) for the modeled storm events, it is necessary to translate these results into EAD estimates. This metric, which reflects the amount of damage that could be expected in any given year, is calculated by accounting for the annual likelihood of a modeled storm event occurring. Consider for example a 10-year storm, which has 10% chance of occurring in any given year. If the damages from this event are estimated at \$100,000, then this value is multiplied by 0.1 (10% chance), resulting in an EAD of \$10,000. Because a range of storm events were modeled in this analysis, it was necessary to estimate the interval probabilities, which account for the chance of an event occurring that is between two exceedance probability events, with the size of the event being the average of the two exceedance levels. The EAD is then calculated as the sum of each probability interval multiplied by the average damage in that interval and then summed over all the interval probabilities.

Cumulative and Annualized Damages

The estimated total EAD for each alternative was applied to each year in the 50-year period of analysis and then discounted and summed to calculate the net present value of the cumulative flood damages. The net present value of the cumulative damages was then annualized to represent the annual flood damages that could be expected average discounted to factor in consideration of the time value of money.

Summary Findings

Table C-2 shows the number of buildings where flooding was projected to equal or exceed one-half foot in depth. As discussed above, this flood depth threshold was applied to account for the assumed first floor elevation of buildings which is considered the inflection point for direct flood damage occurrence.

Under the Base Case, no buildings were determined to be at-risk of flooding during two-year, five-year, ten-year and 25-year modeled storm events. During 50-year and 100-year storm events, 6 and 8 buildings respectively were identified as being exposed to one-half foot or more of flooding. For these storm events, the maximum flood depth recorded at exposed buildings ranged from 1.3 to 1.5 feet, indicating a relatively shallow flooding profile.

Arroyo Calero Creek would run unconstrained under Alternative 2 and the number of buildings projected to experience one-half foot or more of flooding would range from 8 during a two-year event and up to 18 during a 100-year event. Consistent with the Base Case findings, a relatively shallow flood profile was observed under Alternative 2 with maximum flood depths projected to range from 1.6 to 2.5 feet.

Table C-2. Flooding Characteristics Between Calero Reservoir and Harry Road

With Dam: Base Case / Alternative 1						
Storm Event	2-year	5-year	10-year	25-year	50-year	100-year
# of Buildings with Flooding $\geq$ 0.5 (ft.)	-	-	-	-	6	8
Max Building Flood Depth (ft)	-	-	-	-	1.3	1.5
No Dam: Alternative 2						
Storm Event	2-year	5-year	10-year	25-year	50-year	100-year
Building with flooding $\geq$ 0.5 (ft)	8	13	15	17	17	18
Max Building Flood Depth (ft)	1.6	2.0	2.1	2.3	2.4	2.5
<i>Note: ft = feet</i>						

Table C-3 reports the direct (i.e., structures and contents) and indirect (e.g., relocation assistance, emergency costs) damages estimated for each storm event modeled. These results represent the estimated total flood damages on the existing built environment resulting from each storm event modeled. The results represent the damages from a single occurrence of the specific storm event type and are not adjusted to account for the likelihood of the storm event occurring (which are determined in the EAD values presented in Table C-4 below).

No economic damages were estimated for the two-year, five-year, ten-year and 25-year storm events under the Base Case. For the 50-year and the 100-year storm events, damages were estimated at \$1.2 and \$1.8 million, respectively. Affected property types were overwhelmingly residential. For Alternative 2, estimated damages ranged from \$1.8 million for the two-year event to \$4.7 million for the 100-year event; the damages for the two-year event are greater than those that were estimated for the 100-year event for the Base Case. Under the Base Case and Alternative 2, approximately half of the damages for each modeled storm event are expected to result from structure repair costs.

Table C-3. Event-Based Flood Damages (\$1,000s)

With Dam: Base Case / Alternative 1				
Storm Scenario	Structure Damages	Content Damages	Indirect Damages	Total Damages
100-Year Event	\$883	\$533	\$354	\$1,770
50-Year Event	\$612	\$370	\$245	\$1,227
25-Year Event	\$0	\$0	\$0	\$0
10-Year Event	\$0	\$0	\$0	\$0
5-Year Event	\$0	\$0	\$0	\$0
2-Year Event	\$0	\$0	\$0	\$0
No Dam: Alternative 2				
Storm Scenario	Structure Damages	Content Damages	Indirect Damages	Total Damages
100-Year Event	\$2,373	\$1,382	\$939	\$4,694
50-Year Event	\$1,950	\$1,131	\$770	\$3,851
25-Year Event	\$1,915	\$1,108	\$756	\$3,779
10-Year Event	\$1,753	\$1,020	\$693	\$3,466
5-Year Event	\$1,448	\$850	\$575	\$2,873
2-Year Event	\$913	\$549	\$365	\$1,827
<i>Note: Results in 2019 dollars.</i>				

Table C-4 shows the EAD, cumulative damage, and annualized damage estimates for both the Base Case and Alternative 2. As discussed above, the EAD accounts for the likelihood of the modeled events occurring, as well as events between these return periods, and represents the amount of damage that could be expected in any given year prior to taking into consideration the time value of money (i.e., financial discount rate). The EAD under the Base Case was estimated to be approximately \$15,000. Alternative 2's EAD was estimated to be approximately \$1.4 million which is 90 times greater than that under the Base Case. Cumulative flood damages (which account for the time value of money over the 50-year analysis period) were estimated to be \$0.30 million for the Base Case and \$39.8 million for Alternative 2. Compared to the Base Case, over the 50-year study period, Alternative 2 is projected to result in increased future flood damages with a total net present value of nearly \$31.3 million.

Table C-4. Summary Net Present Value Flood Damages (\$1,000s)

Project Alternatives	EAD	Cumulative Damages (NPV)
Base Case/Alternative 1 (with Dam)	\$15	\$300
Alternative 2 (without Dam)	\$1,358	\$30,100
Alternative 2 – Net Flood Risk Increase	\$1,343	\$29,800

Notes: 2.5% discount rate was used over a 50-year period of analysis (2030 to 2079)

EAD = equivalent annual damages

NPV = Net Present Value

Least Cost Mitigation Alternative

Alternative 2's estimated \$29.8 million net increase in the future flood risk cost provides a measure of the flood reduction benefits resulting from the Base Case or Alternative 1 from avoided future flood costs. However, this projected avoided flood damage benefit will overstate the Base Case's flood reduction benefits if there are less expensive alternate means to achieve a comparable flood risk reduction.

It is considered highly likely that less costly flood mitigation measures could be implemented to protect or raise the at-risk properties to ensure those structure are undamaged during future flood events. In which case, the flood reduction benefits attributable by the BCA for the Base Case's flood reduction benefits will be limited to the lowest cost mitigation alternative that would achieve a comparable flood risk reduction.

It is not possible to determine the feasibility and estimated costs for specific flood protection measures or improvements for each at-risk structure given the limited property and flood data. However, if the average cost to raise or protect the 18 buildings at-risk from a 100-year storm under Alternative 2 was \$1.2 million,¹⁴ then the corresponding total mitigation cost would be expected to be \$21.6 million. In which case, the maximum economic value attributable by the BCA to the Base Case for its flood reduction benefits (compared to Alternative 2) would correspondingly equal the \$21.6 million mitigation cost.

Valley Water's current flood curve storage restrictions require that adequate freeboard conditions are maintained between December and March to enable adequate retention of Calero watershed inflows from major storm events to avoid downstream flood impacts. These flood curve restrictions range from a maximum 1,134 acre foot freeboard requirement beginning on December 1. After December 15 the storage restriction decrease gradually until then are lifted on April 1. During that four-month period freeboard requirement averages 806 acre-feet.

Given the maximum flood curve requirement of 1,134 AF for the Base Case and Alternative 1, it is assumed that development of a flood retention structure with a 1,134 acre foot of storage capability should be able to provide a comparable flood reduction benefits as those under Base Case and Alternative 1. Based on GEI engineers professional judgement and very rudimentary design and cost assumptions, it is conservatively estimated that under Alternative 2 it would likely possible to develop a 1,134 acre foot retention facility within the current reservoir foot with a net present value development cost of approximately \$18.5 million. The proposed facility is expected to represent the least cost alternative for Alternative 2 to achieve future flood risk conditions comparable to those under the Base Case and Alternative 1.

As a result, the maximum economic value attributable by the BCA to the Base Case for its flood reduction benefits (compared to Alternative 2) are estimated to equal the \$18.5 million lifecycle net cost of a 1,134 acre foot retention facility under Alternative 2.

¹⁴ This mitigation cost needs to cover building improvements for flood protection over the entire 50-year study period. Note that acquisition of at-risk properties could in some case also represent possible feasible mitigation options (depending on the buildings' market value and after factoring in Valley Water's administrative and transaction costs).

Analysis Limitations

The purpose of this flood risk assessment was to obtain planning-level flood damage estimates of the future flood risks under the Base Case and Alternative 2. For the purposes of the BCA's high-level analysis more comprehensive and/or detailed flood risk estimation was considered unnecessary and was not possible given the project's schedule, level of effort and data constraints. A brief description of some of the limiting factors in this analysis are provided below:

- **Damage Types:** This analysis primarily focused on estimating direct damages to buildings and contents. However, other types of potential flood damages that could occur include flood impacts on agricultural lands and surrounding infrastructure (i.e., roads). These additional types of flood damages were not included in this analysis and consequently the modeled results may understate total potential flood risk.
- **Reservoir Conditions and Operations:** The modeled results could change if alternative assumptions were incorporated related to the starting water level in the Reservoir when the design storms occur, which is influenced by many factors, including drawdown and recapture operations. For instance, the peak flow outputs were developed with the assumption that the Reservoir is 94% full when the design storms occur. This volume of water would exceed the established flood curve storage restrictions. If the storage restrictions were accounted for in the modeling, the expected flood damages would likely be less than what were currently estimated for the Base Case. Given the limited flood damages estimated for this project alternative, accounting for these flood storage restrictions or other factors that would further reduce the starting water level of the Reservoir (from what was modeled for the design storms) would likely produce changes in the results that would only nominally alter the Base Case's total benefits.
- **Area of Impact:** The flood damages assessment was limited to flooding of Arroyo Calero Creek upstream of Harry Road. Valley Water staff indicated that even during higher-probability storm events significant flood risk increases could result further downstream, if the increased and uncontrolled flows from Arroyo Calero under Alternative 2 result in overtopping and flooding within the highly developed areas below Harry Road. However, estimation of the increased flood risk downstream from Harry Road would require more extensive hydrologic modeling to include and allocate flood effects from confluences with Alamitos and Guadalupe Creeks. To properly ascertain the full extent of flood risk downstream, this additional modeling would need to be undertaken.
- **Data Availability:** Limited data availability on at-risk parcels to the modeled storm conditions required the use of assumptions for the number of stories, first floor elevation heights and building conditions and property values.

References

- California Department of Water Resources, Division of Flood Management. 2008. Flood Rapid Assessment Model (F-RAM) Development.
- FEMA (Federal Emergency Management Agency). 2009. Flood Insurance Rate Maps (FIRM), Santa Clara County, FIRM 06085C0408H.
- GEI. 2015. Downstream Flood Routing – Calero Dam Seismic Retrofit Project Technical Memorandum.
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- Valley Water. 2016. One Water Plan for Santa Clara County – Preliminary Draft.
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- National Oceanic and Atmospheric Administration (NOAA). 2006 Santa Clara Water District Lidar. Accessed on August 6 2019 from: https://coast.noaa.gov/htdata/lidar1_z/geoid12a/data/4870/.
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APPENDIX D
CALERO RESERVOIR RECREATION
ASSESSMENT

CALERO RESERVOIR RECREATION ASSESSMENT

Background

Calero Reservoir is one of 10 reservoirs owned and operated by Valley Water. The Reservoir is surrounded by Calero County Park, which is owned and operated by Santa Clara County Department of Parks and Recreation. The Reservoir provides year-around opportunities for a variety of water-based recreational uses, including power boating, sailing, fishing, waterskiing, jet-skiing, kayaking/canoeing, and paddle boarding. Fishing is only available on a catch and- release basis due to the high levels of mercury in the reservoir. Swimming at the reservoir is prohibited. Surrounding the Reservoir, Calero County Park hosts several miles of trails for hiking, biking, equestrian use and picnicking.

Analysis Overview

This analysis was undertaken to inform planning level estimates of the net change in recreational benefits for the project alternatives under evaluation compared to historical recreational benefits provided by the Reservoir. This analysis is focused on estimating the economic benefit provided by water-based recreation at the Reservoir. Recreation activities that are not water-dependent (e.g., hiking, picnicking) are not assumed to be affected by the project alternatives and as such are not evaluated as part of this analysis. Recreational benefits for the project alternatives were evaluated over a 50-year period, from 2030 through 2079 (the assumed useful life of the project alternatives). Short-term changes in recreational benefits related to dewatering the Reservoir, which would result in no water-based recreation during project construction (approximately 2.5 years), were not evaluated.

Benefit Estimation

Standard recreational demand methodologies were applied to generate estimates of the recreational benefits provided by the project alternatives under evaluation. This analysis primarily draws from historical recreational use patterns at the Reservoir, as documented in the Calero Seismic Retrofit Project Administrative Draft EIR (unpublished), and published recreational user values for the Western Pacific region of the U.S. The use of valuation estimates from previous studies of similar goods or services at comparable sites is commonly referred to as the benefit transfer approach. This method is widely applied in studies like this due to the significant cost of conducting a study to develop site-specific estimates of economic value for specific resource and activity types. Additionally, none of the project alternatives under evaluation are assumed to result in the construction or expansion of the reservoir's recreational facilities.

The primary steps of this analysis include:

1. Estimating the recreational use levels for water-based recreational activities hosted at the Reservoir, accounting for changes in the surface area of the Reservoir.
2. Identifying published recreational user values that can be reasonably applied to the types of water-based recreation allowed at the Reservoir.
3. Applying the estimated recreational use levels at the Reservoir to the published recreational user values to develop an estimate of annual recreational benefits.
4. Calculating cumulative net present recreational benefits by discounting the annual benefit estimate in each analysis year and summing these annual values. Cumulative net present benefits are then annualized for illustrating benefits that could be expected in a year on average.

Visitation

Water-based recreational use levels were identified in the Administrative Draft EIR, accounting for motorized watercraft, non-motorized watercraft and fishing. Visitation level estimates in the Administrative Draft EIR were reported as average annual visitor days based on multiple observation years. Visitation estimates were only available for post-DSOD operations, which correlate to the surface area of the Reservoir for Alternative 1. It was assumed that an increase in the surface area of the Reservoir to pre-

DSOD levels under the Base Case would result in increased use of the Reservoir for each water-based activity type.¹⁵ The change in recreational demand for the Base Case was estimated by calculating the percent change in the surface area of the Reservoir for the Base Case compared to Alternative 1, and then increasing observed visitation estimates for Alternative 1 by one-half of this percent change value.¹⁶ For instance, if the Reservoir's surface area under the Base Case is 20 percent greater than the surface area for Alternative 1, the Base Case visitation would be modeled as 10 percent greater than Alternative 1. No water-based recreation is attributed to Alternative 2.

