Final Supplemental Watershed Plan No. 1 - Environmental Assessment

United States Department of Agriculture

Natural Resources Conservation Service

Central Sonoma Watershed - Matanzas Creek Dam Rehabilitation Project

Sonoma County, California

Sponsoring Local Organization: Sonoma County Water Agency

Lead Agency: Natural Resources Conservation Service (NRCS)

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Appendix D - TM001 Existing Conditions Assessment



TM001 – Existing Conditions Assessment

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1.0 Introduction

1.1 Project Background

Matanzas Creek Dam is an earthen embankment dam located in Sonoma County, California. The Dam was part of the Central Sonoma Watershed project, which was developed under the NRCS PL-566 program. Matanzas Creek Dam was designed by the NRCS and constructed in 1964 with the sole purpose of providing flood control to downstream infrastructure, which includes the City of Santa Rosa. The Dam is located approximately five river miles upstream from the confluence of Santa Rosa Creek and Matanzas Creek. Matanzas Creek Dam is currently operated and maintained by Sonoma County Water Agency (Sonoma Water). Table 1-1 provides a summary of parameters for Matanzas Creek Dam.

Table 1-1. Original Design Parameters of Matanzas Creek Data (Data from 1964 As-Builts)

Location:	38.4063° N, 122.6520° W
Year Completed:	1964
Drainage Area:	11.6 sq. mi.
Height of Dam:	95 feet
Effective Height of Dam:	80 feet
Top Width:	24 feet
Side Slopes:	3:1 Upstream, 2.5:1 Downstream
Elevations:	
Dam Crest:	425 ft (NGVD 29)
Auxiliary Spillway Crest:	410 ft (NGVD 29)
Principal Spillway Crest:	375 ft (NGVD 29)
Auxiliary Spillway:	Open earth channel, 200 ft wide, crest features 3 ft x10 ft concrete cutoff wall
Principal Spillway:	Concrete riser with anti-vortex walls, 5.25 ft x 5.25 ft concrete culvert
NRCS Hazard Rating:	High
Storage Capacity:	
Dam Crest:	2,225 ac-ft
Auxiliary Spillway Crest:	1,520 ac-ft
Principal Spillway Crest:	245 ac-ft

In 2016, HDR/Kleinfelder completed a dam assessment for the NRCS. The assessment evaluated the Dam with respect to standards set forth in Technical Release 210-60 (TR-60) (the 2005 version was used for the assessment which has been superseded by the 2019 version) and California Division of Safety of Dams (CA DSOD) design criteria. The HDR/Kleinfelder dam assessment determined that the principal spillway hydrograph (PSH) cannot be routed through the principal spillway without activating the auxiliary spillway; therefore, the NRCS determined that Matanzas Creek Dam is out of compliance with TR-60 criteria.

1.2 Purpose and Scope

The purpose of this project is to complete a Watershed Plan-EA focused on bringing Matanzas Creek Dam into compliance with NRCS and CA DSOD standards. The NRCS contracted with Jones & DeMille Engineering (JDE) and AECOM to accomplish the scope of work. A general summary of the major scope items related to engineering is provided below:

1. Evaluate Matanzas Creek Dam's hydrologic and hydraulic capacity according to the updated NRCS 2019 TR-60 standards and to CA DSOD's criteria.
2. Evaluate the Dam according to NRCS and CA DSOD seismic criteria. NRCS policy listed in NEM (520.24) requires concurrence within the NRCS at a national level for high hazard dams for any dams constructed over a fault, which Matanzas Creek Dam is reported to be in a seismically active region.
3. Incidental work to the engineering analysis is the topographic survey, mapping, etc.

4. Evaluate project alternatives to a conceptual 30% design level, sufficient for further alternative comparisons and evaluations in the overall Plan-EA.

The purpose of this "Existing Conditions Assessment" is to summarize key findings from available records and the site visit, which include a dam inspection, topographic survey, etc.

2.0 Review of Available Records

Prior to performing the field observations, JDE & AECOM received and reviewed the records provided by the NRCS and Sonoma Water (see Appendix A for full list of records received). The full list of received data included critical information such as as-built drawings, detailed hydrology and hydraulic analysis, detailed geotechnical studies, etc. This section of the report provides a brief summary of findings from key reports received.

Watershed Work Plan – Central Sonoma Watershed (SRSCD and SCFCWCD, 1958) The Work Plan was created under the PL-566 program for the Central Sonoma Watershed, which was stated as approximately 50,000 acres. The study concluded that a 50-year flood event caused flooding in both Santa Rosa Creek and Matanzas Creek. The study also found that the watershed for Matanzas Creek had significant sources for sedimentation in the channel upstream from Grange Road. The annual sediment production rate used for the watershed was 0.18 acre-feet per square mile annually, but the slides and gullies used a rate of 0.8 acre-feet per square mile. The proposed improvements for the Matanzas Creek watershed were a flood detention basin with capacity of 1,500 acre-feet (flood capacity of 1,300 acre-feet and sediment capacity of 200 acre-feet), stabilize sediment slide areas with changes to the alignment of the channel and installation of 2,000 feet of pipe and wire refinement, and improvements to approximately 2 miles of channel.

Final Analysis of Design – Design Calculations and Estimates for Matanzas Creek Dam (WCS, 1960a) This document is the design report for the Dam, which includes hydraulic calculations for the capacity of the spillways (principal and auxiliary). The design criteria for the principal spillway hydrograph (PSH) was a 100-year 24-hour storm (peak inflow of 3,870 cfs), which was an exception made to the Work Plan that required a 72-hour storm. The maximum discharge capacity for the PSH was reported as 1,000 cfs. The design storm for the auxiliary spillway was an 8.5-hour storm with a peak flow of 19,800 cfs (assumed to be the auxiliary spillway hydrograph), and its crest was determined by routing PSH through the principal spillway. The Dam's crest was established by routing the 8.5-hour storm with a peak discharge of 30,100 cfs (this is assumed to be the freeboard hydrograph).

Geology Report – Matanzas Reservoir Sediment Survey (Curry, USDA, 1983) It is reported that practices proposed in the Work Plan to stabilize the slides and gullies upstream of Grange Road were not implemented. Reports the sediment pool of the reservoir has been reduced by 71.7% (219 acre-feet to 62 acre-feet) since construction of the Dam. The Work Plan proposed improvements to the slides and gullies were intended to reduce the annual sediment deposition by approximately 50%, or 4 acre-feet per year. The rate of annual sediment deposition was estimated to be 8.3 acre-feet per year based on data collected at the time of study. To meet the design life of the Dam, the study proposed removal of approximately 100,000 cubic yards (62 acre-feet) of sediment and improving the slides and gullies upstream of the Dam.

Matanzas Creek Detention Reservoir Sediment Removal Project (Sonoma Water, 2005) Purpose of this study was to determine the environmental impacts associated with the proposed alternatives for removing deposited sediment from the reservoir. The study reports that approximately 100,000 cubic yards (62 acre-feet) of sediment was removed in 1988; however, Sonoma Water has confirmed through their historical records that this project never occurred. The proposed project involved removal of approximately 120,000 cubic yards (74.4 acre-feet) of sediment. The report does not state if improvements to the upstream slides and gullies were implemented, but based on the proposed project and feedback from Sonoma Water, it was determined that they have not been constructed.

Matanzas Creek Dam Assessment (HDR/Kleinfelder, 2016) The assessment followed the 2005 version of TR-60 and CA DSOD requirements for evaluate the hydrologic and hydraulic capacity of the Dam. The assessment concluded that the Dam meets all criteria except the fact it could not pass the PSH without activating the auxiliary spillway. It was noted that the hydrologic analysis of the Dam assumed the pool elevation to be at the principal spillway crest for all scenarios. The assessment confirmed the NRCS hazard rating for the Dam as high hazard, and it also confirmed CA DSOD Total Class Weight (TCW) of 30, which includes high capacity, moderate height, extreme population at risk, and high potential damage. Based on the dam failure analysis using NRCS criteria, the Dam has a failure index of 309, a Population at Risk (PAR) of 12,977, and a total risk index of 28,069. The three alternatives provided in the assessment are: No Action, upsize the principal spillway to a 10-ft x 10-ft conduit, or decommission the Dam.

Santa Rosa Creek Hydrologic Modeling Report (ESA, 2017a) The purpose of this study was to evaluate the hydrology for the Santa Rosa Creek watershed and its 14 tributaries. The report outlines methods and procedures to evaluate the hydrology for the Santa Rosa Creek watershed and its 14 tributaries. The data and model were calibrated using four nearby USGS stream gauges and two storm events, referred to as the New Year's Eve 2005 (2005NYE) and January 2010 storm events. After calibrating, the model produced acceptable results throughout the watershed, except for downstream of the Matanzas Creek Dam and the confluence of Matanzas Creek and Santa Rosa Creek. A separate technical memo, written by ESA, investigated in detail the possible sources of error in the results for the Matanzas Creek watershed calibration. The final calibrated model for Matanzas Creek resulted in a -14.1% error with the 2005NYE storm event. The more concerning issue with modeling Matanzas Creek was understanding the long duration high flows being released from Matanzas Creek Dam. For example, the stream gauge reports flows ranging from 1,200 to 1,800 cfs for 15 hours. The Dam's principal spillway, however, is only capable of 1,000 cfs and the auxiliary spillway has reportedly never been used. The HEC-HMS model for this report has been received, and it is being considered to be used for modeling flood occurrence events for the broader Santa Rosa Creek watershed.

Santa Rosa Creek Hydraulic Modeling Report (ESA, 2017b) This report outlines methods and procedures to model flood occurrence storms and evaluate possible flooding of the Santa Rosa Creek watershed. A HEC-RAS 1D/2D unsteady model was created to evaluate the flood potential throughout the watershed. The hydrology from the Santa Rosa Creek Hydrologic Modeling Report were used as inputs to the HEC-RAS model and it was calibrated to the 2005NYE and January 2010 storm events. The terrain for the model was the based on a 2013 1-meter LiDAR surface and on a 2006 topographic survey which included cross-sections for the channel, bridges, and culverts. Also similar to the hydrologic report, calibration for downstream of Matanzas Creek Dam and the confluence of the Matanzas Creek and Santa Rosa Creek were poor (-23.4% and -13.4%, respectively, for the NYE2005 storm event). The model concluded that segments of Matanzas Creek downstream of the Dam overtop the channel banks starting at the 2-year storm event and increases in flooding up to the 100-year storm event. Based on the model results, Sonoma Water suggested that the 2016 dam assessment's recommended alternative to upsize the principal spillway of the Dam is not a feasible option. The HEC-RAS model has for this report has been received, and it is being considered for use in the current study.

3.0 Topographic Survey

3.1 Previous Topographic Data

Previous topographic survey information for the Dam is available from as-built drawings and several benchmarks that were provided by Sonoma Water.

In addition, the previous and best available topographic data for the Dam is a 2013 3-feet LiDAR surface received from Sonoma Water. The original coordinate systems for the LiDAR surface were California

State Plane Zone II (FIPS 0402), NAD83 (2011) with a NAVD88 (12A) vertical datum. It is anticipated that this surface will be used for hydrologic, hydraulic, and sedimentation analyses.

3.2 Elevation Data and Engineering Surveying of the Dam and Reservoir Area

A topographic survey of the Dam was performed on January 12-13, 2021 by Cinquini & Passarino, Inc (CPI). Both RTK and Static survey methods were used to establish survey control and perform the topographic survey. A drone was also used to establish an updated LiDAR surface (further referred to as 2020 LiDAR data) that extends around the immediate area of the Dam. The extent of the 2020 LiDAR data includes the Dam, auxiliary spillway and its channel, the downstream channel and dike, and the immediate upstream storage area where sediment removal has occurred. The 2020 LiDAR, however, was not collected throughout the entire storage area and watershed, where the topography is not expected to have changed significantly since the 2013 LiDAR data was collected.

The final topographic map presented in Appendix C extends a minimum of 10 feet above the Dam crest elevation, and it includes the locations survey control points, cross-sections, and 2020 LiDAR. Note that all survey data are projected in the NAD83 (2011) California State Plane Zone II, and all elevations are reported in the NAVD88 (12A) vertical datum. Electronic files of the survey data will be provided as a separate deliverable.