Recreation User Values

Recreation benefits were quantified using unit day values from the Recreation Use Values Database (RUVd) for North America (Rosenberger 2016). This resource provides a meta-analysis of hundreds of studies that estimated the use value of one or more than a dozen recreation types over the past 60 years. These recreational use value estimates reflect net consumer surplus,¹⁷ in per person per activity day units. The RUVd provides average estimates for the U.S., as well as for the Northeastern, Midwestern, Southern and Western regions (as defined by U.S. Census regions) of the U.S. The Western Region estimates were incorporated into this analysis. These values have been endorsed for use by State and Federal actors for estimating recreational benefits at reservoirs.

Findings

Table D-1 shows the annual visitor days for water-based recreational activities, selected unit day values for similar recreational activity types and the estimated annual recreational benefits, which is calculated by multiplying the annual visitor days by their respective unit day values. The visitation values assume that recreational demand is correlated to the surface area of the Reservoir. The Base Case, which has the largest surface area available for water-based recreation, was estimated to provide an annual benefit of nearly \$1.5 million, followed by Alternative 1 at over \$1.1 million. No water-based recreation benefits were estimated for Alternative 2.

Table D-2 shows cumulative and annualized recreational benefit estimates provided by the project alternatives under evaluation. Cumulative benefits, which incorporate financial discounting principles over the 50-year period of analysis were estimated at \$32.7 million for the Base Case and \$25.1 million for Alternative 1. No recreational benefits were estimated for Alternative 2.

¹⁵ Estimated average reservoir surface area is 337 acres (Base Case) and 210 acres (Alternative 1) per Administrative Draft EIR.

¹⁶ There is a limit placed on the number of watercrafts allowed at Calero Reservoir at any given time of one boat per six surface acres. The projected Base Case recreation use increase would likely not exceed this limit at most times during the year.

¹⁷ Consumer surplus is not represented by cash flow in the economy but instead reflects the value that consumers gain by paying less than what they would be willing to pay for a given product or resource.

Table D-1. Annual Benefits for Water-Based Recreation

Base Case			
Recreational Activity	Annual Visitor Days	Unit Day Value	Annual Benefits (\$1,000s)
Motorized Watercraft	7,633	\$57	\$437
Non-Motorized Watercraft	1,993	\$130	\$260
Fishing	8,288	\$94	\$780
Total	17,914	\$82	\$1,477
Alternative 1			
Recreational Activity	Annual Visitor Days	Unit Day Value	Annual Benefits (\$1,000s)
Motorized Watercraft	5,861	\$57	\$336
Non-Motorized Watercraft	1,530	\$130	\$200
Fishing	6,364	\$94	\$599
Total	13,755	\$82	\$1,134
Alternative 2			
Recreational Activity	Annual Visitor Days	Unit Day Value	Annual Benefits (\$1,000s)
Motorized Watercraft	0	\$57	\$0
Non-Motorized Watercraft	0	\$130	\$0
Fishing	0	\$94	\$0
Total	0	\$0	\$0

Note: Unit day value totals calculated using a weighted average across recreational activity types. Results in 2019 dollars.

Table D-2. Summary Net Present Value Recreational Benefits (\$1,000s)

Project Alternatives	Annual Benefits	Cumulative Benefits (NPV)
Base Case	\$1,477	\$32,725
Alternative 1	\$1,134	\$25,126
Alternative 2	\$0	\$0

Notes: Net Present Value based on 2.5% discount rate and 50-year analysis period (2030 to 2079).

NPV = Net Present Value

Analysis Limitations

This analysis provides planning level estimates of the recreational benefits provided by the project alternatives under evaluation. Time and resource constraints made a full cost accounting of potential recreational benefits. Below is a description of some of the limiting factors in this analysis:

- Substitution:** This analysis focuses on net changes of use at the Reservoir. It is possible that some affected users would choose to substitute their recreational trip to other sites in Santa Clara County that provide similar recreational opportunities. For example, Alviso Marina County Park, Coyote Lake Harvey Bear Ranch County Park, Lexington Reservoir County Park, Stevens Creek County Park, and Vasona County Park all provide water-based recreational opportunities and are within 10 to 20 miles from Calero Reservoir. While site substitution is a potential outcome, no data was available to determine if affected users would seek alternative recreation locations inside or outside of Santa Clara County.
- Population:** Santa Clara County and nearby counties are projected to have population increases over the 50-year period of analysis. Increases in population would likely result in increased use of

Calero Reservoir and other nearby sites that provide similar recreational opportunities. These additional potential users were not accounted for in this analysis.

References

Rosenberg. 2016. Recreation Use Values Database – Summary.

Santa Clara Valley Water District (Valley Water). No Date. Calero Dam Seismic Retrofit Project: Administrative Draft EIR, Chapter 3.12, Recreation. Unpublished.



INCOMING BOARD CORRESPONDENCE

Board Correspondence (open)

Correspond No	Rec'd By District	Rec'd By COB	Letter To	Letter From	Description	Disposition	BAO/ Chief	Staff	Draft Response Due Date	Draft Response Submitted	Writer Ack. Sent	Final Response Due Date
BC-26-0043	05/22/26	05/22/26	Varela	SCOTT GEFFRE	Email from Scott, dated 5/22/26, to Director Varela, requesting assistance to review local hydrology for an upcoming development project.	Refer to Staff	Baker	Gurdak Williams	05/30/26	-	n/a	06/05/26

From: [Candice Kwok-Smith](#)
To: [Board of Directors](#)
Subject: FW: 15395 Development Project
Date: Friday, May 22, 2026 2:53:31 PM
Attachments: [Revised Preliminary Technical Report Sycamore Dr 10-02-25 Redacted.pdf](#)

From: sgeffre@gmail.com
Date: May 22, 2026 at 10:07:58 AM PDT
To: John Varela <jvarela@valleywater.org>
Subject: RE: 15395 Development Project

*** This email originated from outside of Valley Water. Do not click links or open attachments unless you recognize the sender and know the content is safe. ***

Hi John,

Thanks again for taking the time to meet with me this morning. Per our conversation, here is a recap of our discussion and what I'm hoping that you can help me with.

1. Under State Senate Bill 330, there has been a proposed development at 15395 Sycamore Drive that consists of 23 new single family homes. The County is conducting an Environmental Impact Review to determine if there are any health and safety issues.
2. The development proposes drilling two new wells and installing a leach field to provide for water and waste management.
3. Many of us in the adjacent properties are struggling with water availability and we are very concerned that this project will have a major impact on the health and safety of the neighborhood by further reducing water supply.
4. The developer has produced a technical hydrology report, which I have attached here. The report discusses water availability at the regional level, and relies on selective historical well data to establish availability of water for the project.

What I'm hoping you can help with is any recent analysis, or a proposed course of action using your organization's expertise that can be taken to provide a more up-to-date and accurate picture of the local hydrology. This will enable the County to make a more informed decision about the potential impact this development would have on our water supplies.

Happy to answer any questions you have, and thanks again for your help.

Best,
Scott

Preliminary Technical Report
Public Water System
for
Sycamore Dr
Morgan Hill, California

Revised October 2, 2025



Prepared By

Questa Engineering Corporation
1220 Brickyard Cove Road, Suite 206
Richmond, California 94807


Norman N. Hantzsch, P.E.

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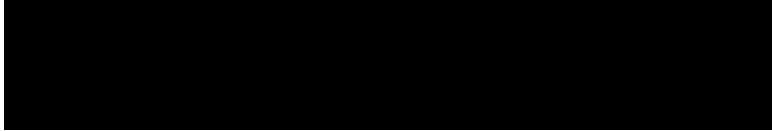
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ATTACHMENTS:

- Attachment A – Preliminary Title Report
- Attachment B - Correspondence with City of Morgan Hill
- Attachment C – Cost Estimation Tables

SECTION 1. APPLICANT GENERAL INFORMATION

Applicant Information



Consultant Information

Name:	Norman Hantzsche, Questa Engineering Corporation
Phone number:	510-236-6114, ext. 214
Email address:	nhantzsche@questaec.com

Property Information

Prior applications:	No prior public water system applications for the property
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Maps and Drawings: (attached)	Figure 1. Project Location Map. Figure 2. Proposed Water System Service Area Map Figure 3. Project Site Plan Figure 4. Water System Schematic Figure 5. Preliminary Water Facilities Layout
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SECTION 2. GENERAL INFORMATION ON PROPOSED WATER SYSTEM

Water System General Information

County:	Santa Clara
Assessor's Parcel No.	773-31-041
Proposed connections:	23 single family residences
No. of people:	80
No. of days water served:	365 days per year
Source of water:	Two new wells
Type of uses served:	Domestic-residential
Surface Water Rights:	No use of surface water; groundwater only (overlying right)
Water Treatment:	No treatment proposed; direct supply of well water

SECTION 3. WATER SYSTEM SUMMARY

Overview

This Preliminary Technical Report presents the plans for a new public water system to serve the proposed Sycamore Drive 23-unit residential housing project to be located on a 5-acre site in unincorporated Santa Clara County adjacent to the City of Morgan Hill (**Figure 1**). An aerial view of the project site and proposed boundaries of the new water system are shown in **Figure 2**. The site falls within the sphere of influence of the City of Morgan Hill but is outside its present urban service limit. Formal request has been made to the City for both water supply and wastewater service. In its response, the City indicated that they are opposed to an out-of-agency request for utility services and that they would require annexation, subject to approval by the City Council and the Santa Clara County Local Agency Formation Commission (LAFCO). However, under a 2016 settlement agreement with LAFCO, the City is legally precluded from considering any annexations until certain environmental studies are completed, for which there is presently no timetable. Copies of correspondence with City of Morgan Hill are included in **Attachment B**.

The surrounding area has also been canvassed to identify all other public water systems within a 3-mile distance of the project site for possible consolidation. As discussed later in this report, there are several other public water systems within 3 miles from the project site; however, for various reasons, none of these offer a reasonable opportunity to provide water service or management assistance to the Sycamore Dr project.

In lieu of obtaining City water service or consolidation with another nearby existing public water system, the project applicant (The Latala Group) plans to form a new public water system and has engaged in discussions with California American Water Company (Cal Am) regarding a transaction to acquire and manage both the water and wastewater facilities for the project. Cal Am is a well-established private water-utility company, currently operating in seven California counties and providing water services to several hundred thousand customers. They come under the regulatory oversight of the California Public Utilities Commission (CPUC)-Water Division (WD) regarding business operations, customer rate structures and ensuring safe, reliable and compliant water facilities and management. They would be the responsible entity for permitting and compliance with the public water system regulatory requirements administered by the State Water Board, Division of Drinking Water (DDW).

Water supply for the project is planned to be supplied by two (redundant) new wells to be located in the southeast corner of the property, estimated 300-ft to 500-ft deep, tapping lenses of alluvium and fractured bedrock at the edge of the Llagas sub-basin. The project development plans and overall layout of the proposed water and onsite wastewater facilities are shown in **Figure 3**. A water system schematic is provided in **Figure 4**. A preliminary water facilities site plan is provided in **Figure 5**, showing proposed locations for wells, storage tanks, and other facilities.

Groundwater Source – Well Water

Regional. The project site lies along the northwest edge of the Llagas Subbasin of the Gilroy-Hollister Valley Groundwater Basin. Ground water in this subbasin occurs generally under unconfined conditions, with some zones of confinement. For characterization and reporting

purposes, the Santa Clara Valley Water District (Valley Water) divides the Subbasin vertically into “Shallow” and “Principal” aquifers. The Shallow Aquifer includes all basin fill materials to a depth of 150 feet below ground surface and the Deep Aquifer consists of all materials at greater depth to the base of the aquifer¹. The groundwater is used extensively for domestic, agricultural and industrial water uses, providing 95 percent of the water supply for the cities of Gilroy and Morgan Hill, unincorporated community of San Martin and other rural residential and uses in the area. The new wells to serve the project are proposed to extend below the “Shallow” aquifer, penetrating the deeper deposits of the “Principal” aquifer or the adjacent fractured bedrock formation along the west side of the Llagas Subbasin.

Local Conditions. The water supply for domestic and agricultural uses on the project site has historically been provided by a shallow well located in the southeast corner of the property. This well will be abandoned, and new deep wells will be installed in the southwest corner of the site to meet the proposed public water supply needs. Research and review was conducted of water well completion reports available from the California Department of Water Resources (DWR)² for several existing wells near the project site; the findings summarized in **Table 1**. Inspection of the boring logs shows most of the wells screened in zones of fractured rocks of the Franciscan Formation, including greenstone, greywacke, shale and undefined lensed of hard rock. It is anticipated that similar conditions will be encountered for new wells to serve the project.

Table 1. Existing Domestic Water Wells in Project Vicinity

Well ID	Proximity to Project Site		Well Depth (feet, bgs)	Static Water Level (feet, bgs)	Estimated Well Yield* (gpm)
	Compass Direction	Distance, feet			
1	NW	500	385	174	60
2	W	400	500	187	57
3	W	800	500	6	15
4	SW	800	200	50	7
5	SW	1,500	665	226	20
6	SW	1,500	600	118	13
7	SW	1,900	885	285	15
8	S	600	396	67	15
9	S	1,400	35	20	3

*From short-term (2-hr to 8-hr) pumping test by well driller at time of well installation.

Project Wells. The project wells will be installed with County Environmental Health approval, and in accordance with State Well Standards and Valley Water District requirements, including a minimum 50-ft annual seal with 3-inch minimum radial thickness. The proposed well locations have been identified to provide: (a) 50-ft radius area around the wells for protection against vandalism; (b) minimum 150-ft horizontal setback from existing onsite wastewater systems serving properties to the south and west of the site; (c) 50-ft setback from sanitary sewer lines; and (d) minimum 150-ft horizontal setback to the proposed wastewater disposal to be located along the eastern boundary of the project site.

¹ Santa Clara Valley Water District. December 2014. *Final Salt and Nutrient Management Plan, Llagas Subbasin*. Todd Groundwater.

²

Well Capacity

The expected production capacity of the two new wells for the property is anticipated to be on the order of 15 to 50 gpm, in line with reported yields for the other existing wells in the project vicinity.

Pumping tests (minimum 72-hr duration) will be conducted to validate the actual yield of the new project wells following installation and well development. The results will be provided in the Final Engineer's Report for the new public water system.

Source Water Quality

Groundwater in the Llagas Subbasin is generally of good quality that does not need normally require treatment for domestic and municipal supplies. Although data for project site and neighboring wells is not available, review of Valley Water information for groundwater in the project vicinity shows no evidence of elevated concentrations of lead, nitrate, perchlorate, TDS, iron, or manganese. Sampling and analysis of well water quality will be conducted for the new Sycamore Dr wells following installation and development to verify conformance with drinking water standard and determine the need for treatment, if any.