Table 3-1 summarizes elevations of key features and benchmarks based on the as-built drawings, survey data provided by Sonoma County, and the 2021 CPI survey. Overall, the 2021 CPI survey data agrees with previous benchmarks and as-built elevations.

Note that the National Oceanic and Atmospheric Administration's (NOAA) Coordinate Conversion and Transformation Tool calculates a datum shift of +2.9 feet (see Appendix B). This shift was used in the previous 2016 dam assessment. However, after evaluating the survey data in Table 3-1, the actual datum shift is approximately 2.63 feet; therefore, a datum shift of 2.63 feet was used to convert all previous NGVD 29 elevations for the purposes of this project.

Table 3-1. Matanzas Creek Dam Surveyed Elevations (NAVD88)

Elevation Description	As-Built Elev. (NGVD 29 - ft)	Sonoma Water Elev. (NAVD 88 - ft)	2021 CPI Elev. (NAVD 88 - ft)	Average Datum Shift (ft)
Dam Crest	425	---	---[1]	---
Dam Crest Camber	---[2]	---	428.2	---
Mitchell Benchmark (brass disk) – Dam Crest at Right Abutment	427.09	429.73	429.67	2.61
Auxiliary Spillway Crest	410	---	412.62	2.62
Michell Benchmark – Top of Principal Spillway Structure	380.5	383.21	383.12	2.67
Principal Spillway Crest	375	---	---[3]	---
Low-Level Outlet Invert	350.8	---	354.5	---[4]

[1]Unable to survey due to camber (see as-built drawings)
[2]Elevation not shown on as-built drawings; based on survey data and a datum shift of 2.63 ft, it would suggest the camber is approximately 6 inches thick
[3]Principal spillway not accessible during 2021 CPI survey
[4]Elevation has been confirmed by CPI; based on a datum shift of 2.63 ft, survey suggests the low-level outlet invert is approximately 12 inches above the invert shown on the as-builts

3.3 Surveying of Upstream and Downstream Impact Areas

Potential upstream impact areas were evaluated based on the 2013 LiDAR topographic data, including estimates of the lowest adjacent grades of homes. Water surface elevations at the existing principal spillway crest, auxiliary spillway crest, and dam crest were used to identify any potential infrastructure that may be affected during a storm event. In addition, a survey of the Grange Road bridge was completed

to identify any potential impact. Exhibit 4 in Appendix C displays the mentioned water surface elevations and the infrastructure that may be impacted from the Dam.

The 2013 LiDAR data was also used to evaluate the expected downstream impact areas. Estimating the lowest adjacent grade of homes, roads, and other infrastructure downstream of the Dam will be completed with the 2013 LiDAR data. Other available survey data downstream of the Dam that will be used for the project includes channel cross-sections for Matanzas Creek and elevations and dimensions of bridges and culverts. This survey data was provided by Sonoma Water, and it was collected in 2006 by Doble Thomas & Associates. This data was previously built into a HEC-RAS model by ESA, for the Santa Rosa Creek Hydraulic Modeling Report (ESA, 2017a). This model has been received and will be utilized for the HEC-RAS modeling in future phases of this project to further determine the impact areas downstream of the Dam.

4.0 Geology

4.1 Bedrock and Surficial Geology

Bedrock geology in the vicinity of Matanzas Creek Dam is dominated by various lithologies of the Tertiary-age Sonoma Volcanics including basalt, basaltic andesite, and andesite, with minor rhyolitic to dacitic tuff (McLaughlin et al., 2008). The basalt and andesite are generally harder, stronger and more resistant to weathering than are the tuff layers. Based on the subsurface investigations of the damsite undertaken as part of the design, the underlying Sonoma Volcanics are described as "… composed of a variety of rock types, few of which have great vertical or lateral extent. Short flows of dense, blocky lavas are separated by layers of scoriaceous tuffs, detrital debris, and relatively extensive beds of massive pumice." Underlying Mesozoic basement rocks of the Franciscan Complex do not crop out at or near Matanzas Creek Dam.

Much of the west slope above the reservoir and embankment is mapped by McLaughlin et al. (2008) and Huffman and Armstrong (1980) as a Quaternary-age landslide complex. Quaternary alluvial fan, alluvial terrace, and recent alluvium have been deposited adjacent to and within the channel of Matanzas Creek upstream and downstream of the Dam. See Figure 4-1 for the regional geologic map from USGS.

4.2 Seismicity and Faulting

The seismotectonic setting of the San Francisco Bay region is controlled by its location within the plate boundary zone between the Pacific and North American tectonic plates where the Pacific plate, to the west is traveling northwest relative to the North American plate at a rate of about 50 mm/yr (deMets et al., 2010). Most of this plate motion is accommodated on a series of strike-slip faults that constitute the San Andreas fault system, including the primary trace of the San Andreas fault, the Hayward-Rodgers Creek fault zone, and the Calaveras fault zone. Because the orientation of the San Andreas fault system is variable and deviates from the relative plate motion direction, other structures accommodate some of the plate motion including east-west-striking reverse faults and folds, north-northwest-striking strike-slip faults inland of the San Andreas fault, and north-south-striking normal faults. Segments of all of the major faults in the San Francisco Bay region have ruptured in historical time, and are projected to generate large earthquakes in the future, which together pose a high regional seismic hazard; the 30-year earthquake outlook forecast for the region (2014-2043) estimates a 72% probability that at least one earthquake with a moment magnitude of 6.7 or greater will occur in the San Francisco Bay region (Aagaard, et al., 2016).

The Rodgers Creek along with the Healdsburg and Maacama Fault Zones are considered to be the northern extension of the active right-lateral Hayward-Calaveras Fault System and represent the most significant earthquake hazard east of the San Andreas Fault in the northern San Francisco Bay region (McLaughlin et al., 2008).

The Rodgers Creek-Healdsburg fault is 82 km long and its geomorphic expression is similar to that of the Hayward fault. At its northern end, the Rodgers Creek fault is separated from the Maacama fault by a 6-km-wide right step. Holocene activity along the Rodgers Creek is indicated by a series of fault scarps in Holocene deposits, side-hill benches, right-laterally offset streams, and closed linear depressions. Paleoseismic investigations by Schwartz et al. (1992) revealed three events in past 925 to 1,000 years. This gives a preferred recurrence of 230 years for a maximum earthquake of **M** 7.0. The most recent earthquake occurred on the fault sometime between 1438 to 1654 AD (Schwartz et al., 1992). The calculated slip rate for the Rodgers Creek fault is 9 ± 2 mm/yr. As mapped by Hecker and Randolph Loar (2018) the fault passes within approximately 1,000 m of Matanzas Creek Dam (see Figure 4-2).

The Bennett Valley Fault Zone extends for approximately 30 km southeastward from the Spring Valley Reservoir (Spring Lake) area east of Santa Rosa to Sonoma Valley and passes within 2 km of Matanzas Creek Dam to the east. The fault zone exhibits evidence of latest Pleistocene displacement along the east side of the Santa Rosa pull-apart basin, where the fault has strong geomorphic expression and offsets terrace and alluvial fan deposits of latest Pleistocene age. Bennett Valley Fault Zone and associated unnamed faults are associated with northeastward partitioning of slip between the Rodgers Creek and the Maacama Fault Zones (McLaughlin et al., 2008). The USGS Quaternary fault database assigns a slip rate of 0.01 mm/yr to the Bennett Valley Fault.

The Matanzas Creek Fault Zone is inferred from a series of N 50º W to N 60º W-trending en-echelon topographic lineaments that bound the southwest side of Bennett Valley. Along the northeast side of Bennett Valley Road and southeast of Bennett Valley School, the fault zone exhibits a prominent east-side-down scarp that is associated with seeps, suggesting that Holocene fan deposits of Bennett Valley may be faulted. However, the scarp and seeps are also close to the toe of a large landslide complex and thus may have origins more closely associated with the landsliding. (McLaughlin et al., 2008). As mapped by Mclaughlin et al. (2018) the fault goes beneath the dam, however the fault is not included in the USGS Quaternary fault database and is, therefore, not a "…fault that demonstrates geological evidence of coseismic surface deformation in large earthquakes during the Quaternary."

4.2.1 Seismicity

As required by TR-60, a map of recent and historic earthquakes within a 100 kilometer radius of the site is provided (see Figure 4-3). Earthquake data is from the USGS National Seismic Hazard map earthquake catalog (Rukstales and Petersen, 2019), updated with data from the Northern California Earthquake Data Center (NCEDC) through the end of 2020.

Twenty-eight earthquakes of **M** ≥ 5.0 and seven **M** ≥ 6.0 have been reported within 100 km of Matanzas Dam. The most significant include the 1868 **M** 6.8 Hayward earthquake that occurred along the Hayward fault, 92 km southeast of the site and the 1906 **M** 7.9 San Francisco earthquake which occurred along the San Andreas fault, 80 km south of the site (see Figure 4-3).

In Sonoma County there have been seven earthquakes of **M** ≥ 5.0. The most significant of these are briefly described below:

- On 9 August 1893, A M 5.6 event occurred east of Santa Rosa, 4.1 km west of Matanzas Dam, though its exact location is highly uncertain. Most of the loss of property occurred in Santa Rosa. In Petaluma, plaster was cracked and crockery was thrown. The event was felt north to Middletown and south to Alameda and east to Sacramento. The maximum modified Mercalli Intensity (MMI) is reported as VII (Stover and Coffman, 1993).
- On 31 March 1898 a M 6.4 event occurred on southern Sonoma County, 27 km south of Matanzas Dam. At Mare Island Naval Yard, several buildings were either partly or totally collapsed. Extensive damage was reported along Petaluma Creek. The event was felt north to Chico, east to Carson City and south to Monterey. Maximum MMI was VIII (Stover and Coffman, 1993).
- Two events occurred on 2 October 1969, a M 5.7, 10 km northwest of Matanzas Creek and a M 5.6, 10.3 km to the north. Both events had a MMI of VIII. The events caused one fatality and left severe

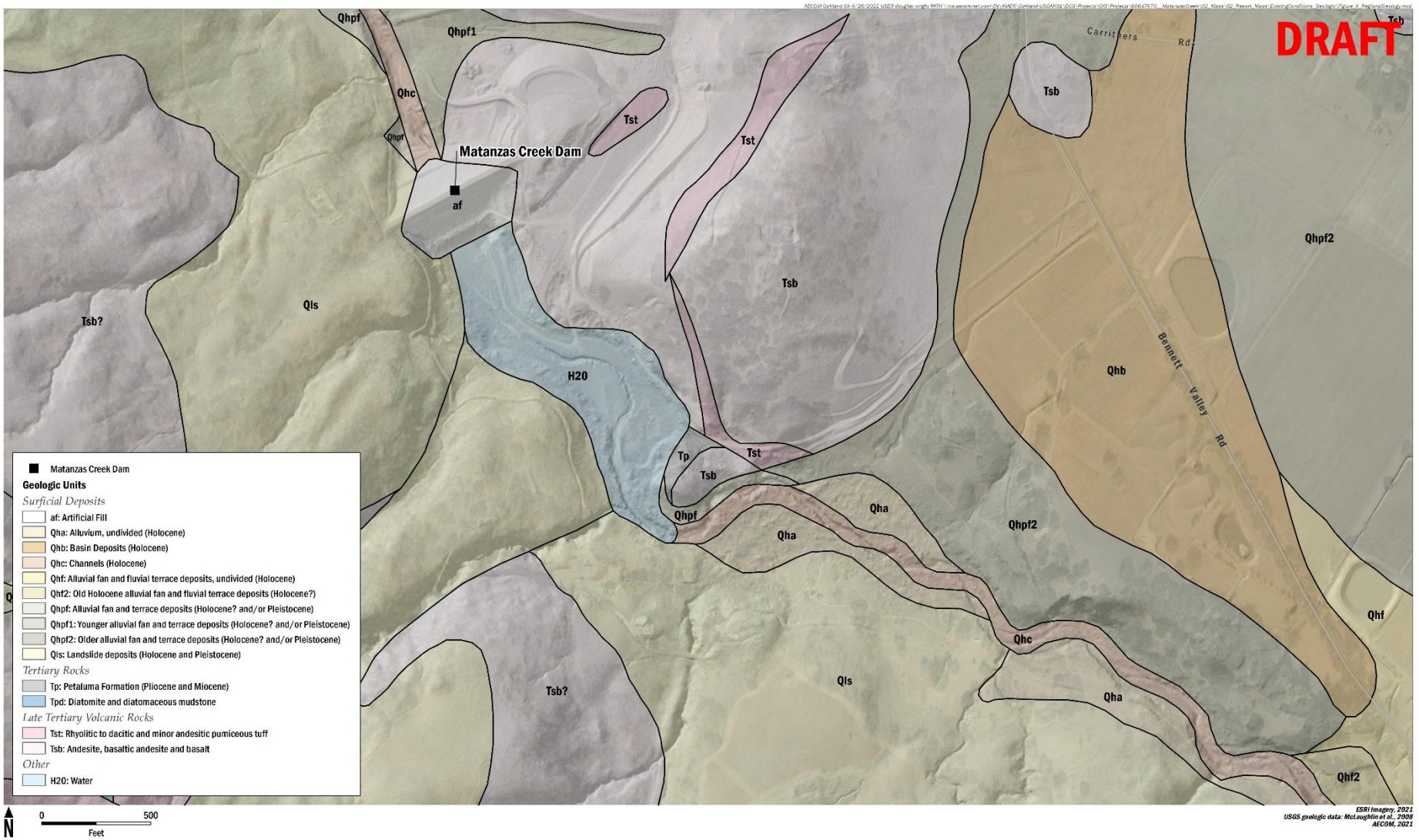


Figure 4-1. Regional Geologic Map

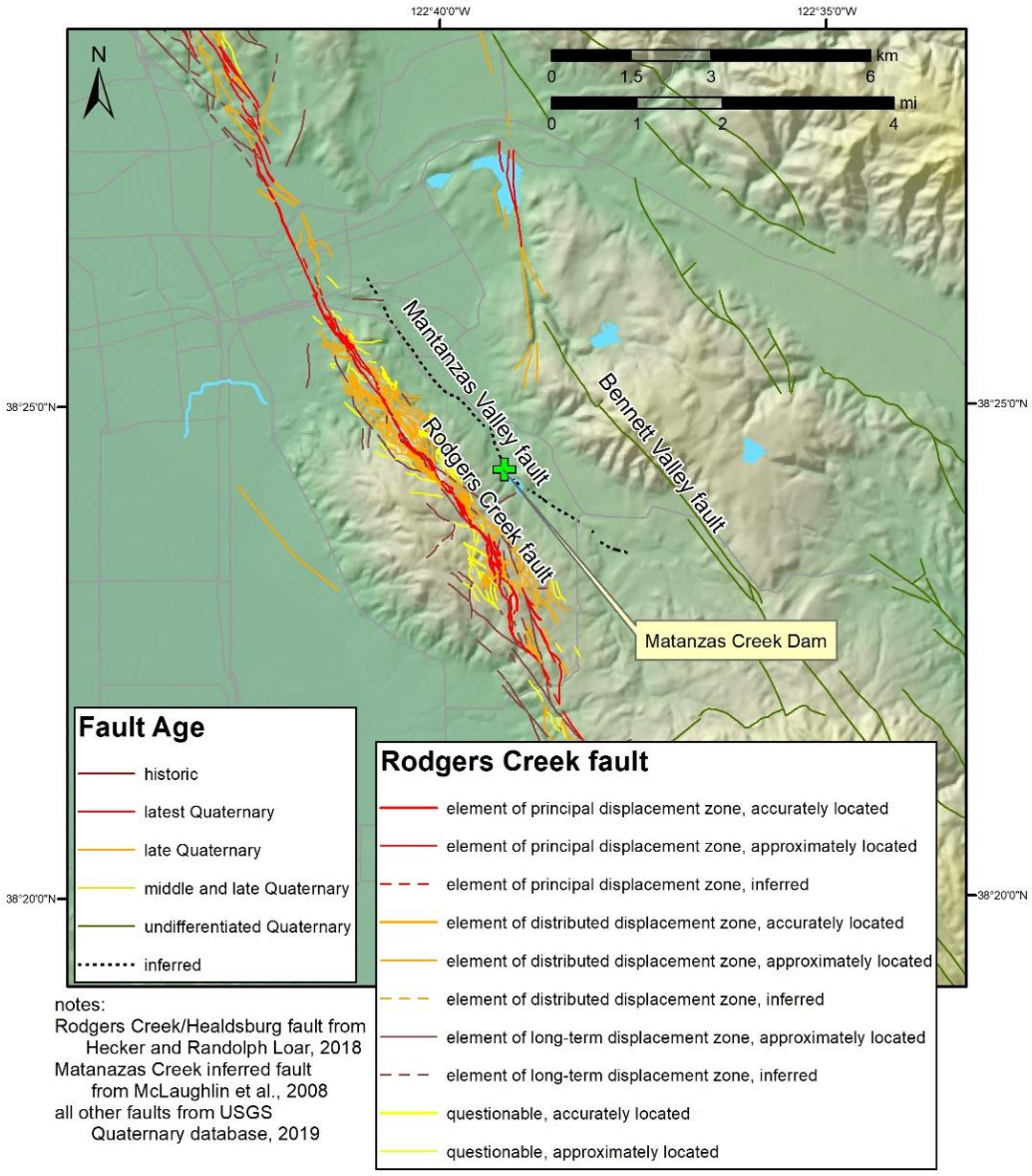


Figure 4-2. The Rodgers Creek Fault and Other Local Faults

property damage in Santa Rosa, estimated at over $8 million. Several old brick and wood-frame buildings were damaged beyond repair and underground pipes ruptured. Both earthquakes were felt from Sonoma County to Sacramento County and south to Santa Cruz County (Stover and Coffman, 1993).

4.3 Landslides and Slope Stability

As described above in Section 4.1 and shown on Figure 4-1 (as landslide deposits, Qls), landslides have been mapped on most of the east-facing slope west of the reservoir and dam (McLaughlin et al., 2008 and Huffman and Armstrong, 1980). These landslides encompass most of the western reservoir shoreline and extend upslope westward to near the ridge line of Taylor Mountain. Landslides have not been mapped elsewhere in the site vicinity. It should be noted that this mapping was based upon large-scale regional

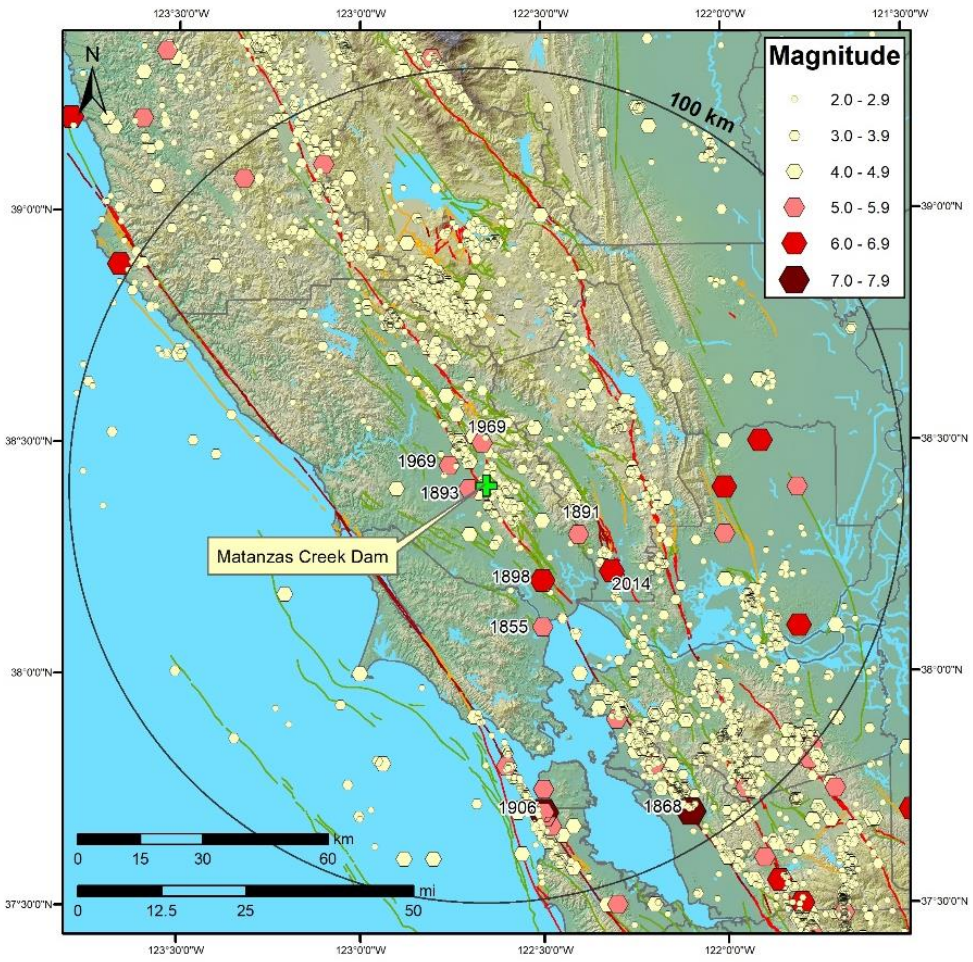


Figure 4-3. Historical Seismicity in Northern California (1808 to 2020)

interpretation and aerial photo review and not on detailed site-specific mapping or subsurface investigations. Only large landslides are depicted on these regional published maps.

4.4 Landslides and Slope Stability

As described above in Section 4.1 and shown on Figure 4-1 (as landslide deposits, Qls), landslides have been mapped on most of the east-facing slope west of the reservoir and dam (McLaughlin et al., 2008 and Huffman and Armstrong, 1980). These landslides encompass most of the western reservoir shoreline and extend upslope westward to near the ridge line of Taylor Mountain. Landslides have not been mapped elsewhere in the site vicinity. It should be noted that this mapping was based upon large-scale regional interpretation and aerial photo review and not on detailed site-specific mapping or subsurface investigations. Only large landslides are depicted on these regional published maps.

4.5 Groundwater

Review of boring logs by Woodward-Clyde-Sherard & Associates (WCS) (1959, 1960, and 1963) indicates that many borings did not encounter groundwater. In the borings where groundwater was encountered, the depth to water varied from 1 foot adjacent to the creek channel within the Dam footprint to 49 feet on the right side of the auxiliary spillway about 600 feet downstream of the concrete weir.

4.6 Engineering Geology

Exploration for the design of the Dam, spillway, and borrow areas by WCS (1959) included 38 borings identified as boring 1 to 29, B-1 to B-7, and L-1 and L-2. WCS drilled 7 borings within the proposed Dam footprint, 24 borings within the proposed emergency spillway, and 7 borings within the right bank of the proposed reservoir to evaluate a borrow area for filter material. Several trenches and test pits were also part of the WCS 1959 investigations. A site plan was not included with this 1959 report, but these borings are shown on Drawing D57-2 in the project construction drawings (WCS, 1962). WCS performed two later phases of geotechnical investigation and laboratory testing at the site. The first of these subsequent phases was done to further evaluate the spillways and a spring identified on the downstream right abutment (WCS, 1960b) and included 7 borings identified as borings 30 to 36. The second subsequent phase was performed to further evaluate the Dam foundation after a highly permeable pumiceous sand layer was encountered near the toe of the left abutment during foundation excavation (WCS, 1963) and included 24 borings identified as borings 1, 2, and 4 to 25. (Note that these boring numbers overlap completely with boring numbers used to identify borings drilled for the Dam design investigation in 1959.)

Of the 69 exploratory borings drilled at the site, the shallowest was 5 feet deep, the deepest was 83 feet deep, and the average depth was about 36 feet. The site investigation borings indicate that the Dam is primarily founded on medium dense to very stiff soils overlying weathered volcanic tuff, volcanic breccia, and sand which may have been poorly welded and/or highly weathered tuff.