Estimated Water Demand

Water demand for the system will consist of domestic water supply for 23 single family residences plus water required for common area landscape irrigation and a small amount of water for utility/maintenance uses. The domestic water demand will typically fluctuate seasonally, with the greatest demand occurring during the summer months due to water use for landscape/garden irrigation and other outside uses. Following Santa Clara County Land Development Standards and Policies Manual - Volume II, Water Systems³, maximum daily residential water demand is estimated at 500 gpd per residence. An additional allowance of 1,000 gpd is included for common area irrigation demand and site maintenance. Overall water demand estimates developed for the proposed water system are:

- Maximum Day Demand (MDD): 12,500 gpd (9 gpm)
- Peak Hour Demand (PHD): 2,400 gallons (1.5 x MDD over 8 hours; 40 gpm)
- Average Daily Demand (annual): 7,500 gpd (60% of maximum day demand)
- Average Pumping Rate (~12 hrs/day) 10 gpm
- Total Annual Water Use: 2.74 million gallons (8.4 acre-ft)

Based on review of the well yields for other private wells in the immediate project vicinity, the proposed new project wells are expected to be able to produce an ample supply of groundwater to meet estimated project demands on a long-term basis.

Water Treatment

No need for water treatment is anticipated, as is the case for nearly all domestic-municipal water systems drawing from the Llagas Subbasin⁴.

³ https://stgenpln.blob.core.windows.net/document/StandardsPoliciesManual_Vol2_Water.pdf

⁴ Santa Clara Valley Water District. 2021 Groundwater Management Plan for the Santa Clara and Llagas

Storage and Distribution

Domestic Water Storage. Water storage capacity of 37,500 gallons will be provided for the domestic supply, sufficient for three (3) days at maximum day demand (12,500 gpd). Preliminary site design includes (2) 26-ft diameter by 20-ft high welded steel tanks with 79,000 gallons capacity each, 158,000 gallons total capacity. The two tanks will be provided to meet both domestic supply needs (37,500 gal) and fire flow storage (105,000 gal), as discussed below.

Fire Flow Storage. Fire flow storage and distribution system will be provided for the project in accordance with Santa Clara County Fire Marshall requirements, County Ordinance and applicable provisions of the California Fire Code. Fire flow requirements are based on type and size of buildings and fire sprinkler provisions. Preliminary assessment and proposed facilities to meet fire flow demand is as follows:

- Building types: One and two-family dwellings, Type V-B construction
- Maximum building fire flow area: 4,045 ft²
- Fire sprinklers: all buildings, type 13D
- Minimum fire flow & duration per building type, size, w/sprinklers: 875 gpm for 1.0 hrs (see Tables B105.1(1) and B105.1(2) California Fire Code)
- Total required fire storage: 875 gpm*60 min = 52,500 gallons
- 200% storage capacity to meet minimum 8-hr refill requirement: 105,000 gallons
- Total fire storage proposed: minimum 105,000 gals (in shared tanks with domestic supply)
- Storage tank dimensions: (2) tanks, 26-ft diameter, 20-ft high = 158,000 gallons capacity

As noted above the domestic and fire flow storage volumes will be supplied by the combined capacity of the two 79,000-gal tanks. The total capacity of 158,000 gallons exceeds the minimum domestic and fire storage needs of 142,500 gallons, allowing for a 12-inch air gap at the top of the tanks and 6 to 12 inches of ineffective storage in the bottom of the tanks.

Water Distribution System. A combined domestic and fire flow distribution system will be provided, consisting of 8-inch diameter main and hydrants and pumping systems having capacity to deliver domestic supply in the range of 40 to 60 psi, with minimum 20 psi residual pressure for fire flow during periods of Maximum Day Demand.

The water system will be compatible with the City of Morgan Hill's adopted design standards to facilitate integration with the City's water infrastructure should that become a possibility in the future. **Table 2** provides a side-by-side comparison of City Water Design Standards and how the proposed Sycamore Dr water system complies with each item.

Subbasins. https://s3.us-west-1.amazonaws.com/valleywater.org.us-west-1/s3fs-public/2021_GWMP.pdf

Table 2. Water System Design Standards Summary

City of Morgan Hill Water Design Standards	Sycamore Dr - Compliance
2.100 General	
• Designed in accordance with accepted engineering principles	Yes
• Conform to current American Water Works Association Standards	Yes, to be included in specifications
• Conform to City of Morgan Hill Details for Construction	Yes, to be included in specifications
• Separation of Water Mains and Sanitary Sewers per latest State Criteria	Yes, shown on plans & required by State DDW
2.200 Vertical Alignment	
• 36" minimum cover on water mains	Yes, shown on plans
• Water main 12" clearance above sanitary sewer at crossings	Yes, shown on plans
2.300 Horizontal Alignment	
• Water mains installed within street rights-of-way & parallel to centerline	Yes, shown on plans
• Min 10' horizontal clearance between water main and sanitary sewer	Yes, shown on plans
• Min 6' horizontal clearance between water main and storm drain	Yes, shown on plans
2.400 Pipe	
• Water mains sized per City's Master Water Plan & Grid system	8" min. water mains shown on plans.
• For lines other than 10" or 8" grid, 6" size line Ok if looped	No 6" lines proposed
• Pipe shall be Ductile Iron Pipe Class 50	Yes, shown on plans
2.500 Water Service	
• 1" minimum water service lines	Yes, 1" service lines proposed
2.600 Fire Hydrants	
• Must be supplied from minimum 8" water line	Yes, min.8" water main shown on plans
• Maximum hose lay of 250 feet in high density residential areas	Yes, shown on plans
• Maximum 500 feet spacing between fire hydrants	Yes, shown on plans
• Fire hydrant within 200 feet of the radius point of cul-de-sacs	Yes, shown on plans
• Per recommended standards of Insurance Services Office & National Fire Code	Yes, to be included in specifications
• Fire flow & hydrant distribution approved by City Engr & Fire Chief	Initial approval will be by County Fire Marshall, followed by City review & approval if/when connected to City water system
2.700 Valves	
• 500-ft maximum spacing	Yes; maximum spacing less than 500 ft
• 3 valves required at "tees"	Yes, required valves shown on plans
• 4 valves required at "crosses"	Yes, required valves shown on plans
• As needed to facilitate future tie-ins and pressure testing of new systems	Yes, required valves shown on plans
2.800 Dead-End Runs	
• No dead-end runs longer than 600 feet	Only dead end is <200 ft
• 8" mains required for dead-end runs which serve fire hydrants	No fire hydrants on dead-end run.
• Reasonable looping of mains required	Yes, project design facilitates looped system

City of Morgan Hill Water Design Standards	Sycamore Dr - Compliance
2.900 Blow Offs	
Required at the end of dead-end runs	Blow-off provided
2.1000 Air Relief Valves	
Shall be installed at high points in distribution system	Yes, air relief valves at high points shown on plans.
2.1100 Thrust Blocks	
Shall conform with City of Morgan Hill Standard Details for Construction	To be incorporated in specifications
2.1200 Water Line Acceptance Test	
Water lines to be pressure tested, disinfected, flushed, and tested for bacteria per City of Morgan Hill Standard Details for Construction prior to final City acceptance	Yes; initial testing will be required per State Standards, and re-tested for City acceptance if/when connected to City water system

SECTION 4. POTENTIAL TO BE SERVED BY AN EXISTING SYSTEM

California Health and Safety Code requires consideration of service from or consolidation with an existing adjacent public water system before establishing any new public water system. Section 116527(c) requires the following be addressed in the Preliminary Technical Report:

“(1) The name and type of each public water system for which any service area boundary is within three miles, as measured through existing public rights-of-way, of any boundary of the applicant's proposed public water system's service area.

(2) A discussion of the feasibility of each of the adjacent community water systems identified pursuant to paragraph (1) annexing, connecting, or otherwise supplying domestic water to the applicant's proposed new public water system's service area. The applicant shall consult with each adjacent community water system in preparing the report and shall include in the report any information provided by each adjacent community water system regarding the feasibility of annexing, connecting, or otherwise supplying domestic water to that service area.

(3) A discussion of all actions taken by the applicant to secure a supply of domestic water from an existing community water system for the proposed new public water system's service area.”

The City of Morgan Hill borders the project site and has a 10-inch water main in Sunnyside Avenue bordering the east side of the property. Outreach has been made to the City by letter; a copy of the letter is provided in **Attachment B**, which briefly describes the project and inquires as to possible interest and ability to provide water service or managerial support. In its response, the City indicated they are opposed to an out-of-agency request for utility services and that they would require annexation, subject to approval by the City Council and the Santa Clara County Local Agency Formation Commission (LAFCO). However, under a 2016 settlement agreement with

LAFCO, the City is legally precluded from considering any annexations until certain environmental studies are completed, for which there is presently no timetable.

In addition to the City of Morgan Hill, a search was made of the State Water Resources Control Board database resources, maps and website links to identify other existing public water systems (PWS) in the project vicinity, and then to determine which existing PWS are within a 3-mile distance of the Sycamore Drive site. In total, 8 PWS are located within 3.0 miles of the project site as summarized in **Table 4**. As indicated, 6 of the 8 nearby PWS are relatively small community or non-community water systems, with service areas/populations not much larger in size than the proposed Sycamore Drive project. It would be impractical to consider any of these existing PWS for consolidation with or service to the proposed Sycamore Drive project. The two water systems with consolidation potential are:

- **City of Morgan Hill.** As discussed, the City of Morgan Hill would be the obvious PWS to provide service to the project but is currently legally restricted from doing so.
- **West San Martin Water Works, Inc.** The West San Martin Water Works (WSMWW) PWS is located 0.7 miles south of the project site along Santa Teresa Blvd. The water system is currently in the process of obtaining approval from the California PUC for acquisition by Cal Am. Discussions with Cal Am indicate that future integration of the Sycamore Drive project into the WSMWW system would not be practical. However, if the pending acquisition goes through, the close proximity would be advantageous for the proposed plan for Cal Am to also acquire and operate the Sycamore Drive water system.

Table 4. Other Public Water Systems in Project Vicinity

Water System I.D.	Name	Type*	Population Served	Water Source	Distance from Project Site
CA4310006	City of Morgan Hill	C	47,374	GW	Adjacent
CA4300543	West San Martin Water Works Inc.	C	1,173	GW	0.7 miles
CA4300542	San Martin County Water District	C	631	GW	2.5 miles
CA4300912	Mecchi Water Company	C	104	GW	2.1 miles
CA4300575	Twin Valley Inc	C	317	GW	1.7 miles
CA4300593	Green Acres Mutual WC	C	53	GW	1.7 miles
CA4300593	Morgan Hill USD Machado School	NTNC	NT – 60	GW	2.0 miles
CA4300602	Economy Inn	NC	Res-2; T – 50	GW	1.9 miles

*NTNC = Non-transient, Non-community; C = Community; NC = Non-community; TNC= Transient, Non-community

SECTION 5. ORGANIZATION AND MANAGEMENT

In lieu of obtaining consolidation and water service from the City of Morgan Hill, the project applicant proposes to form a new public water system and has engaged in discussions with California American Water Company (Cal Am) for ownership, operation and management of both the water and wastewater facilities for the project.

Cal Am is a well-established private water-utility company, currently operating in seven California counties and providing water service to several hundred thousand customers. They come under the regulatory oversight of the California Public Utilities Commission (CPUC)-Water Division (WD) in regard to business operations, customer rate structures and ensuring safe, reliable and compliant water facilities and management. They would be the responsible entity for permitting and compliance with the public water system regulatory requirements administered by the State Water Board, Division of Drinking Water (DDW).

SECTION 6. COST OF PROPOSED NEW PUBLIC WATER SYSTEM

Cost estimates for development, construction and operation and maintenance (O&M) of the proposed new public water system (including fire protection) for Sycamore Drive are summarized below, based on itemized cost estimates provided in **Attachment D**. Cost estimates were developed based on information from a variety of sources, including recent project construction in the S.F. Bay Area, City of Morgan Hill Water System Master Plan (2021), and Valley Water District. Construction cost estimates include a 15% contingency allowance.

Estimated Capital Costs

<u>Category</u>	<u>Estimated Cost</u>
Construction	\$ 1,299,500
Engineering, Admin, Construction Mgt	\$ 389,850
Total Capital Cost	\$ 1,689,350

Estimated Annual Costs

<u>Category</u>	<u>Estimated Annual Cost</u>
O&M & Management	\$ 16,400
Groundwater Pumping Charges	\$ 4,565
Annual Capital Reserve	\$ 20,000
Total Annual Cost	\$ 49,965

Projected Monthly Cost per Connection	\$ 148.42
--	------------------

The annual capital reserve allowance was determined as the amount required for equipment replacement, assigning life cycles ranging from 20 to 30 years for mechanical and electrical equipment, and 40 to 60 years for fixed components such as wells, tanks, and pipelines. O&M and management cost estimates reflect economies of scale derived from: (a) overhead being covered under Cal Am regional management structure; and (b) day-to-day activities for both water and wastewater facilities generally conducted concurrently by the same individual(s). Groundwater

pumping costs are based on current Valley Water pumping charges for projected average annual water demand.

Comparable monthly rates for individual residential water service in the City of Morgan Hill were reviewed and are summarized below for typical water use of 300 gpd per connection (12 ccf per month). The City rates are variable, with an additional volumetric charge based on the level of water usage reduction in the City; i.e., the rate increases when the City-wide water usage decreases. Shown in **Table 4** is a comparison for years 2025-2027 between the projected rates for Sycamore Dr. and the adopted City rates, including the basic City rate and increases corresponding to 10% and 30% water use reduction in the system. As indicated, the projected rates for Sycamore Dr. are considerably higher than the City's current water rates.