5.0 Dam Inspection Field Observations

5.1 Review of Previous Dam Inspections

In preparation for the site visit, previous CA DSOD dam inspections and the field inspection completed in the 2016 dam assessment (HDR/Kleinfelder, 2016) were reviewed. Below is a brief summary of findings and recommendations:

- 2016 HDR/Kleinfelder Field Inspection
    - No indications of settlement in foundation.
    - Auxiliary spillway was unobstructed and lined with mowed grass.
    - Dike is in good condition.
    - Abutments are in satisfactory condition.
    - Occasional animal burrows found.
    - No signs of deterioration or cracking at the principal spillway inlet structure.
    - Outlet structure is satisfactory with minor concrete degradation.
    - No indications of seepage.

- October 2016 CA DSOD Inspection
    - Required removal of vegetation and driftwood around principal spillway.
    - Required installation of riprap around outlet of principal spillway.
    - No indication of surficial distress or instability on dam faces, crest, and abutment contacts.
    - No indications of seepage.

- July 2018 CA DSOD Inspection
    - Required emerging trees and bushes to be removed from embankment, groins, abutments, and auxiliary spillway annually.
    - Noted that riprap was placed along principal spillway outlet wing walls.

    - 18-inch low-level outlet was partially exercised, but accumulated sediment prevented fully cycling.
    - No indications of seepage.

- August 2019 CA DSOD Inspection
    - Required removal of vegetation within 5 feet of upstream and downstream left groins.
    - Required removal of emerging bushes on downstream face of dam.
    - Noted that emerging trees in auxiliary spillway were removed.
    - No indications of seepage.

5.2 Visual Dam Inspection

AECOM and JDE performed a site visit on January 12, 2021, to observe the condition of the Dam. A summary of the findings is presented below. Dam inspection forms and photographs from the visual inspection are included in Appendix D. The purpose of the dam inspection was to examine the Dam and appurtenant structures for any signs of damage or potential for future damage to occur. The crest, upstream and downstream faces, groins, and toes of the embankment were inspected along with the intake structure, outlet structure, and an auxiliary spillway.

5.2.1 General Conditions

The Dam consists of an earthen embankment, principal spillway/outlet that runs underneath the embankment, and an auxiliary spillway that wraps around the right abutment of the Dam. During the site visit no water was present on the upstream side of the embankment although recent rains had occurred.

Overall, the Dam appeared in relatively good condition with no items of immediate concern. The following sections outline key observations made during the inspection and provides some recommendations for minor repairs.

5.2.2 Embankment

The crest, upstream face, downstream face, groins, and toes of the embankment all appeared to be in relatively good condition. No items were identified that require immediate attention. Key findings from the inspection of the embankment include:

- A few small depressions were observed in the downstream face and one more along the upstream edge of the crest. All the depressions are relatively shallow (approximately less than 4 feet long, 2 to 3 feet wide, and 4 to 6 inches deep) and do not pose a risk to the embankment. The depressions may have formed due to ground settlement or minor slumping during rains but could also be present from construction or other repairs/maintenance.

- In the groins of the Dam, particularly on the left abutment, rocks/riprap appears to have been placed to limit erosion from surface water running down the groins. Signs of past erosion were observed but no significant erosion seemed to have occurred recently.

- A few small animal burrows were observed on the lower portion of the upstream and downstream faces, and gopher mounds were observed along the lower portion of the left abutment groin on the upstream face. The animal burrows were up to a few inches wide with some of them appearing to have caved in or eroded. While animal burrows and gopher mounds are not desirable it is unlikely that these few animal burrows pose a significant risk to the embankment due to their relatively shallow nature and the lack of critical features (such as drains, filters, etc.) near the observed burrows. The animal burrows should be monitored and if

the numbers increase significantly then attempts should be made to stop the animals from burrowing into the Dam, either by removal of the animals or other ground protection.

- Vegetation was adequate although the vegetation became more sporadic at lower elevations on the upstream face, likely due to the periodic submerging of that portion of the embankment face.
- Standpipes and relief wells were observed on the upstream face of the embankment, as shown in the as-builts. One of the standpipes was tilted several inches downstream, potentially indicating past movement. However, given that no other signs of movement were observed, it seems more likely that the standpipe was bent during construction or during maintenance/repair efforts since.

5.2.3 Principal Spillway

The principal spillway intake structure consists of a cast-in-place reinforced concrete riser with a 10-feet x 10-feet intake crest. The concrete riser is surrounded by a concrete structure with anti-vortex walls and several large trash racks. The intake structure also features a low-level outlet, which consists of an 18-inch pipe, slide gate, and trash rack. The principal spillway intake then reduces to a 5.25-feet x 5.25 feet reinforced concrete conduit that runs through the embankment to the outlet structure and stilling basin. The outlet structure consists of reinforced concrete walls, spillway, and a stilling basin that features chute blocks, baffle blocks, and a concrete cutoff wall.

Overall, the principal spillway components appear in decent condition, although there are a few items that should be addressed, as described below.

5.2.3.1 Intake Structure

Overall, the intake structure appeared to be in decent condition for its age, although there are signs of the concrete's age. Several observations were made during the inspection:

- Spalling was observed around the trash racks, with some rebar exposed and showing signs of corrosion. Concrete appears in decent shape for its age, with no signs of significant cracking. It is recommended that the concrete be repaired to prevent further corrosion of the underlying rebar and surrounding concrete.
- Small slumps/sloughing were observed on the hillside immediately adjacent to the intake tower, like due to oversteepening the slope when the reservoir was dredged. The slumps do not pose an immediate risk to operation of the intake structure but should be monitored in case they expand enough to block the lower intake.
- Some sediment was present within the intake structure, particularly on the lower portion, where a tree was observed growing out of an opening. It is recommended that the tree and sediment be removed from the structure.
- On the trashrack covering the lower level outlet, one of the bars was bent out of shape. It is recommended that the trashrack be repaired.

5.2.3.2 Outlet Structure and Stilling Basin

The outlet structure appeared to be in decent condition for its age. Inspection was performed from above the outlet structure concrete walls, as access to the structure was not possible at the time of our site visit. Expansion joints did not have filling and some appeared to have expanded about an inch over time. Staining was observed on the concrete, but no significant cracking was observed. While past performance shows that the outlet structure can pass the flows required, the lack of filling within the expansion joints

may eventually lead to hydraulic jacking and failure of the structure. Therefore, it is recommended that filling be added to the joints.

Erosion and/or sloughing was observed on the slopes near the end of the concrete stilling basin, likely due to high currents eroding behind the concrete walls of the stilling basin. Some attempts to place rock over the slopes to protect them appeared to have been made, particularly on the left side, however they appear to be insufficient. Installation of designed riprap may protect the bank from further erosion, which will be considered pending further analysis and development of alternatives.

The downstream channel is at a higher elevation than the stilling basin floor which causes standing water in the basin. Therefore, the chute blocks and baffle blocks could not be observed.

5.2.3.3 Spillway Conduit

A CCTV inspection of the principal spillway conduit was completed on March 30, 2021. Overall, the 5.25-feet x 5.25 feet reinforced concrete conduit was in great condition. No major settling or cracks were observed in the CCTV inspection. Also, no settled sediment was observed in the conduit. Minor spalling of grout in a conduit joint was observed at station 0+70, and it appears repairs were made in the conduit joints at stations 1+21 and 3+46. The 18-inch diameter low-level outlet pipe also appeared to be in great condition with no settled sediment.

Electronic files of the CCTV inspection will be provided as a separate deliverable.

5.2.3.4 Auxiliary Spillway

The auxiliary spillway consists of an unlined spillway that wraps around the right abutment of the embankment. At the bottom of the spillway a small earthen dike is present (see Appendix C) to prevent water from going into the neighboring property. Based on the provided information, the spillway has never been used. Overall, the spillway appears in good condition although it may be subject to erosion if activated. Some observations include:

- No large (greater than 1-foot deep) sloughs or slides were observed within the spillway. However, a large slough was noted above the spillway on the right side near the top, indicating that there is potential for instability in this material.
- Erosion was noted in a natural drainage feature that runs down the middle of the lower approximately ½ to ¾ of the spillway.
- Vegetation on the upper portion of the spillway consisted of up to 1-foot tall grasses with some areas with little vegetation and pooled water from recent rains, to very thick vegetation on the lower half of the spillway. Tall trees are present near the bottom of the spillway and an area of thick vegetation surround an abandoned building was observed just past the turn in the spillway, although it may be outside the flow path. Small amounts of debris (such as tires and other trash) were observed within the spillway.
- Some small rodent and gopher holes were observed but were not in sufficient numbers to be of significant concern. A gopher mound was observed in the dike at the base of the spillway. It's recommended that the number of gopher mounds/animal burrows be monitored and if the amount increases that some form of control be implemented.

5.3 Geotechnical Investigation

AECOM geologists completed a site reconnaissance in the vicinity of Matanzas Creek Dam, Auxiliary Spillway, accessible (i.e., above the water surface) portions of the reservoir, and the surrounding hillslopes during the week of January 11, 2021. The purpose of the geologic reconnaissance was to identify the lithology, physical properties, and distribution of rock outcrops, the characteristics of soil

exposures, and surficial evidence of erosion, landslides, and faulting. Field observations were documented in written notes in field notebooks and with photographs. The information will be used to develop a geologic map of the site, which will be documented in the Geotechnical Investigation Report.

In addition, NorCal Geophysical Consultants completed surface geophysical surveying in the Auxiliary Spillway during the week of January 11, 2021. A total of seven (7) geophysical survey lines were completed in the Auxiliary Spillway: one (1) seismic refraction line and six (6) electrical resistivity lines. The results of this study will be documented in the Geotechnical Investigation Report.

6.0 Sediment Survey

A sediment survey of Matanzas Creek Dam was completed using original as-built drawings, design reports, previous sedimentation studies for the watershed, 2013 and 2020 LiDAR data, and several cleanout records provided by the NRCS and Sonoma Water.

6.1 Previous Sedimentation Studies/Background

Matanzas Creek Dam has had several sedimentation studies previously performed, and the Dam has had several instances of major sediment removal. The following is a summary of events that aided the assumptions made to complete the sedimentation survey portion of this report.

1958 – The Work Plan (SRSCD and SCFCWCD, 1958) was completed and proposed that Matanzas Creek Dam be constructed. The Work Plan notes several slides and gullies upstream of the proposed Dam that will be a significant source of sedimentation. An annual average deposition rate of 0.18 acre-feet per square mile was used for the watershed and a rate of 0.8 acre-feet per square mile was used for the slides and gullies. The proposed sediment pool storage capacity for the Dam was 200 acre-feet. The 50-year design life of the sediment pool assumed upstream gully and slides would be stabilized; however, there are no records indicating the proposed stabilizations were implemented.

1964 – Matanzas Creek Dam was constructed. Based on several records and confirmation with Sonoma Water officials, the Dam was historically operated with a closed low-level outlet until approximately 2005; thus, creating a permanent pool (reservoir elevation assumed to be near the principal spillway crest). This affects how the sediment is deposited (submerged vs aerated, deposited upstream of reservoir vs near the intake, trap efficiency, etc.). The as-built drawings show a sediment pool capacity of 245 acre-feet.

1983 – Matanzas Reservoir Sediment Survey (Curry, USDA, 1983) conducted. Results showed sands and gravels had been deposited which reduced the sediment pool capacity by 71.7% (reports capacity as 219 acre-feet and is reduced to 62 acre-feet). The study reports an average sediment deposition rate of 8.3 acre-feet annually. The document notes the Work Plan estimated rate is 4.0 acre-feet annually which includes the mitigation to the upstream slides and gullies. Also, the study references a report completed in 1972 that estimated the trap efficiency of the reservoir to be 83%. Recommends excavating 100,000 cubic yards (62 acre-feet) of sediment and treating the slides and gullies to meet the design life of the Dam.

1984 – Matanzas Reservoir Sediment Study (Sonoma Water, 1984) conducted to present several alternatives for sediment removal. Mentions the impounded sediment is approximately 174 acre-feet. It is unclear which, if any, of the alternatives were selected.

1988 – The Matanzas Creek Detention Reservoir Sediment Removal Project (Sonoma Water, 2005) mentions that approximately 100,000 cubic yards (62 acre-feet) of sediment was removed in 1988. However, Sonoma Water searched historical records and confirmed that this project never

occurred. Therefore, this 100,000 cubic yards of sediment removal was not included when determining the annual sediment deposition rate.

2005 – Sonoma Water conducted an environmental impact study of excavating approximately 120,000 cubic yards (74 acre-feet) of sediment.

2006 – Construction record drawings provide the approximate cross-sections of dredged out sediment. States that 102,516 cubic yards (63.5 acre-feet) was excavated.

2006-Current – While it is not stated in any received records, the operation of the Dam was changed to an opened low-level outlet (no permanent pool) in approximately 2005. After discussing with Sonoma Water officials, that change occurred while coordinating with State of California officials regarding water rights and a desire by Sonoma Water to increase flood storage.

2010-2019 – Impounded sediment is excavated from the Dam annually (see Table 6-1 for history of sediment removal).

A discrepancy throughout the previous reports is the design sediment storage capacity of the Dam. The Work Plan states that the Dam must have a sediment storage capacity of 200 ac-ft (SRSCD and SCFCWCD, 1958). The design report for the Dam states that the principal spillway crest elevation is 375 feet (NGVD 29) that provides a sediment storage of 230 acre-feet (WCS, 1960a). However, based on the as-built drawings and the provided stage-storage curve of the Dam, the storage capacity at the principal spillway crest is approximately 245 acre-feet (this was also confirmed in the 2016 Dam Assessment performed by HDR/Kleinfelder). Also, a geology report completed in 1983 states that capacity of the sediment pool is 219 acre-feet (Curry, USDA, 1983). Although there are several sources stating different sediment storage capacities, the constructed Dam provides sufficient sediment storage than what was proposed in the Work Plan. For the purposes of this sediment survey, the sediment pool elevation is assumed to be the principal spillway crest elevation with a corresponding sediment storage pool capacity of 245 acre-feet.

Sonoma Water has removed varying quantities of impounded sediment from the reservoir throughout its history. A summary of sediment removal for the Dam is shown in Table 6-1.

Table 6-1. History of Impounded Sediment Removal from Matanzas Creek Dam

Year	Excavated Sediment (CY)	Excavated Sediment (ac-ft)
1964 (Dam Constructed)	0	0
2006	102,216	63.4
2012	216	0.1
2013	544	0.3
2014	1,136	0.7
2015	856	0.5
2016	1,520	0.9
2017	6,336	3.9
2018	4,408	2.7
2019	3,040	1.9
2020	0	0
Estimated Total	**120,272**	**74.5**

6.2 Current Average Annual Sediment Deposition Rate

Note that sedimentation deposition processes are episodic in nature, but for planning purposes, the estimated average annual sediment deposition rate was determined using available data such as sedimentation reports, records of sediment excavated from the Dam, and LiDAR data.

The Work Plan describes several significant sources (gullies and slides) for sedimentation upstream of the Dam. The Work Plan outlined stabilization measures at these sediment sources to reduce the design sedimentation rate to 4.0 acre-feet per year. However, this mitigation was never implemented.

The 1964 as-built drawings for the Dam report a sediment capacity of 245 acre-feet. Based on the 2013 and 2020 LiDAR data, the remaining sediment capacity of the Dam has been reduced to approximately 86 acre-feet. Records also indicate that a total of 74.5 acre-feet (120,272 cubic yards) of impounded sediment has been excavated from the reservoir since it was constructed (see Table 6-1). Based on this data, the average annual sediment deposition rate for Matanzas Creek Dam is approximately 3.8 acre-feet, which is relatively close with the original Work Plan sedimentation rate.

6.3 Current Sediment and Flood Storage Capacities

Per the USDA National Engineering Handbook Section 3 – Sedimentation, all sediment in dry reservoirs is considered aerated sediment (USDA, 1983) which is the case for Matanzas Creek Dam. The remaining aerated sediment capacity of the Dam consists of the storage up to the principal spillway crest, which is calculated to be 86 acre-feet based on the 2013 and 2020 LiDAR data.

The flood retarding pool is the portion of the reservoir allotted to the temporary impoundment of floodwater with an upper limit set by the auxiliary spillway crest elevation. The current floodwater retarding capacity, which includes the remaining sediment capacity, is approximately 1,449 ac-ft. Floodwater retarding capacity between the principal spillway crest and auxiliary spillway crest is 1,359 ac-ft.

6.4 Future Average Annual Sediment Deposition Rate

Future land use conditions in the watershed due to growth and proposed project measures will affect the estimated sediment deposition rate. The future average annual sediment deposition rate will be determined in future stages of the analysis of the dam.

7.0 Summary

JDE and AECOM have completed an assessment for the existing conditions for Matanzas Creek Dam. A thorough review of previous reports and data has been completed to determine key findings and fundamental background for the Dam. Topographic survey data and an inspection of the Dam has been provided to describe its overall condition. Also, an approximate sediment deposition rate for the Dam has been determined.

Further analyses, such as geological investigations and the hydrologic and hydraulic analysis of the Dam, will be provided by JDE and AECOM in future stages of the project.

7.1 Limitations

The results, discussions, suggestions, recommendations, and conclusions presented in this inspection report are professional opinions based solely on the inspection team's review of field observations conducted on a single site visit in January 2021 and relevant reference documents. No analysis was completed as part of these findings.

The observational data used to prepare this report apply only to the specific locations indicated and the conditions existing at the time of inspection. No data in this inspection report should be applied to any other projects other than this inspection; nor should any of the data be applied at a future date without appropriate verification by qualified individuals.

AECOM and JDE has relied on third-party information and discussions with knowledgeable persons to prepare this document. The inspection team is not responsible for—and has not independently verified—the accuracy of this information. The inspection team does not attest to the accuracy, completeness, or reliability of reports, figures, or data prepared by others that are included or discussed in this inspection report. AECOM has not performed independent validation or verification of data prepared by others and does not assume any liability for errors or omissions of the third-party information obtained during the performance of this work.

AECOM and JDE makes no warranty, express or implied, that the actual site and subsurface conditions encountered conform exactly to the conditions described herein. AECOM and JDE's services were performed within the limits prescribed by the contract and the client, and with the customary thoroughness and competence ordinarily exercised by the profession.

The condition of the Dam was based on the available data and the hydraulic conditions observed during field inspection. Actual performance of the Dam may vary because different hydraulic loads and water surface elevations may be encountered at different times, resulting in different observations (for example, seepage might be observed if the reservoir is at the design level).

This inspection report is for the sole use of NRCS and Sonoma Water and may not be appropriate for parties and uses other than those explicitly stated herein. No portion of this report shall be used as a basis for final design or construction, and this report shall not be used as a basis to develop any final cost estimates associated with repairs, modifications, or alterations to levees or associated areas. Any use or re-use of any portion of this report or any use of this report's findings, conclusions, or recommendations by any entity other than NRCS is at the sole risk of that entity.

8.0 References

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Appendix A. List of Data Received

Data Library Outline – Matanzas Creek Dam

This document lists the data and files received from the National Resources Conservation Service and the Sonoma County Water Agency for the Matanzas Creek Dam.

Environmental

- Appendix G1 - IPaC Matanzas Dam Report.pdf
- RLF SMP Final 23Dec08.pdf
- RLF SMP Report Final 2010.pdf
- SCWA_SMP_FWS_BA_submitted_030409.docx
- SMP CRLF Eval 15May17 Final.pdf
- USFWS PBO

General Dam Records

- As-Builts
    - AS-BUILT DWGS for Matanzas Creek Dam.pdf
    - MatanzasDam_OriginalConstruction_RecordDwgs.pdf
- Dam Inspections
    - 2016 Oct DSD Dam Inspections incl matanzas.pdf
    - InspectionReport_Matanzas_20161012.pdf
    - InspectionReport_Matanzas_20180724.pdf
    - InspectionReport_Matanzas_20190801.pdf
    - Matanzas Dam Inspections MIDDLE FK BRUSH.pdf
- Design Reports
    - Final analysis of Design - Matanzas Crk Dam..pdf
    - matanzas 1962-2-2 documents ES change from plan.pdf
- O&M Agreement
    - ca00794__O&M Agreement_Matanzas Creek Dam.pdf
- Specifications
    - Matanzas crk rsrvr specs 2.pdf
    - SCFCD_StandardSpecifications_1959.pdf
    - SCFCD_StandardSpecifications_1960revised.pdf
- zMiscellaneous
    - National Inventory of Dams(NID) data.png
    - SCS Agrmntsd-Matanzas Rsrvr.pdf

General Project Info

- NRCS Watershed Program References
    - NWPH04_2014.pdf
    - NWPM__4th_Ed_Amendment_1_January_2015.pdf
    - Watershed_Program_Guide.pdf
- Agreement&SOW_A01 12FPC320F0273.pdf

Geology and Geotechnical

- Sedimentation
    - Sediment Removal
        - 2017_MatanzasCK_Reservoir_SedRemovalDwgs.pdf
        - 2018_MatanzasCK_Reservoir_SedRemovalDwgs.pdf
        - 2019_MatanzasCK_Reservoir_SedRemovalDwgs.pdf
        - Matanzas_SedRemoval_2006_PlanSet.pdf
        - MatanzasCkRes_CNDDB.pdf
        - MatanzasCkRes_CNDDB_2019.pdf
        - matanzaresIS_revised.pdf
        - SedimentRemovalDatabase_Extract.docx
    - 643.1_Matanzas Creek Reservoir Sediment Assessment.pdf
    - 643_Assessment of Sedimentation Matanzas.pdf
    - 1983 res sed survey matanzas.pdf
    - Matanzas Reservoir Sediment Study 1984.pdf
- zMiscellaneous
    - 113_Soil Engineering Consultation.pdf
    - 327_Geotechnical Feasibility Study for Culvert Modification.pdf
    - 589_Soil Stability Analysis.pdf
    - matanzas 1959 analysis of prelim design and geol studies.pdf
    - Matanzas 1959 perm tests.pdf
    - Matanzas 1960 supplemental boreholes 30-36 SM ps_es.pdf
    - Matanzas bore logs July 24 1963-7-24.pdf
    - Matanzas July 5 1963 memos regarding left abutment sand issue.pdf
    - Matanzas Rsrvr-Materials tsts during construct..pdf
    - Matanzas SM borrow 1958.pdf
    - Material Certs - Matanzas Rsrvr.pdf
    - Soils tst & field logs - Matanzas Rervr.pdf

GIS

- Web Links for GIS Data in Sonoma County.docx

Hydraulics and Hydrology

- 2016 Dam Assessment_HDR Kleinfelder
    - Matanzas Creek Dam Assessment_FINAL_Submittal_04272016.pdf
    - Matanzas_NRCSmodels_SITES_HMS_20210205.zip
- 2017 SRC H&H Modeling Reports
    - ESA_SRC_HydrologicModelCalibration_Memo.pdf
    - SRC_HECRAS_ClimateAdaptation.zip
        - (HEC-RAS model files)
    - SRC_HMS_ClimateAdaptationPlan.zip
        - (HEC-HMS model files)
    - SRC_Hydraulic_TechnicalReport_FINAL_clean.pdf
    - SRC_Hydrolofy_TechnicalReport_FINAL_clean.pdf

- CA NRCS Rainfall Distributions
    - 6 files for CA Rainfall Distributios
    - Email from NRCS explaining the data
- NRCS Spreadsheets
    - Evaluation of Potential Rehabilitation Projects.xlsx
    - PAR Computation Worksheet.xlsx
- SCWA Breach Inundation Mapping
    - GeospatialFiles_Matanzas.zip
        - Matanzas_1ft_InundationBoundary.shp
        - Matanzas_Arrival Time.tif
        - Matanzas_MaxDepth.tif
        - Matanzas_MaxVelocity.tif
    - Matanzas_DamBreach_RAS.zip
        - (HEC-RAS files for dam breach model)
    - MatanzasCreekDam_DamInundation_MapPacket_20200602.pdf
    - MatanzasCreekDam_DamInundation_TechMemo_FINAL.pdf
- SCWA SITES Files.zip
    - FBH&SDH_06hrPMP_Exist_Asbuilt.D2C
    - FBH&SDH_06hrPMP_Future_Asbuilt.D2C
    - FBH&SDH_72hrPMP_Exist_Asbuilt.D2C
    - FBH&SDH_72hrPMP_Future_Asbuilt.D2C
    - PSH_Exist_Asbuilt.D2C
    - PSH_Future_Asbuilt.D2C
    - PSH_Future_Modified.D2C
    - SUMMARY.IDE
- Watershed Plan
    - ca00794__Watershed Plan_Matanzas Creek Dam.pdf
    - Central-Sonoma-Watershed_1958.pdf