Table 4. Water Rate Comparison – Sycamore Dr. and City of Morgan Hill (\$)

Year	Sycamore Drive Projected Ave Monthly Water Rate for 12 CCF*	City of Morgan Hill Example Costs based on Adopted Rates		
		Basic Rate for 12 CCF/month*	With Low (10%) Usage Reduction**	With High (30%) Usage Reduction**
2025	148.42	79.04	84.44	97.28
2026	152.88	84.50	90.38	104.06
2027	157.46	87.06	95.10	109.74

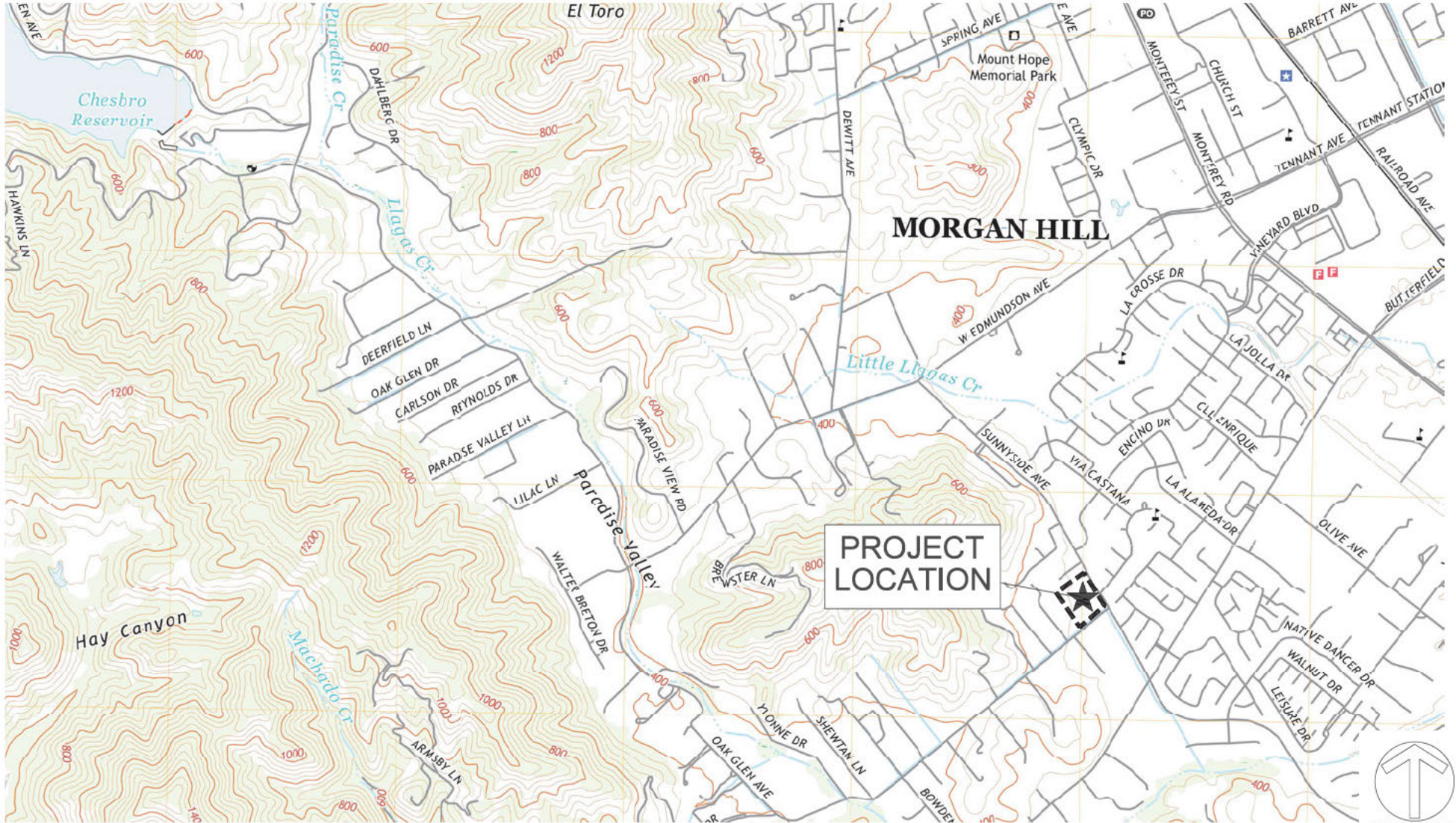
*1 CCF = 748 gals; 12 CCF = 300 gpd

** Per adopted volumetric charge based on City-wide water usage reduction (10% to 30%)

Projected Annual Costs – 20 Year-period

The above annual cost approximates the expected costs for the initial year of operation. Estimated annual costs for future years (extending through year 20) were developed by assuming a yearly 3% increase in O&M, equipment replacement costs and Valley Water groundwater charges to account for inflation. Detailed listing of projected annual costs over 20 years are provided in **Attachment D**. Based on this analysis, annual costs are projected to increase gradually year-to-year from an initial estimated cost of \$49,965 up to approximately \$71,832 in year 20.

Figures



**SYCAMORE DRIVE
WATER & WASTEWATER SYSTEM**
MORGAN HILL, CALIFORNIA

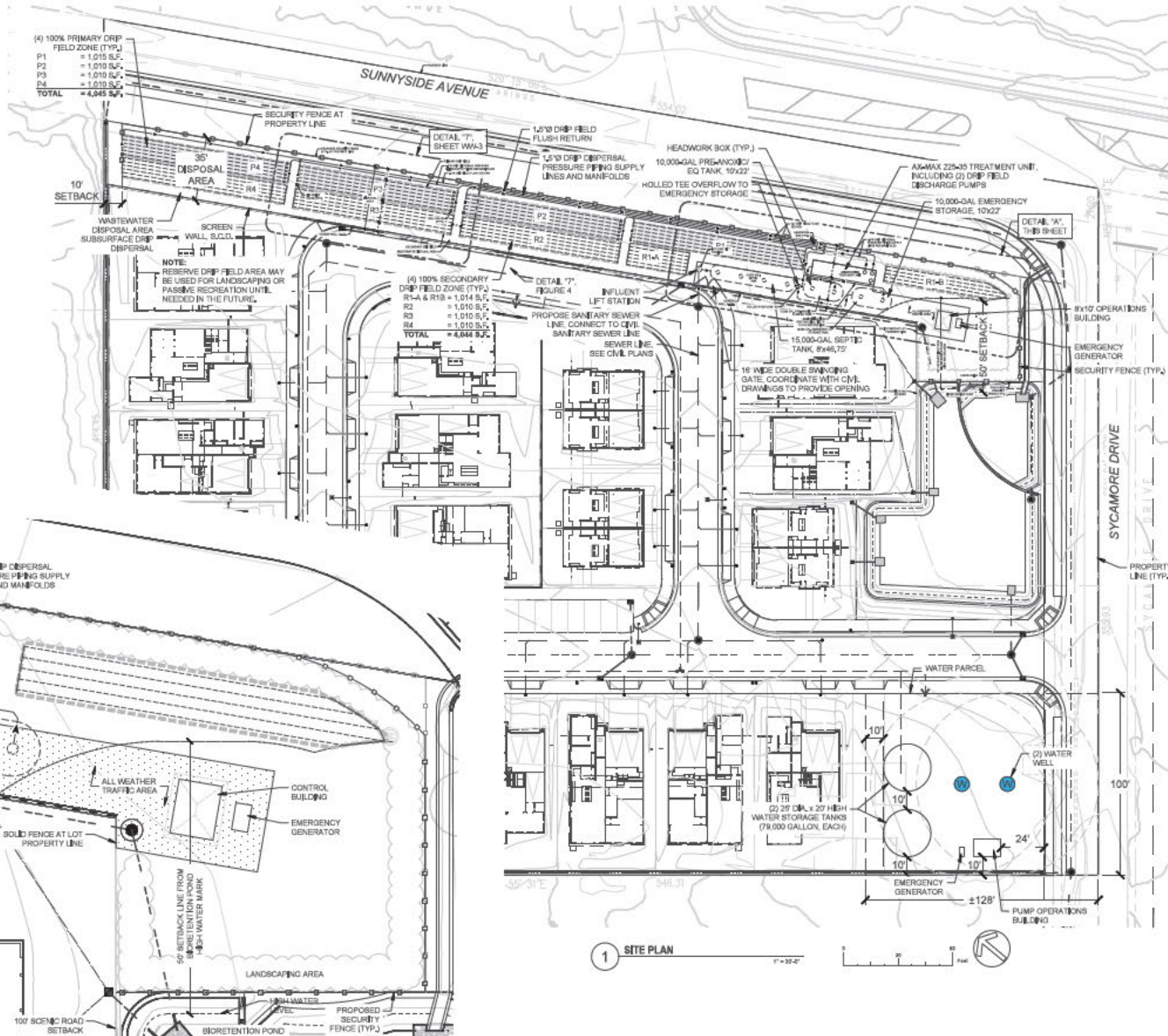
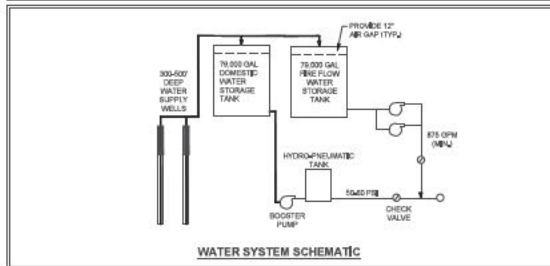
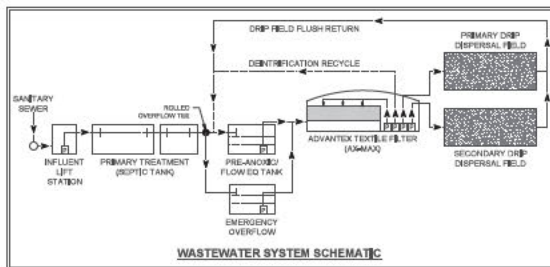
QUESTA
ENGINEERING CORP.
Civil
Environmental
& Water Resources
2153 3344114
FAX 2153 3344123
P.O. Box 70356 1220 Brickyard Cove Road Pleasanton, CA 94507

Rev	Date	By	Description	App'd

Design: NH
Drawn: MN
Checked: NH
App'd: NH

**WATER & WASTEWATER FACILITIES
LOCATION MAP**

**FIGURE
1**



A TREATMENT LAYOUT

**SYCAMORE DRIVE
WATER & WASTEWATER SYSTEM**
MORGAN HILL, CALIFORNIA

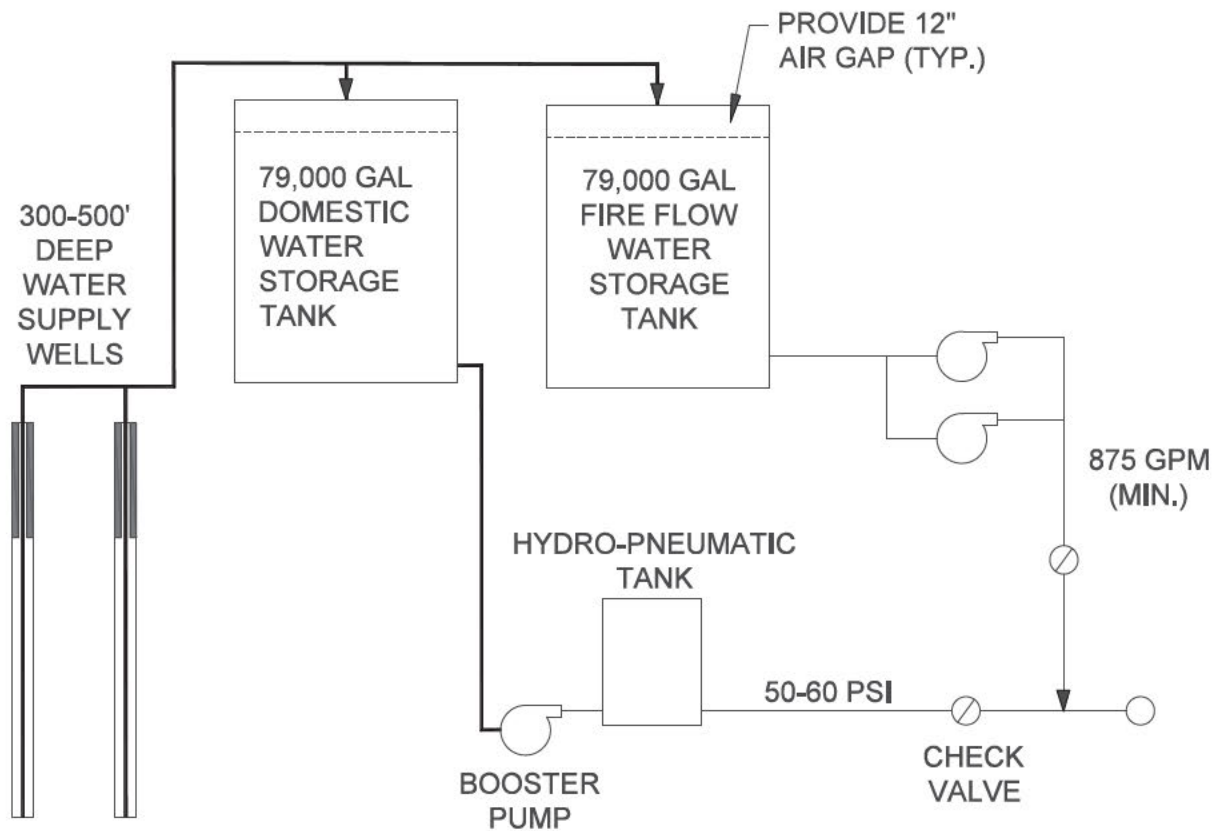
QUESTA
ENGINEERING CORP.
Civil Environmental & Water Resources
310 334-1114
FAX 310 334-0223
QUESTA@QUESTACORP.COM
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Slr	Rev	Date	By	Description	App'd

Design: NH
Drawn: MN
Checked: NH
App'd: NH

**WATER & WASTEWATER FACILITIES
SITE PLAN**

**FIGURE
3**



SYCAMORE DRIVE
WATER & WASTEWATER SYSTEM
MORGAN HILL, CALIFORNIA

QUESTA
ENGINEERING CORP.
Civil
Environmental
& Water Resources
210 334-1114
FAX 210 334-1123
QUESTA@questacorp.com
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

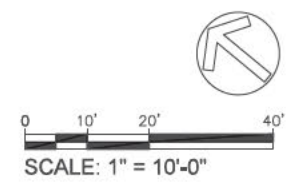
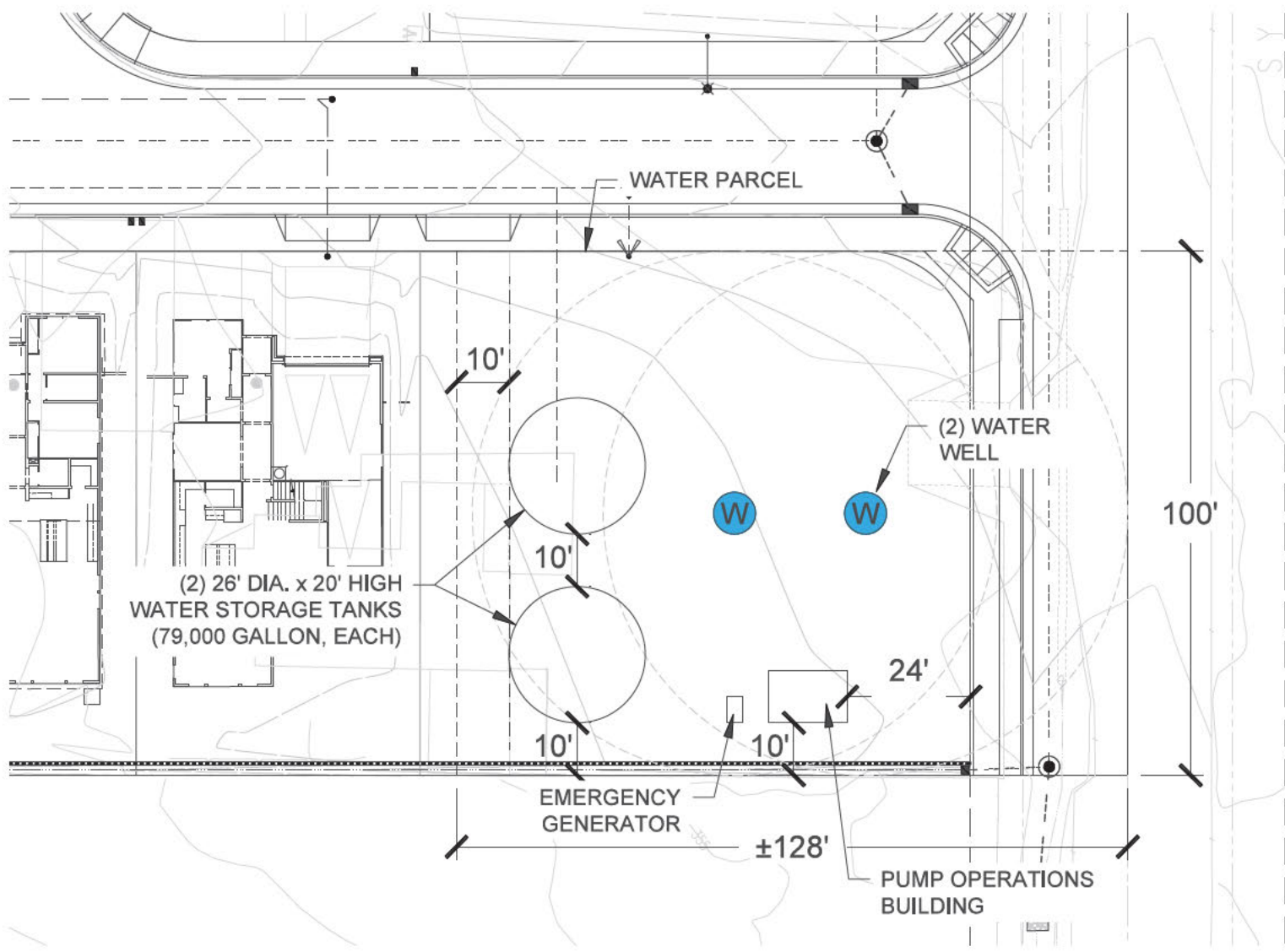
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Checked: NH
App'd: NH