Survey

- Survey Data from County
    - Matanzas Rec Bndy.dwg
    - MatanzasCtl.83_88.kmz
    - MatanzasCtl_27_29.txt
    - MatanzasCtl_83_88.txt
    - SCWA – Matanzas Reservoir Control 08.21.2020

Appendix B. Datum Shift – NAVD88

NGS Coordinate Conversion and Transformation Tool (NCAT)

National Geodetic Survey

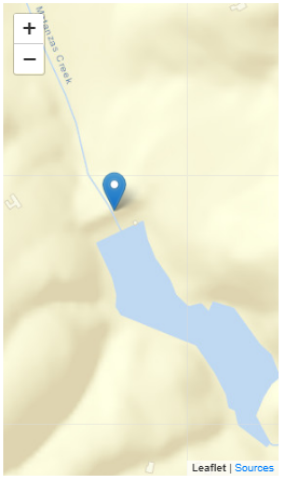
NGS Home | About NGS | Data & Imagery | Tools | Surveys | Science & Education | Search

Single Point Conversion | Multipoint Conversion | Web services | Downloads | About Conversion Tool

Convert/Transform from: Horizontal | Horizontal+height | XYZ

Select the type of horizontal coordinate: Geodetic lat-long | SPC | UTM | USNG

Select a height: Ellipsoidal | Orthometric



Enter lat-lon in decimal degrees

Lat 38.4056316452

Lon -122.6529818773

or degrees-minutes-seconds

Lat N 38-24-20.27392

Lon W 122-39-10.73476

or drag map marker to a location of interest

Input reference frame (historically called 'horizontal datum') NAD27

Output reference frame (historically called 'horizontal datum') NAD83(2011)

Don't see a reference frame in the list?Click here *to learn more.*

Orthometric Height (m) 0.000

Input geopotential datum (historically called 'vertical datum') NGVD29

Output geopotential datum (historically called 'vertical datum') NAVD88

SPC zone Auto Pick (default zone)

Submit

Export Results to

Click blue bar(s) to expand/collapse

Transformed Coordinate

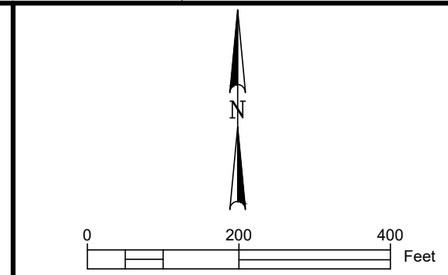
Input Coordinate		Output Coordinate		Total Change + Uncertainty	
Latitude	N38° 24' 20.27392" N382420.27392 38.4056316452	Latitude	N38° 24' 19.97275" N382419.97275 38.4055479869	Latitude	-0.30117" ±0.006061" (-9.286 m ±0.1869 m)*
Longitude	E237° 20' 49.26524" W1223910.73476 -122.6529818773	Longitude	E237° 20' 45.30148" W1223914.69852 -122.6540829218	Longitude	-3.96376" ±0.006702" (-96.172 m ±0.1626 m)*
Ellipsoid Height (m)	Not given	Ellipsoid Height (m)	Not given	Ellipsoid Height	Not given
Orthometric Height (m)	0.000	Orthometric Height (m)	0.887	Orthometric Height	0.887 m ±0.020 m
Reference Frame	NAD27	Reference Frame	NAD83(2011)		
Geopotential Datum	NGVD29	Geopotential Datum	NAVD88		

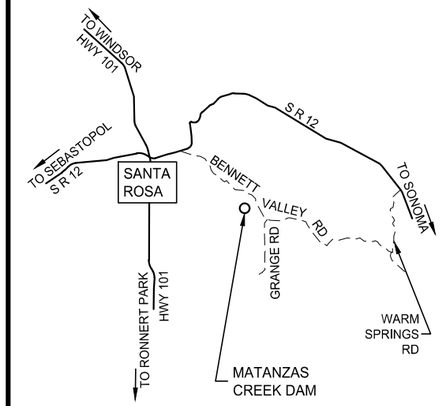
*Approximate value to aid interpretation and not an actual distance. See **TM NOS NGS 82** for more details.

Appendix C. Exhibits

C.1. Topographic Survey Exhibit







LOCATION OF ELEV.	AS-BUILT	JAN 2021 FIELD SURVEY
DAM CREST	427.63	---[1]
DAM CREST CAMBER	---[2]	428.2
AUXILIARY SPILLWAY CREST	412.63	---
PRINCIPAL SPILLWAY CREST	377.63	---[3]
LOW LEVEL OUTLET INVERT	353.43	354.5

[1] UNABLE TO SURVEY DUE TO CAMBER COVER (SEE AS-BUILT DRAWINGS)

[2] ELEVATION NOT SHOWN ON AS-BUILT DRAWINGS

[3] PRINCIPAL SPILLWAY CREST NOT ACCESSIBLE DURING SURVEY

NOTES:

1. ALL ELEVATIONS ARE REPORTED IN THE NAVD 88 DATUM.
2. NGVD 29 TO NAVD 88 DATUM SHIFT = +2.63 FT

NRCS

USDA United States Department of Agriculture

Natural Resources Conservation Service

THIS PROJECT IS PARTIALLY FUNDED BY NRCS THROUGH THE EWP PROGRAM

REVISIONS

NO.	DATE	REMARKS

UPDATED: 3/18/2021
PLOTTED: 6/7/2021

DWG NAME: H:\JD\Proj\2006-048\dwg\C-101.dwg

SCALE: 1" = 200'

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PROJECT DESIGN ENGINEER DATE
APPROVAL RECOMM.
APPROVED
QUALITY MANAGEMENT REVIEW DATE

NATURAL RESOURCES CONSERVATIOIN SERVICE

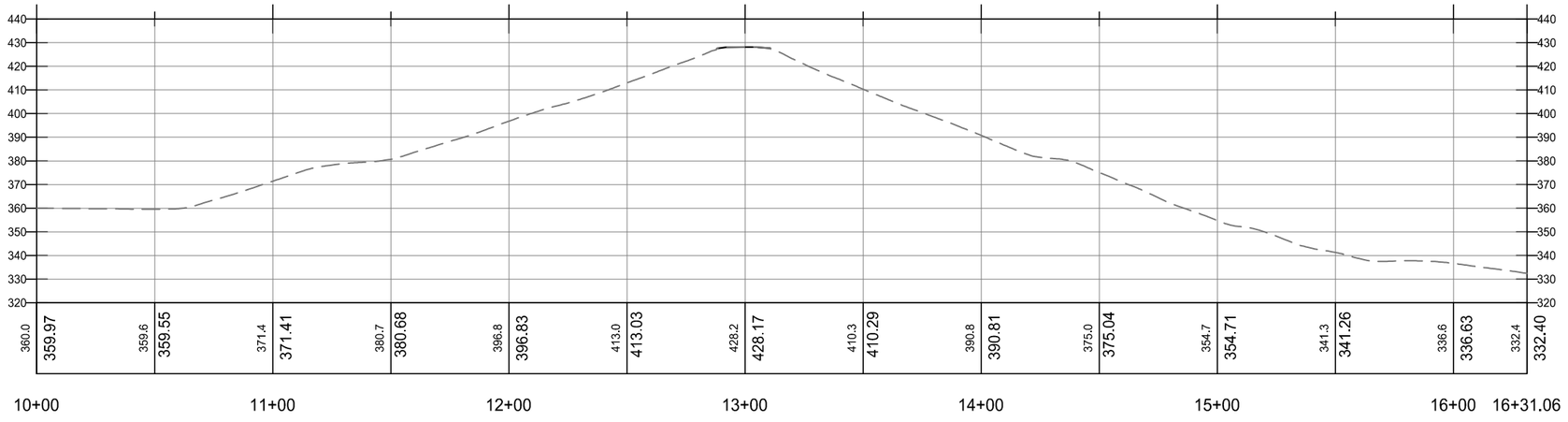
MATANZAS CREEK DAM

TOPOGRAPHICAL SURVEY EXHIBIT - DAM SITE

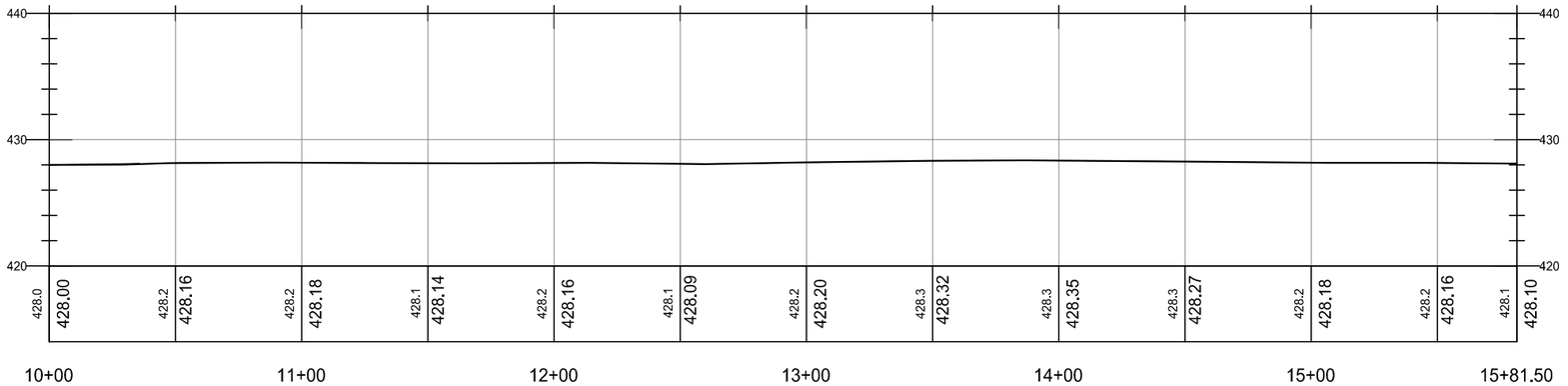
PROJECT NUMBER: 2006-048

SONOMA COUNTY

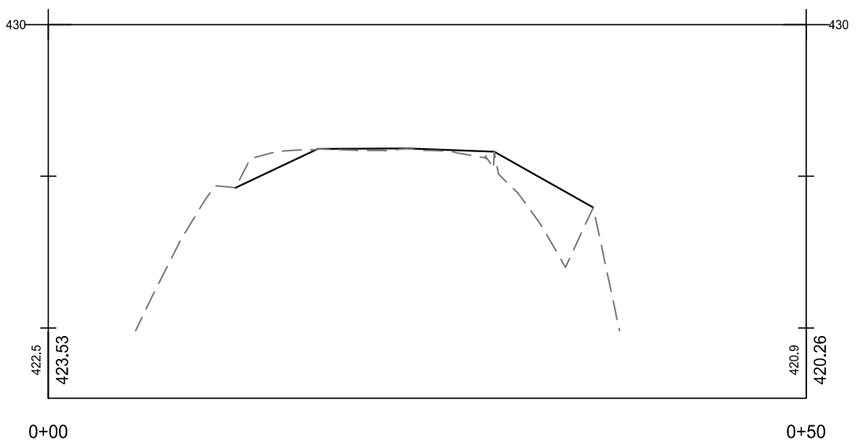
SHEET NO. EX-01



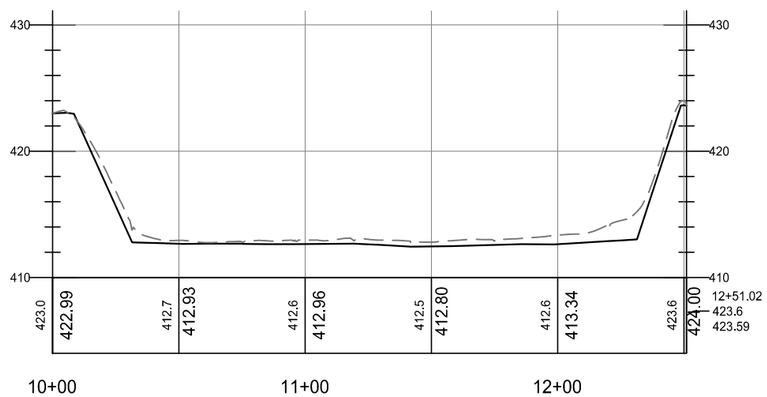
SECTION A-A
PROFILE OF DAM EMBANKMENT



SECTION B-B
DAM CREST



SECTION C-C
DAM CREST CROSS SECTION



SECTION D-D
AUXILIARY SPILLWAY CREST
(TOP OF CONCRETE CUTOFF WALL)

KEY

EXISTING GROUND
(JAN. 2021 LIDAR)

EXISTING GROUND
(JAN. 2021 FIELD SURVEY)

SCALE:

SECTION A-A
HORIZONTAL: 1"=60'
VERTICAL: 1"=60'

SECTIONS B-B, AND D-D
HORIZONTAL: 1"=60'
VERTICAL: 1"=12'

SECTION C-C
HORIZONTAL: 1"=10'
VERTICAL: 1"=2'

NOTES:
1. ALL ELEVATIONS ARE REPORTED IN THE NAVD 88 DATUM.