WATER & WASTEWATER FACILITIES
SCHEMATIC PLAN

FIGURE
4

QUESTA ENGINEERING CORP. & WASTEWATER FACILITIES SCHEMATIC PLAN - 10/2/2018



SYCAMORE DRIVE
WATER & WASTEWATER SYSTEM
MORGAN HILL, CALIFORNIA

QUESTA
ENGINEERING CORP.
Civil
Environmental
& Water Resources
210 334-1114
FAX 210 334-1123
QUESTA@QUESTACORP.COM
P.O. Box 70356 1220 Brickyard Cove Road Point Richmond, CA 94807

Rev	Date	By	Description	App'd

Design: NH
Drawn: MN
Checked: NH
App'd: NH

WATER & WASTEWATER FACILITIES
ENLARGEMENT SITE PLAN

FIGURE
5

Attachment A

Property Documentation

EXHIBIT A

The land referred to is situated in the unincorporated area of the County of Santa Clara, State of California, and is described as follows:

PARCEL ONE:

Beginning at a point in the center line of Sycamore Avenue distant thereon North 51° East 141.24 feet from the most Southerly corner of Lot 20, as shown on the Map hereinafter referred to, said point also the most Southerly corner of that certain 4.9 acre parcel of land conveyed by J.W. Van Unen, et ux, to L.J. Fisher, et ux, by Deed dated August 8, 1945 and recorded September 21, 1945 in Book 1282, Official Records, Page 522; thence from said Point of Beginning running along said center line of Sycamore Avenue North 51° East 158.833 feet; thence leaving said center line and running parallel with the Southwesterly line of said 4.9 acre parcel of land North 39° West 548.50 feet to a point in the Northwesterly line of said 4.9 acre parcel; thence along said Northwesterly line South 51° West 158.833 feet to the most Westerly corner of said parcel of land; thence along the Southwesterly line of said 4.9 acre parcel of land so conveyed to Fisher South 39° East 548.50 feet to the Point of Beginning and being a portion of Lot 20 as shown on that certain Map entitled "Map of the Machado Tract in the Rancho San Francisco De Las Llagas", which Map was filed for record in the Office of the Recorder of the County of Santa Clara in Book G of Maps at Page 43.

PARCEL TWO:

Beginning at a point in the center line of Sycamore Avenue distant thereon North 51° East 300.073 feet from the most Southerly corner of Lot 20, as shown on the Map hereinafter referred to, said point of beginning being the most Easterly corner of that certain parcel of land conveyed by L.J. Fisher, et ux, to J.D. Carlton, et ux, by Deed dated March 5, 1947 and recorded March 11, 1947 in Book 1426, Official Records, Page 533; thence from said Point of Beginning along the said center line of Sycamore Avenue North 51° East 217.367 feet to the point of intersection of said center line with the center line of Sunnyside Avenue; thence along the center line of Sunnyside Avenue, being also the Easterly line of said Lot 20, North 29° 15' West 556.64 feet to a point; thence Westerly and parallel with Sycamore Avenue South 51° West 311.67 feet to the most Northerly corner of the said parcel of land so conveyed to Carlton; thence along the Northeasterly line of said parcel of land so conveyed to Carlton South 39° East 548.50 feet to the Point of Beginning and being a portion of Lot 20 as shown on that certain Map entitled "Map of the Machado Tract in the Rancho San Francisco De Las Llagas", which Map was filed for record in the Office of the Recorder of the County of Santa Clara in Book G of Maps at Page 43.

APN: 773-31-041



OLD REPUBLIC
TITLE COMPANY

226 Airport Parkway, Suite 200
San Jose, CA 95110
(408) 557-8400 Fax: (408) 249-2314

PRELIMINARY REPORT

Our Order Number 0616022850-LC



When Replying Please Contact:

Leticia Colon
lcolon@ortc.com
(408) 557-8400
(408) 557-8400

Property Address:

15395 Sycamore Drive, Morgan Hill, CA 95037
[Unincorporated area of Santa Clara County]

In response to the above referenced application for a policy of title insurance, OLD REPUBLIC TITLE COMPANY, as issuing Agent of Old Republic National Title Insurance Company, hereby reports that it is prepared to issue, or cause to be issued, as of the date hereof, a Policy or Policies of Title Insurance describing the land and the estate or interest therein hereinafter set forth, insuring against loss which may be sustained by reason of any defect, lien or encumbrance not shown or referred to as an Exception below or not excluded from coverage pursuant to the printed Schedules, Conditions and Stipulations of said policy forms.

The printed Exceptions and Exclusions from the coverage and Limitations on Covered Risks of said Policy or Policies are set forth in Exhibit I attached. The policy to be issued may contain an arbitration clause. When the Amount of Insurance is less than that set forth in the arbitration clause, all arbitrable matters shall be arbitrated at the option of either the Company or the Insured as the exclusive remedy of the parties. Limitations on Covered Risks applicable to the Homeowner's Policy of Title Insurance which establish a Deductible Amount and a Maximum Dollar Limit of Liability for certain coverages are also set forth in Exhibit I. Copies of the Policy forms should be read. They are available from the office which issued this report.

Please read the exceptions shown or referred to below and the exceptions and exclusions set forth in Exhibit I of this report carefully. The exceptions and exclusions are meant to provide you with notice of matters which are not covered under the terms of the title insurance policy and should be carefully considered.

It is important to note that this preliminary report is not a written representation as to the condition of title and may not list all liens, defects, and encumbrances affecting title to the land.

This report (and any supplements or amendments hereto) is issued solely for the purpose of facilitating the issuance of a policy of title insurance and no liability is assumed hereby. If it is desired that liability be assumed prior to the issuance of a policy of title insurance, a Binder or Commitment should be requested.

Dated as of March 6, 2024, at 7:30 AM

OLD REPUBLIC TITLE COMPANY
For Exceptions Shown or Referred to, See Attached

OLD REPUBLIC TITLE COMPANY
ORDER NO. 0616022850-LC

The form of policy of title insurance contemplated by this report is:

ALTA Homeowner's Policy of Title Insurance - 2021; AND ALTA Loan Policy of Title Insurance - 2021. A specific request should be made if another form or additional coverage is desired.

The estate or interest in the land hereinafter described or referred to by this Report is:

Fee

Title to said estate or interest at the date hereof is vested in:

Richard Della Maggiore, a married man as his sole and separate property

The land referred to in this Report is situated in the unincorporated area of the County of Santa Clara, State of California, and is described as follows:

PARCEL ONE:

Beginning at a point in the center line of Sycamore Avenue distant thereon North 51° East 141.24 feet from the most Southerly corner of Lot 20, as shown on the Map hereinafter referred to, said point also the most Southerly corner of that certain 4.9 acre parcel of land conveyed by J.W. Van Unen, et ux, to L.J. Fisher, et ux, by Deed dated August 8, 1945 and recorded September 21, 1945 in [Book 1282, Official Records, Page 522](#); thence from said Point of Beginning running along said center line of Sycamore Avenue North 51° East 158.833 feet; thence leaving said center line and running parallel with the Southwesterly line of said 4.9 acre parcel of land North 39° West 548.50 feet to a point in the Northwesterly line of said 4.9 acre parcel; thence along said Northwesterly line South 51° West 158.833 feet to the most Westerly corner of said parcel of land; thence along the Southwesterly line of said 4.9 acre parcel of land so conveyed to Fisher South 39° East 548.50 feet to the Point of Beginning and being a portion of Lot 20 as shown on that certain Map entitled "Map of the Machado Tract in the Rancho San Francisco De Las Llagas", which Map was filed for record in the Office of the Recorder of the County of Santa Clara in [Book G of Maps at Page 43](#).

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APN: 773-31-041

OLD REPUBLIC TITLE COMPANY
ORDER NO. 0616022850-LC

At the date hereof exceptions to coverage in addition to the Exceptions and Exclusions in said policy form would be as follows:

1. Taxes and assessments, general and special, for the fiscal year 2024 - 2025, a lien, but not yet due or payable.

2. Taxes and assessments, general and special, for the fiscal year 2023 - 2024, as follows:

Assessor's Parcel No	:	773-31-041	
Code No.	:	087-018	
1st Installment	:	\$8,691.84	Marked Paid
2nd Installment	:	\$8,691.84	NOT Marked Paid
Land Value	:	\$1,400,000.00	
Imp. Value	:	\$110,000.00	

3. The lien of supplemental taxes, if any, assessed pursuant to the provisions of Section 75, et seq., of the Revenue and Taxation Code of the State of California.

4. Any special tax which is now a lien and that may be levied within the Santa Clara County Library District, notice(s) for which having been recorded.

NOTE: Among other things, there are provisions in said notice(s) for a special tax to be levied annually, the amounts of which are to be added to and collected with the property taxes.

NOTE: The current annual amount levied against this land is \$.

NOTE: Further information on said assessment or special tax can be obtained by contacting:

Name	:	Fiscal Agent of the Santa Clara County Library District, Joint Powers Authority
Address	:	14600 Winchester Blvd., Los Gatos, CA 95032
Telephone No.	:	(408) 293-2326, Ext. 3004

OLD REPUBLIC TITLE COMPANY
ORDER NO. 0616022850-LC

5. The herein described property lying within the proposed boundaries of a Community Facilities District, as follows:

District No : 2014-1
For : Clean Energy
Disclosed By : Assessment Map
Recorded : [August 25, 2015 in Book 51 of Official Records, Page 29 under Recorder's Serial Number 23062519](#)

Further information may be obtained by contacting:

County of Santa Clara

6. Rights of the public, County and/or City, in and to that portion of said land lying within the lines of Sunnyside Avenue and Sycamore Drive.

7. NOTE: Information in possession of this Company indicates the possibility of a division of land ownership. If such division is in fact contemplated, the transaction would appear to fall within the purview of the Subdivision Map Act (66410 et seq. Government Code).

As a prerequisite to the Company's participation in land division transactions, compliance with one of the following provisions of the Subdivision Map Act will be required:

- a. The recording of a subdivision map in compliance with statutes or related local ordinances; or
- b. The recording of a parcel map in compliance with statutes or related local ordinances; or
- c. The recording of a Certificate of Compliance, as provided by statute; or
- d. The recording of a waiver as provided by Government Code Section 66428; or
- e. Submission of other satisfactory evidence of compliance with or non-violation of the Act.

NOTE: The requirement that a copy of the tentative or preliminary map be furnished to this company for review.

NOTE: The requirement that a copy of the final map as submitted to the City or County Engineer be furnished to this company for review and preparation of our parcel map or subdivision guarantee.

8. The requirement that this company be provided with a suitable Owner's Declaration from the Seller (form ORT 174). The Company reserves the right to make additional exceptions and/or requirements upon review of the Owner's Declaration.

----- **Informational Notes** -----

- A. We find no open Deeds of Trust. A written statement must be provided by the current owner(s) attesting to whether any outstanding Deeds of Trust exist.
- B. The applicable rate(s) for the policy(s) being offered by this report or commitment appears to be section(s) 1.1 and 2.1.
- C. The above numbered report (including any supplements or amendments thereto) is hereby modified and/or supplemented to reflect the following additional items relating to the issuance of an American Land Title Association loan form policy:

NONE

NOTE: Our investigation has been completed and there is located on said land a single family residence known as 15395 Sycamore Drive, Morgan Hill, CA 95037.

The ALTA loan policy, when issued, will contain the CLTA 100 Endorsement and 116 series Endorsement.

Unless shown elsewhere in the body of this report, there appear of record no transfers or agreements to transfer the land described herein within the last three years prior to the date hereof, except as follows:

NONE

OLD REPUBLIC TITLE COMPANY
ORDER NO. 0616022850-LC

D. NOTE: The last recorded transfer or agreement to transfer the land described herein is as follows:

Instrument
Entitled : Grant Deed
By/From : Paul B. Mehew and Marcella L. Mehew, husband and wife
To : Richard W. Della Maggiore, a married man as his sole and separate property
Recorded : [December 29, 2000 in Official Records under Recorder's Serial Number 15512442](#)

Grant Deed executed by Richard Della Maggiore, a married man who acquired title as Richard W. Della Maggiore, a married man to Richard Della Maggiore, a married man as his sole and separate property recorded [May 2, 2003 in Official Records under Recorder's Serial Number 17008259](#).

NOTE:

The following statement is deemed attached as a coversheet to any declaration, governing document, or deed identified in the above exceptions:

If this document contains any restriction based on age, race, color, religion, sex, gender, gender identity, gender expression, sexual orientation, familial status, marital status, disability, veteran or military status, genetic information, national origin, source of income as defined in subdivision (p) of Section 12955, or ancestry, that restriction violates state and federal fair housing laws and is void, and may be removed pursuant to Section 12956.2 of the Government Code by submitting a “Restrictive Covenant Modification” form, together with a copy of the attached document with the unlawful provision redacted to the county recorder’s office. The “Restrictive Covenant Modification” form can be obtained from the county recorder’s office and may be available on its internet website. The form may also be available from the party that provided you with this document. Lawful restrictions under state and federal law on the age of occupants in senior housing or housing for older persons shall not be construed as restrictions based on familial status.

Information for processing a “Restrictive Covenant Modification” form:

1. Print a complete copy of the document in question. Strike out what you believe to be unlawful restrictive language in the document.
2. Print and complete the “Restrictive Covenant Modification” (“RCM”) form. Note that the signature on the form must be acknowledged by a notary public or other qualified officer.
3. Submit the completed RCM form and the document with your strike-outs to the County Clerk-Recorder’s Office for the county where the property is located. No fee is required for this service.
4. The County Clerk-Recorder’s Office will forward the RCM form and the document with your strike-outs to the Office of the County Counsel, who will determine whether the document contains any unlawful restrictions.
5. The Office of the County Counsel will return the RCM form and the document with your strike-outs to the County Clerk-Recorder’s Office along with its determination. If approved, a Deputy County Counsel will sign the RCM, and the County Clerk-Recorder’s Office will record, image and index it. If the Office of the County Counsel determines that the document does not contain an unlawful restriction, the County Clerk-Recorder’s Office will not record the RCM.
6. The approved RCM will be returned to the submitter by mail.

The “Restrictive Covenant Modification” form is linked below:

[Restrictive Covenant Modification form](#)

Exhibit I

CLTA HOMEOWNER'S POLICY OF TITLE INSURANCE – 2021
ALTA HOMEOWNER'S POLICY OF TITLE INSURANCE – 2021

EXCLUSIONS FROM COVERAGE

The following matters are excluded from the coverage of this policy and We will not pay loss or damage, costs, attorneys' fees, or expenses that arise by reason of:

1. a. any law, ordinance, permit, or governmental regulation (including those relating to building and zoning) that restricts, regulates, prohibits, or relates to:
 - i. the occupancy, use, or enjoyment of the Land;
 - ii. the character, dimensions, or location of any improvement on the Land;
 - iii. the subdivision of land; or
 - iv. environmental remediation or protection.
- b. any governmental forfeiture, police, or regulatory, or national security power.
- c. the effect of a violation or enforcement of any matter excluded under Exclusion 1.a. or 1.b.
Exclusion 1 does not modify or limit the coverage provided under Covered Risk 8.a., 14, 15, 16, 18, 19, 20, 23, or 27.
2. Any power to take the Land by condemnation. Exclusion 2 does not modify or limit the coverage provided under Covered Risk 17.
3. Any defect, lien, encumbrance, adverse claim, or other matter:
 - a. created, suffered, assumed, or agreed to by You;
 - b. not Known to Us, not recorded in the Public Records at the Date of Policy, but Known to You and not disclosed in writing to Us by You prior to the date You became an Insured under this policy;
 - c. resulting in no loss or damage to You;
 - d. attaching or created subsequent to the Date of Policy (Exclusion 3.d. does not modify or limit the coverage provided under Covered Risk 5, 8.f., 25, 26, 27, 28, or 32); or
 - e. resulting in loss or damage that would not have been sustained if You paid consideration sufficient to qualify You as a bona fide purchaser of the Title at the Date of Policy.
4. Lack of a right:
 - a. to any land outside the area specifically described and referred to in Item 3 of Schedule A; and
 - b. in any street, road, avenue, alley, lane, right-of-way, body of water, or waterway that abut the Land.Exclusion 4 does not modify or limit the coverage provided under Covered Risk 11 or 21.
5. The failure of Your existing structures, or any portion of Your existing structures, to have been constructed before, on, or after the Date of Policy in accordance with applicable building codes. Exclusion 5 does not modify or limit the coverage provided under Covered Risk 14 or 15.
6. Any claim, by reason of the operation of federal bankruptcy, state insolvency, or similar creditors' rights law, that the transfer of the Title to You is a:
 - a. fraudulent conveyance or fraudulent transfer;
 - b. voidable transfer under the Uniform Voidable Transactions Act; or
 - c. preferential transfer:
 - i. to the extent the instrument of transfer vesting the Title as shown in Schedule A is not a transfer made as a contemporaneous exchange for new value; or
 - ii. for any other reason not stated in Covered Risk 30.
7. Contamination, explosion, fire, flooding, vibration, fracturing, earthquake, or subsidence.
8. Negligence by a person or an entity exercising a right to extract or develop oil, gas, minerals, groundwater, or any other subsurface substance.
9. Any lien on Your Title for real estate taxes or assessments imposed or collected by a governmental authority that becomes due and payable after the Date of Policy. Exclusion 9 does not modify or limit the coverage provided under Covered Risk 8.a. or 27.
10. Any discrepancy in the quantity of the area, square footage, or acreage of the Land or of any improvement to the Land.

Exhibit I

CLTA HOMEOWNER'S POLICY OF TITLE INSURANCE – 2021
ALTA HOMEOWNER'S POLICY OF TITLE INSURANCE – 2021
(Continued)

LIMITATIONS ON COVERED RISKS

Your insurance for the following Covered Risks is limited on the Owner's Coverage Statement as follows:

- For Covered Risk 16, 18, 19, and 21 Your Deductible Amount and Our Maximum Dollar Limit of Liability shown in Schedule A.

Deductible Amounts and Maximum Dollar Limits of Liability for Covered Risks 16, 18, 19, and 21:

	<u>Your Deductible Amount</u>	<u>Our Maximum Dollar Limit of Liability</u>
Covered Risk 16:	1.00% of Policy Amount Shown in Schedule A or \$5,000.00 (whichever is less)	\$25,000.00
Covered Risk 18:	1.00% of Policy Amount Shown in Schedule A or \$5,000.00 (whichever is less)	\$25,000.00
Covered Risk 19:	1.00% of Policy Amount Shown in Schedule A or \$5,000.00 (whichever is less)	\$25,000.00
Covered Risk 21:	1.00% of Policy Amount Shown in Schedule A or \$5,000.00 (whichever is less)	\$25,000.00

**AMERICAN LAND TITLE ASSOCIATION
LOAN POLICY OF TITLE INSURANCE – 2021**

EXCLUSIONS FROM COVERAGE

The following matters are excluded from the coverage of this policy, and the Company will not pay loss or damage, costs, attorneys' fees, or expenses that arise by reason of:

1. a. any law, ordinance, permit, or governmental regulation (including those relating to building and zoning) that restricts, regulates, prohibits, or relates to:
 - i. the occupancy, use, or enjoyment of the Land;
 - ii. the character, dimensions, or location of any improvement on the Land;
 - iii. the subdivision of land; or
 - iv. environmental remediation or protection.
- b. any governmental forfeiture, police, regulatory, or national security power.
- c. the effect of a violation or enforcement of any matter excluded under Exclusion 1.a. or 1.b.
Exclusion 1 does not modify or limit the coverage provided under Covered Risk 5 or 6.
2. Any power of eminent domain. Exclusion 2 does not modify or limit the coverage provided under Covered Risk 7.
3. Any defect, lien, encumbrance, adverse claim, or other matter:
 - a. created, suffered, assumed, or agreed to by the Insured Claimant;
 - b. not Known to the Company, not recorded in the Public Records at the Date of Policy, but Known to the Insured Claimant and not disclosed in writing to the Company by the Insured Claimant prior to the date the Insured Claimant became an Insured under this policy;
 - c. resulting in no loss or damage to the Insured Claimant;
 - d. attaching or created subsequent to the Date of Policy (Exclusion 3.d. does not modify or limit the coverage provided under Covered Risk 11, 13, or 14); or
 - e. resulting in loss or damage that would not have been sustained if consideration sufficient to qualify the Insured named in Schedule A as a bona fide purchaser or encumbrancer had been given for the Insured Mortgage at the Date of Policy.
4. Unenforceability of the lien of the Insured Mortgage because of the inability or failure of an Insured to comply with applicable doing-business law.
5. Invalidity or unenforceability of the lien of the Insured Mortgage that arises out of the transaction evidenced by the Insured Mortgage and is based upon usury law or Consumer Protection Law.
6. Any claim, by reason of the operation of federal bankruptcy, state insolvency, or similar creditors' rights law, that the transaction creating the lien of the Insured Mortgage is a:
 - a. fraudulent conveyance or fraudulent transfer;
 - b. voidable transfer under the Uniform Voidable Transactions Act; or
 - c. preferential transfer:
 - i. to the extent the Insured Mortgage is not a transfer made as a contemporaneous exchange for new value; or
 - ii. for any other reason not stated in Covered Risk 13.b.
7. Any claim of a PACA-PSA Trust. Exclusion 7 does not modify or limit the coverage provided under Covered Risk 8.
8. Any lien on the Title for real estate taxes or assessments imposed by a governmental authority and created or attaching between the Date of Policy and the date of recording of the Insured Mortgage in the Public Records. Exclusion 8 does not modify or limit the coverage provided under Covered Risk 2.b. or 11.b.
9. Any discrepancy in the quantity of the area, square footage, or acreage of the Land or of any improvement to the Land.

**AMERICAN LAND TITLE ASSOCIATION
LOAN POLICY OF TITLE INSURANCE – 2021
(Continued)**

EXCEPTIONS FROM COVERAGE

Some historical land records contain Discriminatory Covenants that are illegal and unenforceable by law. This policy treats any Discriminatory Covenant in a document referenced in Schedule B as if each Discriminatory Covenant is redacted, repudiated, removed, and not republished or recirculated. Only the remaining provisions of the document are excepted from coverage.

This policy does not insure against loss or damage and the Company will not pay costs, attorneys' fees, or expenses resulting from the terms and conditions of any lease or easement identified in Schedule A, and the following matters:

NOTE: The 2021 ALTA Loan Policy may be issued to afford either Standard Coverage or Extended Coverage. In addition to variable exceptions such as taxes, easements, CC&R's, etc., the Exceptions from Coverage in a Standard Coverage policy will also include the Western Regional Standard Coverage Exceptions listed as 1 through 7 below:

1. (a) Taxes or assessments that are not shown as existing liens by the records of any taxing authority that levies taxes or assessments on real property or by the Public Records; (b) proceedings by a public agency that may result in taxes or assessments, or notices of such proceedings, whether or not shown by the records of such agency or by the Public Records.
2. Any facts, rights, interests, or claims that are not shown by the Public Records at Date of Policy but that could be (a) ascertained by an inspection of the Land, or (b) asserted by persons or parties in possession of the Land.
3. Easements, liens or encumbrances, or claims thereof, not shown by the Public Records at Date of Policy.
4. Any encroachment, encumbrance, violation, variation, easement, or adverse circumstance affecting the Title that would be disclosed by an accurate and complete land survey of the Land and not shown by the Public Records at Date of Policy.
5. (a) Unpatented mining claims; (b) reservations or exceptions in patents or in Acts authorizing the issuance thereof; (c) water rights, claims or title to water, whether or not the matters excepted under (a), (b), or (c) are shown by the Public Records.
6. Any lien or right to a lien for services, labor, material or equipment unless such lien is shown by the Public Records at Date of Policy.
7. Any claim to (a) ownership of or rights to minerals and similar substances, including but not limited to ores, metals, coal, lignite, oil, gas, uranium, clay, rock, sand, and gravel located in, on, or under the Land or produced from the Land, whether such ownership or rights arise by lease, grant, exception, conveyance, reservation, or otherwise; and (b) any rights, privileges, immunities, rights of way, and easements associated therewith or appurtenant thereto, whether or not the interests or rights excepted in (a) or (b) appear in the Public Records or are shown in Schedule B.

 OLD REPUBLIC TITLE	
FACTS	WHAT DOES OLD REPUBLIC TITLE DO WITH YOUR PERSONAL INFORMATION?

Why?	Financial companies choose how they share your personal information. Federal law gives consumers the right to limit some but not all sharing. Federal law also requires us to tell you how we collect, share, and protect your personal information. Please read this notice carefully to understand what we do.
What?	The types of personal information we collect and share depend on the product or service you have with us. This information can include: • Social Security number and employment information • Mortgage rates and payments and account balances • Checking account information and wire transfer instructions When you are <i>no longer</i> our customer, we continue to share your information as described in this notice.
How?	All financial companies need to share customers’ personal information to run their everyday business. In the section below, we list the reasons financial companies can share their customers’ personal information; the reasons Old Republic Title chooses to share; and whether you can limit this sharing.

Reasons we can share your personal information	Does Old Republic Title share?	Can you limit this sharing?
For our everyday business purposes — such as to process your transactions, maintain your account(s), or respond to court orders and legal investigations, or report to credit bureaus	Yes	No
For our marketing purposes — to offer our products and services to you	No	We don’t share
For joint marketing with other financial companies	No	We don’t share
For our affiliates’ everyday business purposes — information about your transactions and experiences	Yes	No
For our affiliates’ everyday business purposes — information about your creditworthiness	No	We don’t share
For our affiliates to market to you	No	We don’t share
For non-affiliates to market to you	No	We don’t share

	Go to www.oldrepublictitle.com (Contact Us)
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Who we are

Who is providing this notice?	Companies with an Old Republic Title name and other affiliates. Please see below for a list of affiliates.
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What we do

How does Old Republic Title protect my personal information?	To protect your personal information from unauthorized access and use, we use security measures that comply with federal law. These measures include computer safeguards and secured files and buildings. For more information, visit https://www.oldrepublictitle.com/privacy-policy
How does Old Republic Title collect my personal information?	We collect your personal information, for example, when you: • Give us your contact information or show your driver's license • Show your government-issued ID or provide your mortgage information • Make a wire transfer We also collect your personal information from others, such as credit bureaus, affiliates, or other companies.
Why can't I limit all sharing?	Federal law gives you the right to limit only: • Sharing for affiliates' everyday business purposes - information about your creditworthiness • Affiliates from using your information to market to you • Sharing for non-affiliates to market to you State laws and individual companies may give you additional rights to limit sharing. See the State Privacy Rights section location at https://www.oldrepublictitle.com/privacy-policy for your rights under state law.

Definitions

Affiliates	Companies related by common ownership or control. They can be financial and nonfinancial companies. • Our affiliates include companies with an Old Republic Title name, and financial companies such as Attorneys' Title Fund Services, LLC, Lex Terrae National Title Services, Inc., and Mississippi Valley Title Services Company
Non-affiliates	Companies not related by common ownership or control. They can be financial and non-financial companies. • Old Republic Title does not share with non-affiliates so they can market to you
Joint marketing	A formal agreement between non-affiliated financial companies that together market financial products or services to you. • Old Republic Title doesn't jointly market.

Affiliates Who May be Delivering This Notice

American First Title & Trust Company	American Guaranty Title Insurance Company	Attorneys' Title Fund Services, LLC	Compass Abstract, Inc.	eRecording Partners Network, LLC
Genesis Abstract, LLC	Guardian Consumer Services, Inc.	iMarc, Inc.	L.T. Service Corp.	Lenders Inspection Company
Lex Terrae National Title Services, Inc.	Lex Terrae, Ltd.	Mississippi Valley Title Services Company	Old Republic Branch Information Services, Inc.	Old Republic Diversified Services, Inc.
Old Republic Escrow of Vancouver, Inc.	Old Republic Exchange Company	Old Republic National Ancillary Services, Inc.	Old Republic Title and Escrow of Hawaii, Ltd.	Old Republic National Title Insurance Company
Old Republic Title Company	Old Republic Title Company of Conroe	Old Republic Title Company of Nevada	Old Republic Title Company of Oklahoma	Old Republic Title Company of Oregon
Old Republic Title Company of St. Louis	Old Republic Title Information Concepts	Old Republic Title Insurance Agency, Inc.	Old Republic Title, Ltd.	RamQuest Software, Inc.
Republic Abstract & Settlement, LLC	Sentry Abstract Company	Surety Title Agency, Inc.	Trident Land Transfer Company, LLC	

Updated: January 1, 2024

Privacy Notice for California Consumers

This Privacy Notice for California Consumers supplements the information contained in the Master Privacy Notice for Old Republic Title and applies to consumers that reside in the State of California. The terms used in this Privacy Notice have the same meaning as the terms defined in the California Consumer Privacy Act ("CCPA").