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Natural Resources Conservation Service

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REVISIONS

NO.	DATE	REMARKS

UPDATED: 3/18/2021
PLOTTED: 6/7/2021

DWG NAME: H:\JD\Proj\2006-048\dwg\C-101.dwg

SCALE: VARIES

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1.800.748.5275 www.jonesanddemille.com

APPROVAL RECOMM: PROJECT DESIGN ENGINEER DATE
APPROVED QUALITY MANAGEMENT REVIEW DATE

NATURAL RESOURCES CONSERVATIOIN SERVICE

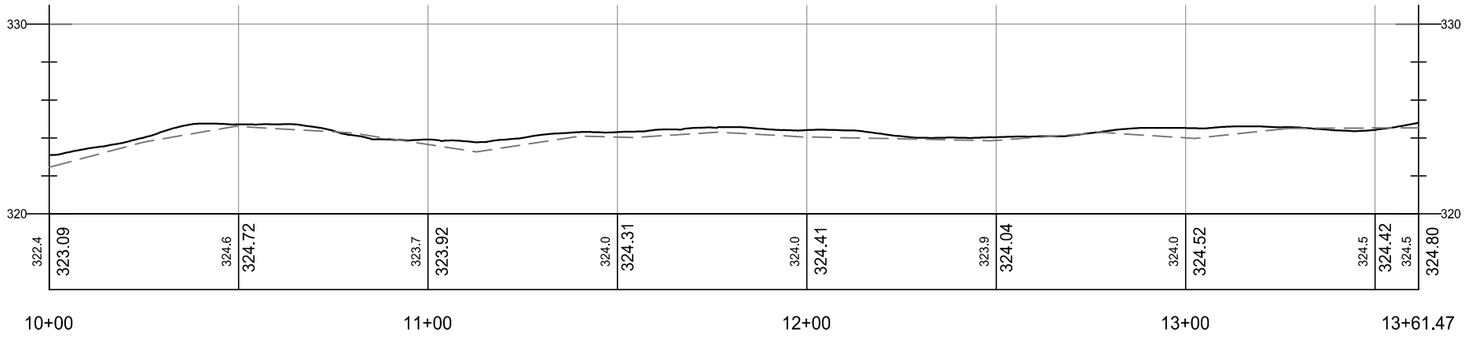
MATANZAS CREEK DAM

TOPOGRAPHICAL SURVEY EXHIBITS - DAM SECTIONS

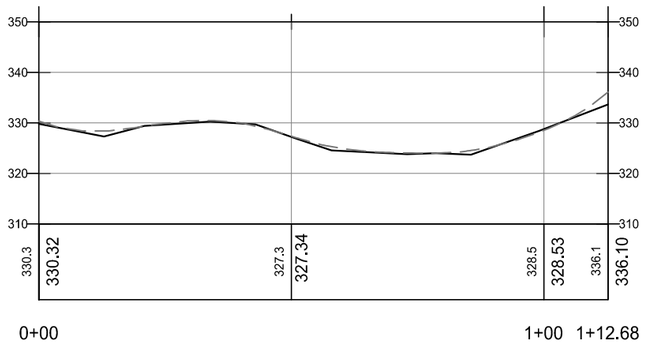
PROJECT NUMBER: 2006-048

SONOMA
COUNTY

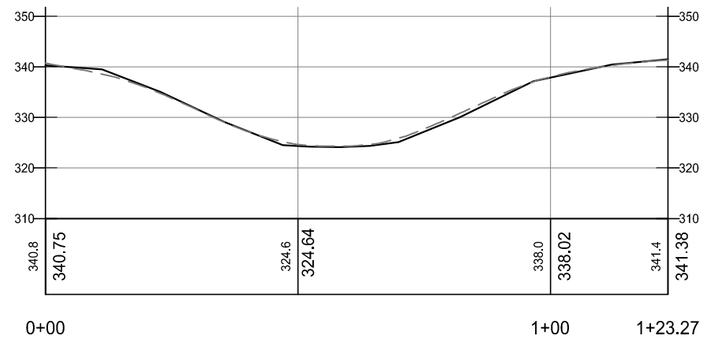
SHEET NO. EX-02



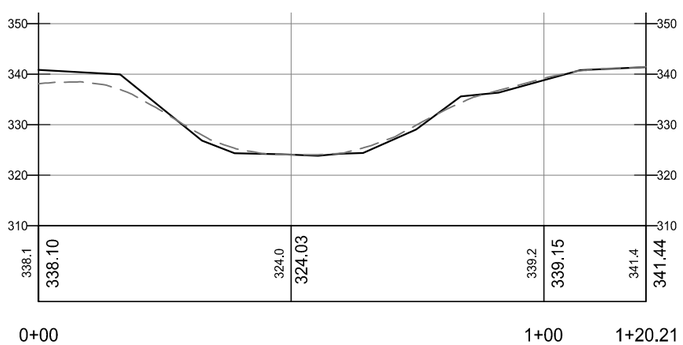
MANTANZAS CREEK PROFILE
(DOWNSTREAM OF DAM)



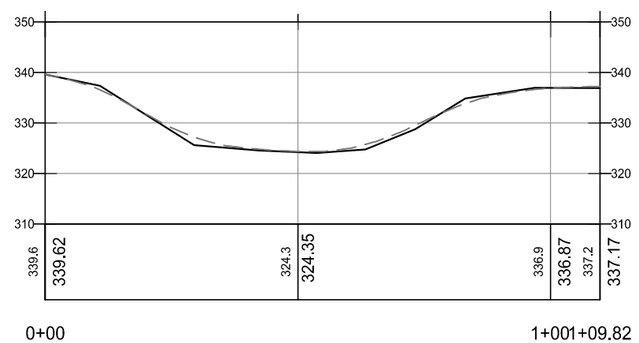
SECTION E-E
STA. 10+25



SECTION F-F
STA. 11+40



SECTION G-G
STA. 12+48.4



SECTION H-H
STA. 13+61.5

KEY

EXISTING GROUND
(JAN 2021 LIDAR)

EXISTING GROUND
(JAN 2021 FIELD SURVEY)

SCALE:

MATANZAS CREEK PROFILE
HORIZONTAL: 1"=40'
VERTICAL: 1"=8'

SECTIONS E-E, F-F, G-G, AND H-H
HORIZONTAL: 1"=30'
VERTICAL: 1"=30'

NOTES:
1. ALL ELEVATIONS ARE REPORTED IN THE NAVD 88 DATUM.

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Natural Resources Conservation Service

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NO.	DATE	REMARKS
		REVISIONS

UPDATED: 3/18/2021
PLOTTED: 6/7/2021

SCALE: VARIES
DWG NAME: H:\JD\Proj\2006-048\dwg\C-101.dwg

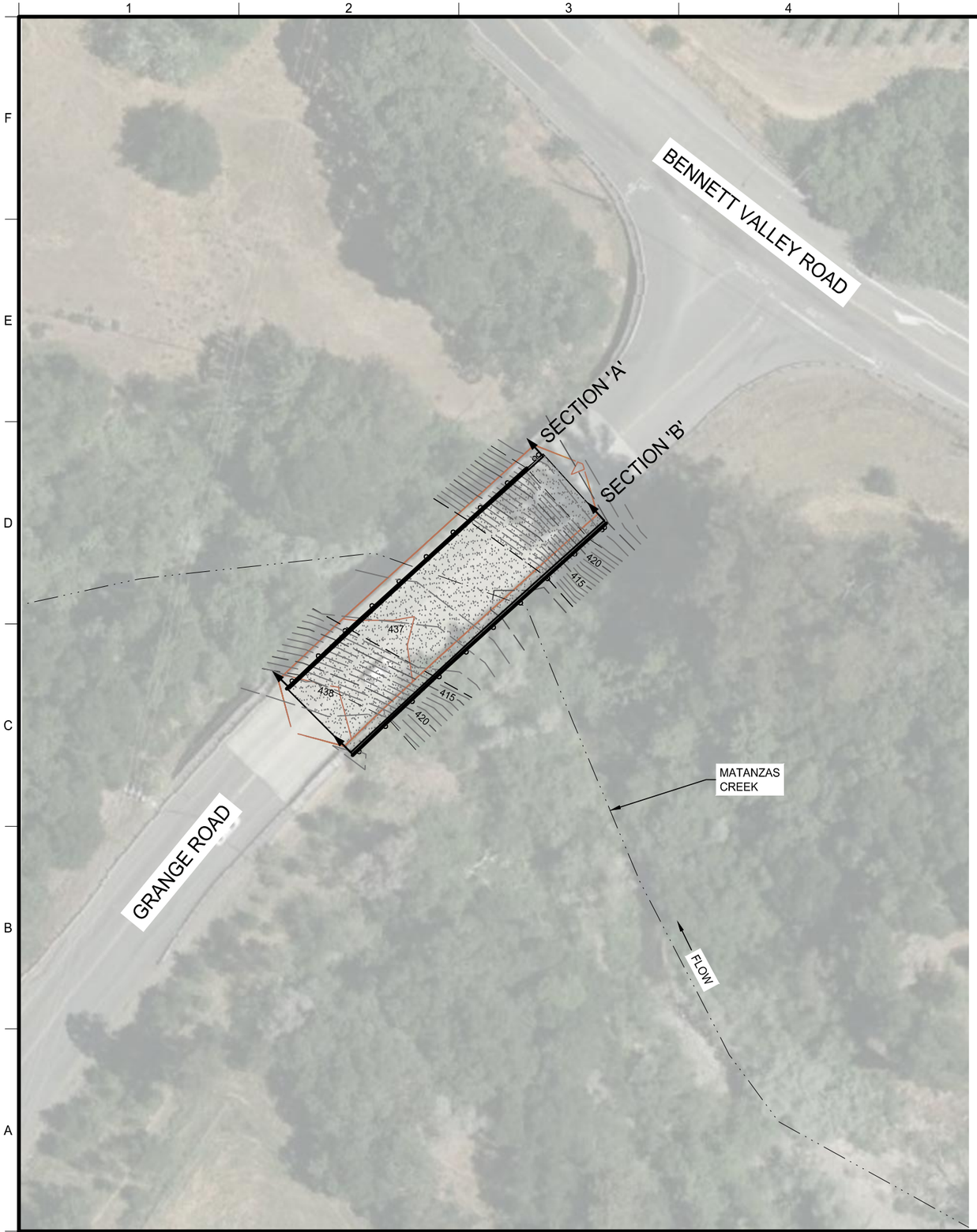
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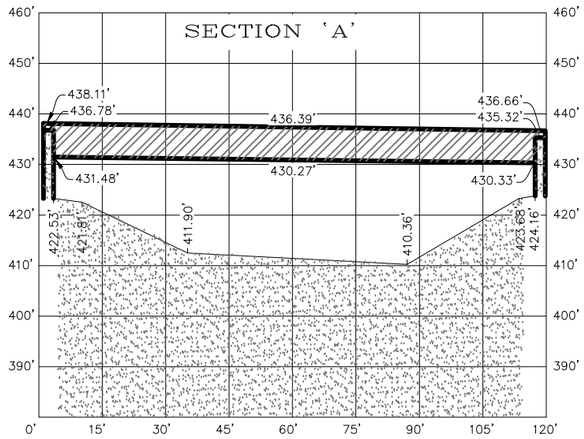
APPROVAL RECOMM. — PROJECT DESIGN ENGINEER — DATE
APPROVED — QUALITY MANAGEMENT REVIEW — DATE