What Personal Information We Collect

In accordance with the CCPA, personal information is information that identifies, relates to, describes, is capable of being associated with, or could reasonably be linked, directly or indirectly, with a particular consumer or household. Personal information does not include:

Information outside the scope of the CCPA such as:

- Health or medical information covered by the Health Insurance Portability Act of 1996 (HIPAA) and the California Confidentiality of Medical Information Act (CMIA).
- Personal Information covered by the Gramm-Leach-Bliley Act (GLBA), the Fair Credit Reporting Act (FCRA), the California Financial Information Privacy Act (FIPA), and the Driver's Privacy Protection Act of 1994,
- Publicly available information or lawfully obtained, truthful information that is a matter of public concern, and
- De-identified or aggregated consumer information.

Please see the chart below to learn what categories of personal information we may have collected about California consumers within the preceding twelve months, the sources of and business purposes for that collection and the third parties to whom the information has been disclosed, if any.

Category	Examples	Sources	Business Purpose for Collection	Categories of Third Parties with Whom Information is Shared
Identifiers	Real name, alias, postal address, unique personal identifier, online	Consumers, Lenders, Brokers, Attorneys, Real Estate Agents, and	Underwriting or providing other products or services, responding to policyholder/consumer claims, inquiries or	Service providers associated with the transaction for a business

	identifier, Internet protocol address, email address, account name, social security number, driver's license number, passport number or other similar identifiers Social security number, driver's license number, passport number are collected	Title Agents associated with the transaction	complaints, detecting security incidents, protecting against malicious, deceptive, fraudulent, or illegal activity. Other audit or operational purposes.	purpose
Personal information described in California Customer Records statute (Cal. Civ. Code § 1798.80(e))	Name, signature, social security number, physical characteristics or description, address, telephone number, passport number, driver's license or state identification card number, insurance policy number, education, employment, employment history, bank account number, credit card number, debit card	Consumers, Lenders, Brokers, Attorneys, Real Estate Agents, and Title Agents associated with the transaction	Underwriting or providing other products or services, responding to policyholder/consumer claims, inquiries or complaints, detecting security incidents, protecting against malicious, deceptive, fraudulent, or illegal activity. Other audit or operational purposes.	Service providers associated with the transaction for a business purpose

	number, or any other financial information, medical information, or health insurance information. "Personal information" does not include publicly available information that is lawfully made available to the general public from federal, state, or local government records. Social security number, driver's license number or state identification card number, passport number, bank account number, citizenship, immigration status are collected			
Characteristics of protected classifications under California or federal law	Age (40 years or older), race, color, ancestry, national origin, citizenship, religions or creed, marital	Consumers, Lenders, Brokers, Attorneys, Real Estate Agents, and Title Agents	Underwriting or providing other products or services, responding to policyholder/consumer claims, inquiries or complaints. Other	Service providers associated with the transaction for a business purpose

	status, medical condition, physical or mental disability, sex (including gender, gender identity, gender expression, pregnancy or childbirth and related medical conditions), sexual orientation, veteran or military status, or genetic information (including familial genetic information). Marital status, sex, physical disability, citizenship is collected	associated with the transaction	audit or operational purposes.	
Internet or other electronic network activity	Browsing history, search history, information about a consumer's interaction with a website, application, or advertisement.	Consumers, Lenders, Brokers, Attorneys, Real Estate Agents, and Title Agents associated with the transaction	To provide access to certain online services. To understand the interests of visitors to our online services, to support certain features of our site, for navigation and to display certain features more effectively. Detecting security incidents,	Not Disclosed

			protecting against malicious, deceptive, fraudulent, or illegal activity. Other audit or operational purposes.	
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What Personal Information We Disclose and Why We Disclose It

The CCPA requires us to tell you what categories of personal information we “sell”, “share” or “disclose.” We do not sell and will not sell your personal information as that term is commonly understood. We also do not sell and will not sell your personal information, including the personal information of persons under 16 years of age, as that term is defined by the CCPA. We do not share your personal information as that term is defined in the CCPA. When it is necessary for a business purpose, we may disclose your personal information with a service provider or contractor, and we enter into a contract with the service provider or contractor that limits how the information may be used and requires the service provider to protect the confidentiality of the information.

In the preceding twelve months, we have disclosed the following categories of personal information for the following business purposes. Where the personal information is shared with third parties, as that term is defined in the CCPA, the category of the third party is indicated.

Category	Examples	Business Purpose for Disclosure	Categories of Third Parties with Whom Information is Shared
Identifiers (Including social security number, driver's license number,	Real name, alias, postal address, unique personal identifier, online identifier, internet protocol address, email address, account name, social security number, driver's license number, passport number or other similar identifiers	Underwriting or providing other products or services, responding to policyholder/consumer claims, inquiries or complaints, detecting security incidents, protecting against	Service providers associated with the transaction for a business purpose

and passport number)		malicious, deceptive, fraudulent, or illegal activity. Other audit or operational purposes.	
Personal information described in California Customer Records statute (Cal. Civ. Code § 1798.80(e)) (Including Social security number, driver's license number or state identification card number, passport number, bank account number, citizenship, and immigration status)	Name, signature, social security number, physical characteristics or description, address, telephone number, passport number, driver's license or state identification card number, insurance policy number, education, employment, employment history, bank account number, credit card number, debit card number, or any other financial information, medical information, or health insurance information. "Personal information" does not include publicly available information that is lawfully made available to the general public from federal, state, or local government records.	Underwriting or providing other products or services, responding to policyholder/consumer claims, inquiries or complaints, detecting security incidents, protecting against malicious, deceptive, fraudulent, or illegal activity. Other audit or operational purposes.	Service providers associated with the transaction for a business purpose
Characteristics of protected classifications under California or federal law (Including marital status, sex, citizenship, and physical disability)	Age (40 years or older), race, color, ancestry, national origin, citizenship, religions or creed, marital status, medical condition, physical or mental disability, sex (including gender, gender identity, gender expression, pregnancy or childbirth and related medical conditions), sexual orientation, veteran or military status, or genetic information (including familial genetic information).	Underwriting or providing other products or services, responding to policyholder/consumer claims, inquiries or complaints. Other audit or operational purposes.	Service providers associated with the transaction for a business purpose
Internet or other electronic	Browsing history, search history, information about a consumer's interaction with a	To provide access to certain online services. To	Not Disclosed

network activity	website, application, or advertisement.	understand the interests of visitors to our online services, to support certain features of our site, for navigation and to display certain features more effectively. Detecting security incidents, protecting against malicious, deceptive, fraudulent, or illegal activity. Other audit or operational purposes.	
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We may also transfer to a third party the personal information of a consumer as an asset that is part of a merger, acquisition, bankruptcy, or other transaction in which the third party assumes control of all or part of the business.

Our Retention of Your Personal Information

The length of time that we retain personal information largely depends upon the purpose for which the information was collected rather than the category of the information as set forth in this Notice. When establishing retention periods, we consider applicable statutes of limitation and legal and regulatory requirements and guidelines. Personal information is generally retained for periods of time that permit the company to meet its legal and regulatory obligations.

Your Rights and Choices

The CCPA provides California consumers with certain rights regarding their personal information. This chart describes those rights and certain limitations to those rights.

Right	What This Means
Notice	At or before the time your personal information is collected, you will be given written notice of the categories of personal information to be collected, the purposes for which the categories of personal information will be used, and whether that information is sold or shared.
Access	At your verifiable request, but no more than twice in a twelve month period, we shall disclose to you: 1) the categories of personal information we have collected about you, 2) the categories of sources for the personal information we collected about you, 3) our business or commercial purpose for collecting, selling or sharing your personal information, 4) the categories of third parties to whom we disclose your personal information, 5) the specific pieces of information we have collected about you, 6) the categories of personal

	information disclosed about you for a business purpose and the categories of persons to whom your personal information was disclosed for a business purpose, and 7) if we sold or shared personal information, the categories of personal information sold or shared and the categories of third parties to whom it was sold or shared.
Deletion	You have the right to request that we delete any of your personal information that we collected from you, subject to certain exceptions. Once we receive and verify your request, we will delete (and direct our service providers and contractors to delete) your personal information from our records unless an exception applies. We may deny your request if retention of the information is necessary for us or our service providers to: • Complete the transaction for which we collected the personal information, provide a good or service that you requested, take actions reasonably anticipated within the context of our ongoing business relationship with you, or otherwise perform our contract with you. • Help to ensure security and integrity to the extent the use of your personal information is reasonably necessary and proportionate to that purpose. Debug to identify and repair errors that impair existing intended functionality. • Exercise free speech, ensure the right of another consumer to exercise their free speech rights, or exercise another right provided for by law. • Comply with the California Electronic Communications Privacy Act (Cal. Penal Code §1546 et seq.) • Engage in public or peer reviewed scientific, historical, or statistical research that conforms or adheres to all other applicable ethics and privacy laws, when the information's deletion is likely to render impossible or seriously impair the research's completion, if you previously provided informed consent. • Enable solely internal uses that are reasonably aligned with consumer expectations based on your relationship with us and compatible with the context in which you provided the information. • Comply with a legal obligation. • Or if it is the type of personal information that falls outside the scope of the CCPA, (HIPAA, CIMA, GLBA, or publicly available information)
Correct	You have the right to request that we correct inaccurate personal information about you, taking into account the nature of the personal information and the purposes of the processing of the personal information. After we receive and verify your request, we will use commercially reasonable efforts to correct the inaccurate personal information as directed by you.
Opt-Out of Sale or Sharing	With some limitations, you may direct a business that sells or shares personal information to third parties not to sell or share the personal information to these third parties. A business may not sell or share the personal information of persons less than sixteen years of age without their affirmative consent, and in the case of those less than thirteen years of age, the consent must come from a parent.

Opt-In to Sale or Sharing	
Limit Use of Sensitive Personal Information	You may direct a business to limit the use of your sensitive personal information to that use which is necessary to perform the services or provide the goods reasonably expected by an average consumer who requests those goods or services and certain other limited uses as described in the CCPA and applicable regulations.
Non-Discrimination	We will not discriminate against you for exercising your rights under the CCPA. Unless otherwise permitted by the CCPA we will not: • Deny you goods or service • Charge you different prices or rates for goods or services, including through granting discounts or other benefits, or imposing penalties • Provide a different level or quality of goods or services • Suggest that you will receive a different price or rate for goods or services or a different level or quality of goods or services

To Exercise Your Rights

To Opt-out of the Sale or Sharing of Your Personal Information

The CCPA gives consumers the right to direct a business that sells or shares personal information about the consumer to third parties not to sell or share the consumer's personal information. We do not sell and will not sell your personal information as that term is commonly understood. We also do not sell and will not sell your personal information, as that term is defined by the CCPA. We do not share your personal information as that term is defined in the CCPA.

To Limit the Use of Sensitive Personal Information

The CCPA gives consumers the right to direct a business to limit the use of the consumer's sensitive personal information to that use which is necessary to perform the services or provide the goods reasonably expected by an average consumer who requests those goods or services and certain other limited uses as described in the CCPA and applicable regulations. We do not use or disclose sensitive personal information for purposes other than those purposes specified in Section 7027, subsection (m) of the California Consumer Privacy Act Regulations. If we begin using or disclosing your sensitive personal information outside of those purposes, then we will provide you with the option to limit our use or disclosure through a clear and conspicuous link on our internet homepage.

To Request Access to, Correction or Deletion of Your Personal Information

To exercise your access, correction or deletion rights described above, please submit a verifiable consumer request to us by either: Calling us at 1-855-557-8437 or contacting us through our website <https://ccpa.oldrepublictitle.com> .

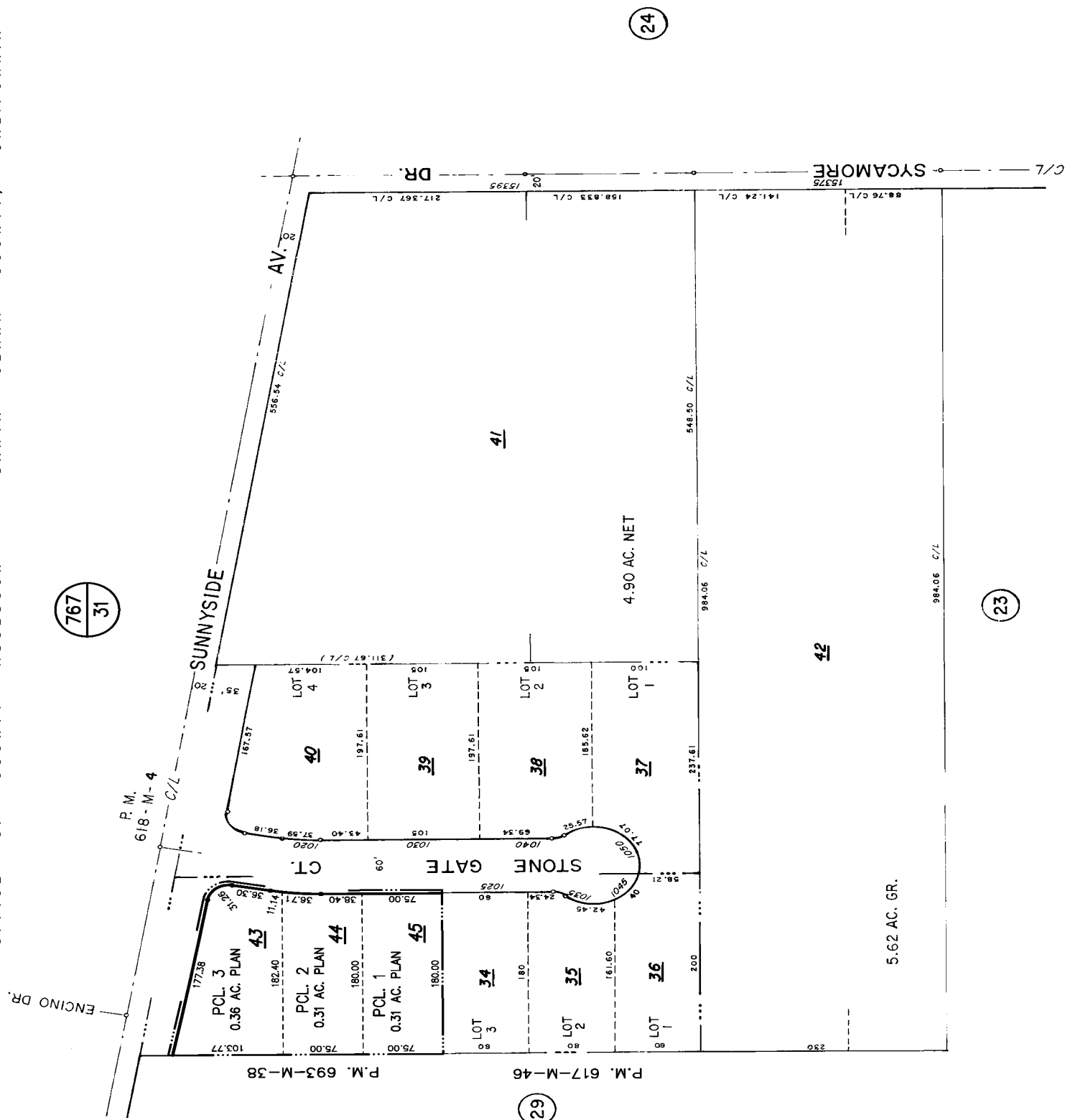
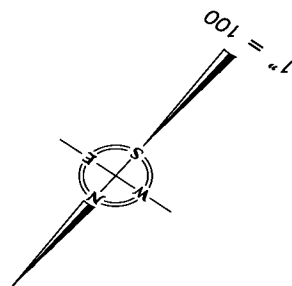
Only you or your representative that you authorize to act on your behalf (Authorized Agent) can make a verifiable consumer request for your personal information. You may also make a request for your minor child. The verifiable request must provide enough information that allows us to reasonably verify you are the person about whom we collected personal information. We cannot respond to your request or provide you with personal information if we cannot verify your identity or authority to make the request and to confirm the personal information relates to you.

We work to respond to a verifiable consumer request within 45 days of its receipt. If we require additional time, we will inform you of the extension period (up to an additional 45 days), and the reason for the extension in writing. If you have an account with us, we will deliver our response to that account. If you do not have an account with us, we will deliver our response by mail or electronically, depending on your preference. The response we provide will also explain any reasons why we cannot comply with a request.

You may only make a consumer request for access twice within a twelve-month period. Any disclosures we provide will apply to the twelve-month period preceding the consumer request's receipt.

Contact Us

If you have any questions regarding our Privacy Notice or practices, please contact us or send your written request to: CCPA@oldrepublictitle.com, 1-855-557-8437, or 3000 Bayport Drive, Suite 1000 Tampa FL 33707



Attachment B

Public Water System

Consolidation Documentation

October 30, 2024



Chris Ghione,
Public Services Director
City of Morgan Hill
17575 Peak Ave
Morgan Hill, CA 95037

Subject: Public Water and Wastewater Service Inquiry – Sycamore Drive, Morgan Hill
Santa Clara County APN 773-31-041

Dear Mr. Ghione:

My name is Norman Hantzsche, Managing Engineer with Questa Engineering Corporation, and I am writing to inquire about possible City water and wastewater service connections for a planned housing development on a 4.84-acre site at 15395 Sycamore Dr. adjacent to the City of Morgan Hill, APN 773-31-041. The project is being processed under SB 330 (Builder's Remedy) by the Latala Group. The project proposes the development of 23 lots, to include 17 single family residences and 6 duet homes, which will be sold at a low-income level. There is currently one single-family residence and some agricultural out-buildings on the property. Domestic and agricultural water has historically been provided by an onsite well, with a septic system for sewage disposal.

The project site lies within the Morgan Hill Urban Growth Boundary but is currently not within the City's urban service area (**Figure 1**). The project developer seeks extension of City water and wastewater service as the most practical approach for the project. If this is not feasible, or if the City is unable to provide services due to the prior settlement agreement with LAFCO or the current status of an Annexation EIR, the project will be pursuing the establishment and permitting of a new standalone public water system and wastewater facilities to serve the project. The standalone water system would be designed and constructed consistent with City Water Standards, supplied by onsite wells to meet an annual demand of approximately 8 acre-feet per year and maximum day demand of approximately 12,000 gpd. A conventional gravity sewer system is proposed that could either tie into the City's sanitary sewer system or be handled by onsite wastewater treatment and disposal facilities permitted by the Regional Water Board under the State Water Board's General Order No. WQ 2014-0153 DWQ for Small Domestic Wastewater Treatment Systems.

In accordance with the requirements of California Health and Safety Code (Section 116527), before establishing a new public water system the owners are required to explore and evaluate opportunities for service from or consolidation with existing public water systems within a 3-mile distance of the new facility. At a minimum, we are required to ask each public water system if a connection to their existing water supply is feasible and also inquire if managerial and/or operational oversight also might be available. The replies from each identified water system will be included in our application to the Division of Drinking Water and will also determine the extent of other work and responses required under Section 116527.

Page 2
Mr. Ghione
October 30, 2024

Since the City of Morgan Hill water and sanitary sewer systems are immediately adjacent to the project site we are inquiring if the City is legally able and will allow the project to connect to and be served by the City for potable water and wastewater services and/or whether the City would be able to provide managerial and operational oversight of onsite water and wastewater facilities for the project.

We would greatly appreciate your response at your earliest convenience. If you have any questions I may be reached by phone at (510) 236-6114, ext. 214 or by email at nhantzsche@questaec.com.

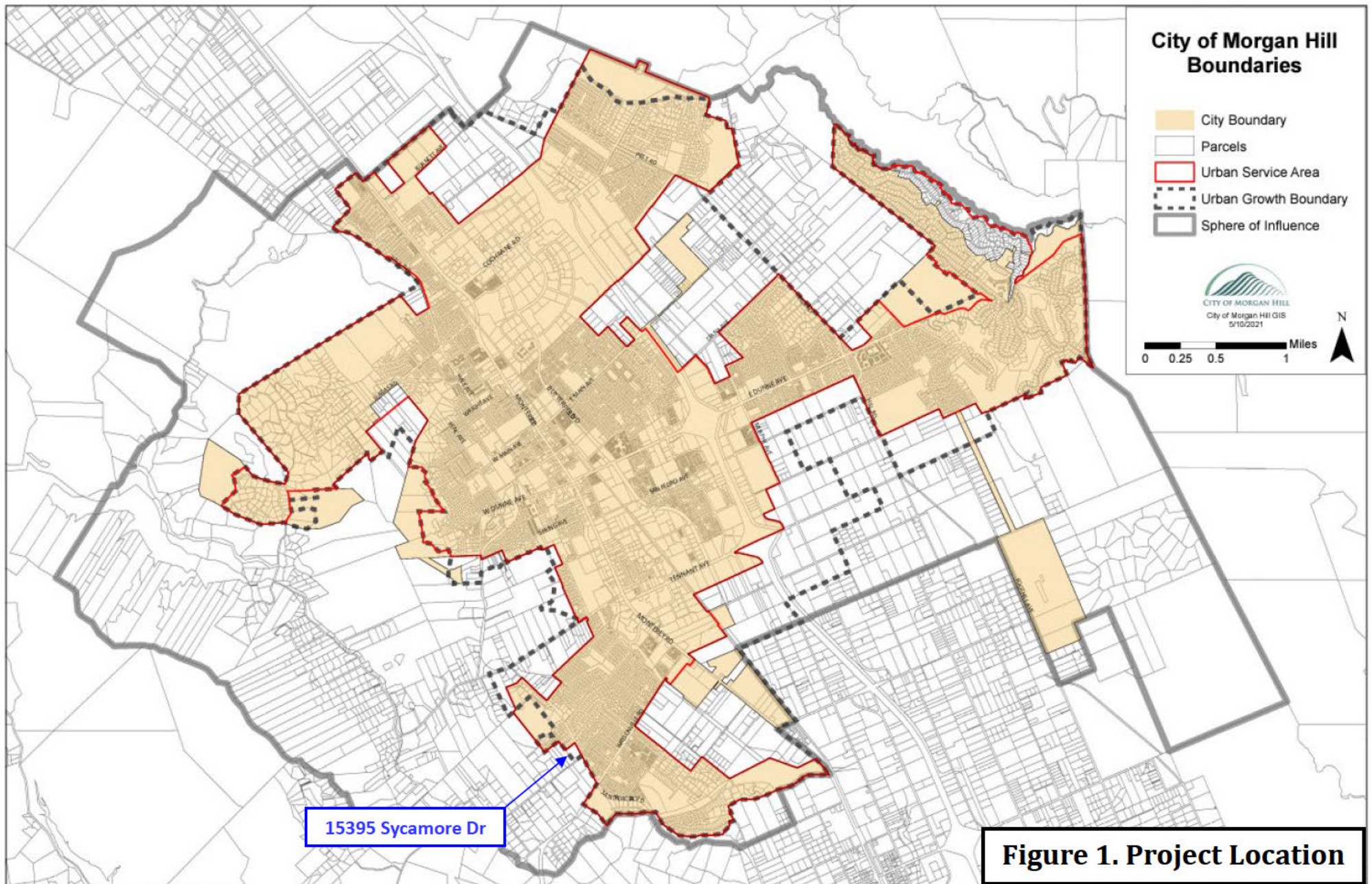
Sincerely,



Norman Hantzsche, PE
Principal/Managing Engineer
Questa Engineering Corporation

Xc: Paul Latala, Latala Group
Amanda Musy-Verdel, Hanna-Brunetti

Ref: 2400036_Sycamore Dr. Water & Wastewater Service Outreach





November 14, 2024

Norman Hantzsche
Questa Engineering Corporation
PO Box 70356
1220 Brickyard Cove Road, Suite 206
Richmond, CA 94807

Re: Response to Public Water and Wastewater Service Inquiry – Sycamore Drive Residential Project

Dear Mr. Hantzche,

This letter is written in response to your request sent to the City via email on October 30, 2024. The request was made for the City of Morgan Hill's Water and Wastewater Utility to provide water and wastewater for a proposed development of 23 housing units to be located on a 4.84 acre site at 15395 Sycamore Drive. The site is outside the City and outside the City's current Urban Service area.

The City plans for orderly expansion of its utility system based on the City's General Plan and supporting infrastructure plans. The location of this site is pre-zoned within the City's General Plan Urban Growth Boundary and therefore the City has planned for its future development from an infrastructure perspective. However, the City will only allow utility connections if the site is annexed into the City. The City would not support an out of agency request for utility services. Annexation requests require review and consent by the City Council and approval by the Santa Clara County Local Area Formation Commission. The settlement agreement noted in your letter does not prohibit the City from accepting and processing annexation requests. If an applicant chooses to submit a formal annexation request, the City will process it.

The City strongly opposes urban development in the unincorporated areas of the County adjacent to the City without proper planning and review as components of an annexation process. The City further opposes the conversion of farmland and believes it to be inconsistent with SB 330's Builder's Remedy provisions.

Without the proper review utilizing the appropriate process the City cannot fully evaluate the impacts to the City's infrastructure nor the cumulative impacts on the overall water supply.

If you have any questions, please feel free to contact us for further discussion.

Sincerely,

Chris Ghione
Public Services Director

Attachment C

Cost Tables

Water System Cost Estimates - Sycamore Dr Public Water System

Table C-1. Estimated Capital Cost

Item	Units	No. of Units	Cost per Unit (\$)	Total Cost (\$)
Construction				
Water Supply Wells, Pumps	EA	2	120,000	\$ 240,000
Combined Domestic Water/Fire Supply Tanks	GAL	68,000	3.00	\$ 204,000
Hydropneumatic Pump Station (Fire & Domestic)	LS	1	250,000	\$ 250,000
8-inch Water Main	LF	1,200	200	\$ 240,000
Lateral Service Connections	EA	23	2,000	\$ 46,000
Water Utility Site Improvements	LS	1	50,000	\$ 50,000
PG&E Service	LS	1	100,000	\$ 100,000
Sub-total Construction				\$ 1,130,000
Contingency @ 15% of Construction				\$ 169,500
Construction Total				\$ 1,299,500
Engr, Admin, Construction Mgt @ 30% of Construction				\$ 389,850
Total Estimated Capital Cost				\$ 1,689,350

Table C-2. Estimated Annual Operation and Maintenance Costs

Item	Period	No. of Periods	Cost per Period (\$)	Total Cost (\$)
Labor	MO	12	\$ 500	\$ 6,000
Administrative, Insurance, Permits	YR	1	\$ 1,000	\$ 1,000
Legal & Technical Services	YR	1	\$ 1,000	\$ 1,000
Monitoring, Testing & Reporting	MO	12	\$ 200	\$ 2,400
Utilities	MO	12	\$ 300	\$ 3,600
Supplies, Maintenance, Travel	MO	12	\$ 200	\$ 2,400
Groundwater Pumping Charges (Valley Water)*	YR	1	\$ 4,565	\$ 4,565
Annual Capital Reserve	YR	1	\$ 20,000	\$ 20,000
Total Estimated Annual O&M & Replacement Cost				\$ 40,965
			Annual Cost per Connection	\$ 1,781.09
			Monthly Cost per Connection	\$ 148.42

* 8.4 AFY at \$543.5/AF = \$4,565

Table C-3

Service Life	Calculated Annual Reserve
60	\$ 4,000
60	\$ 3,400
40	\$ 6,250
60	\$ 4,000
40	\$ 1,150
40	\$ 1,250
N/A	\$ -
Total	\$ 20,050

Table C-4 20-yr Annual Cost Projections - Sycamore Drive

Year		Annual O&M Cost	Groundwater Pumping Charge (8.4 AFY)	Equipment Replacement Allowance	Projected Total Annual Cost	Projected Monthly Charge per Connection
1	2025	\$ 16,400	\$ 4,565	\$ 20,000	\$ 40,965	\$ 148.42
2	2026	\$ 16,892	\$ 4,702	\$ 20,600	\$ 42,194	\$ 152.88
3	2027	\$ 17,399	\$ 4,843	\$ 21,218	\$ 43,460	\$ 157.46
4	2028	\$ 17,921	\$ 4,988	\$ 21,855	\$ 44,764	\$ 162.19
5	2029	\$ 18,458	\$ 5,138	\$ 22,510	\$ 46,106	\$ 167.05
6	2030	\$ 19,012	\$ 5,292	\$ 23,185	\$ 47,490	\$ 172.06
7	2031	\$ 19,582	\$ 5,451	\$ 23,881	\$ 48,914	\$ 177.23
8	2032	\$ 20,170	\$ 5,614	\$ 24,597	\$ 50,382	\$ 182.54
9	2033	\$ 20,775	\$ 5,783	\$ 25,335	\$ 51,893	\$ 188.02
10	2034	\$ 21,398	\$ 5,956	\$ 26,095	\$ 53,450	\$ 193.66
11	2035	\$ 22,040	\$ 6,135	\$ 26,878	\$ 55,054	\$ 199.47
12	2036	\$ 22,701	\$ 6,319	\$ 27,685	\$ 56,705	\$ 205.45
13	2037	\$ 23,382	\$ 6,509	\$ 28,515	\$ 58,406	\$ 211.62
14	2038	\$ 24,084	\$ 6,704	\$ 29,371	\$ 60,158	\$ 217.97
15	2039	\$ 24,806	\$ 6,905	\$ 30,252	\$ 61,963	\$ 224.50
16	2040	\$ 25,551	\$ 7,112	\$ 31,159	\$ 63,822	\$ 231.24
17	2041	\$ 26,317	\$ 7,325	\$ 32,094	\$ 65,737	\$ 238.18
18	2042	\$ 27,107	\$ 7,545	\$ 33,057	\$ 67,709	\$ 245.32
19	2043	\$ 27,920	\$ 7,772	\$ 34,049	\$ 69,740	\$ 252.68
20	2044	\$ 28,757	\$ 8,005	\$ 35,070	\$ 71,832	\$ 260.26

Assumptions:

1. Year 1 annual O&M and Equipment Replacement Allowance per Tables C-2, C-3.
2. Annual inflation of 3% applied to Years 2 through 20 for O&M and Equip. Replacement