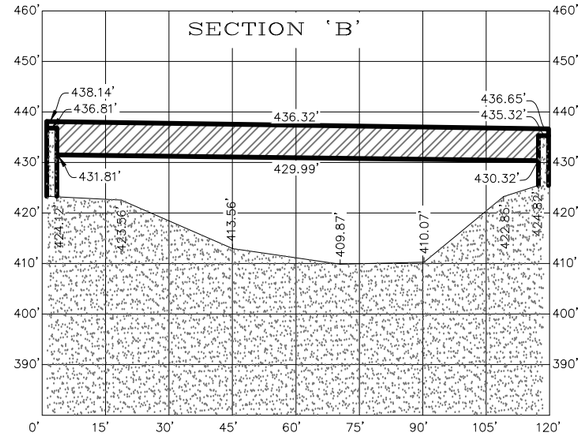
NATURAL RESOURCES CONSERVATIOIN SERVICE
MATANZAS CREEK DAM
TOPOGRAPHICAL SURVEY EXHIBITS - CHANNEL SECTIONS
PROJECT NUMBER: 2006-048

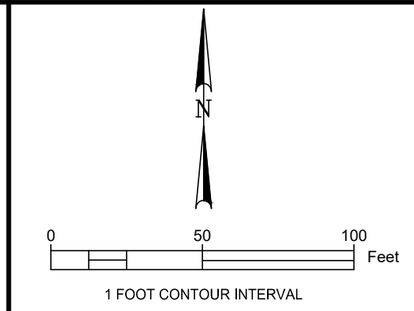
SONOMA
COUNTY

SHEET NO. EX-03

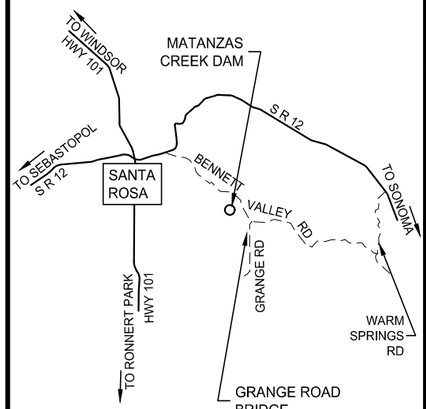








1 FOOT CONTOUR INTERVAL



NOTES:
1. ALL ELEVATIONS ARE REPORTED IN THE NAVD 88 DATUM.
2. GRANGE ROAD BRIDGE IS LOCATED UPSTREAM OF MATANZAS DAM.

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USDA United States Department of Agriculture
Natural Resources Conservation Service

THIS PROJECT IS PARTIALLY FUNDED BY NRCS THROUGH THE EWP PROGRAM

NO.	DATE	REVISIONS	REMARKS

UPDATED: 3/18/2021
PLOTTED: 6/7/2021
DWG NAME: H:\JD\Proj\2006-048\dwg\C-101.dwg
SCALE: 1" = 50'

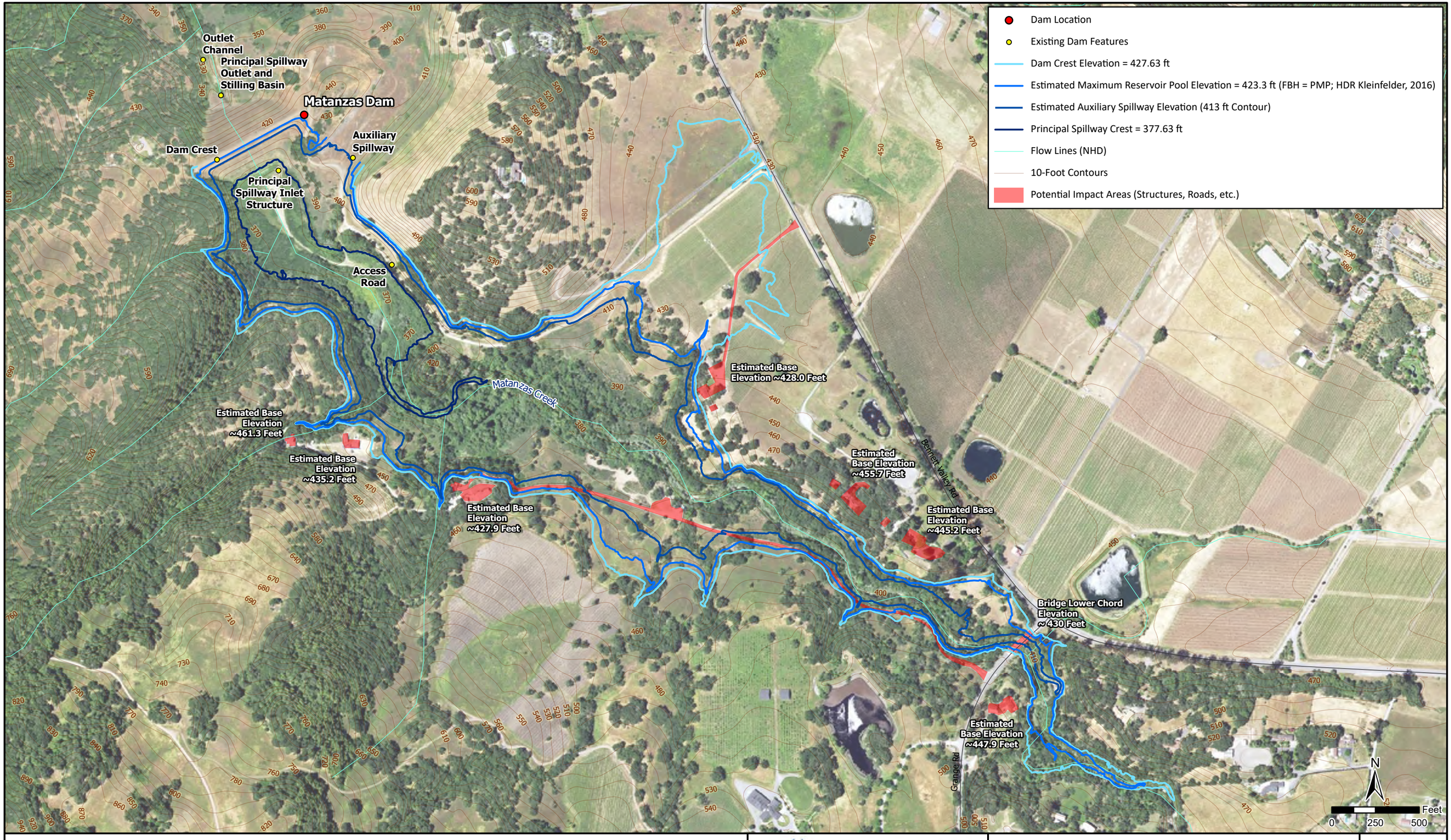
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PROJECT DESIGN ENGINEER DATE
APPROVAL RECOMM. APPROVED
QUALITY MANAGEMENT REVIEW DATE

NATURAL RESOURCES CONSERVATIOIN SERVICE
MATANZAS CREEK DAM
TOPOG. SURVEY EXHIBITS - UPSTREAM BRIDGE SITE
PROJECT NUMBER: 2006-048

SONOMA
COUNTY
SHEET NO. EX-04

C.2. Potential Upstream Impact Areas



Jones & DeMille Engineering

- Shaping the Quality of Life -

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Natural Resource Conservation Service (NRCS)

Matanzas Creek Dam
Potential Upstream Impact Areas

Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Water\2006-048_Water.aprx - Exh04 Potential Upstream Impact

Project Number: 2006-048 | Drawn by: JWW 03-21 | Last Edit: 06/07/2021

Sonoma County

Scale: 1" = 500'

4

Appendix D. Dam Inspection Reports and Photographs

U.S. DEPARTMENT OF AGRICULTURE Natural Resources Conservation Service	**DAM FIELD INSPECTION CHECKLIST**	Rev 05/2019

State	California	Site Number		Inspection Date	12-Jan-21
Watershed	Matanzas Creek	NID #	CA00794		
County	Sonoma	Hazard Class	High	Hazard Class Still Accurate	Yes
Service Center		Purpose(s) of Dam	Flood Control		
Owner	NRCS/Sonoma County Water Agency	Weather	Cloudy with occasional light rain. 45-50 °F		
Sponsor with Operation and Maintenance Responsibility		Sonoma County Water Agency			
Address	404 Aviation Boulevard, Santa Rosa, CA 95403				
Latitude	38.4063 N	Longitude	122.652 W		

A hazard classification that is no longer accurate or unknown (can't tell) need explanation in Remarks section after checklist.

"YES" responses need explanation added to "Remarks" section. (i.e.: What? Where? Extent?)

"NO" responses indicate problems not observed during inspection.

Non-applicable items should be noted by NA.

ITEM	Y	N	N/A	REMARKS
1. General Condition				
a. Alterations to Dam?		X		
b. Recent high water marks?		X		Elevation[1/]
c. Fencing adequate? Are gates open?		X		
d. Grass Cover adequate?		X		
e. Development in flood pool?		X		
f. Development in downstream floodplain?	X			Santa Rosa and other development downstream
g. Development in upstream watershed?		X		
h. Easement Violations?		X		
2. Dam Crest earthen__X__ vegetated___ concrete___ paved___ gravel___ other (please specify):				
a. Condition of surface material				Good condition, little to no vegetation (gravel road surface)
b. Erosion/rutting evident?	X			One minor depression at approx. middle of embankment
c. Trees/woody vegetation?		X		
d. Rodent holes?		X		
e. Settlement, obstructions or other concerns?		X		
3. Upstream Slope				
a. Erosion?	X			Minor erosion on left groin; overall slope in good condition
b. Cracks, settlements or bulges?		X		
c. Seepage or boils?		X		Estimated gpm
d. Distinct vegetation change?		X		Elevation[1/]
e. Vehicle ruts or animal trails?	X			Minor ruts; possibly from mower or grazing goats
f. Trees?		X		
g. Rodent holes?	X			A few small animal burrows were observed
h. Adequate and sound riprap?		X		No riprap on face, just vegetation; sporadic riprap located in groins

4. Downstream Slope					
a. Erosion?		X			
b. Cracks, settlements, & bulges?	X			No sig. issues; but visual slope change in embankment (see note 1)	
c. Seepage or boils?		X		Estimated gpm	
d. Distinct vegetation change?		X		Elevation[1/]	
e. Vehicle ruts or animal trails?	X			Minor ruts; possibly from mower or grazing goats	
f. Trees?		X			
g. Rodent holes?	X			Few small animal burrows seen, gopher mounds near left abutment	
h. Drains or wells flowing?		X		Estimated gpm	
i. Adequate and sound riprap?		X		No riprap on face, just vegetation; sporadic riprap located in groins	
5. PS Intake Structure - Concrete___ Metal___				Water Surface Elevation[1/] As-built PS Crest =377.9 ft	
a. Spalling, cracking, & scaling?	X			Minor spalling on outside of structure (see note 2)	
b. Exposed reinforcement?	X			A few locations of exposed rebar (see note 2)	
c. Corrosion present?	X			Minor corrosion near exposed rebar (see note 2)	
d. Manhole cover present?		X		Manhole located on top of structure; access ladder in good cond.	
e. Leakage?			X	Estimated gpm	
f. Trash rack adequate?		X		One bar for low level inlet trash rack is bent, but is acceptable	
g. Inlet or trash rack obstructed?	X			Minor woody debris	
h. Drawdown operative? closed___ open___X			X	Did not operate during inspection; in open position	
i. Ladder intact?		X		Good condition, no apparent issues	
j. Pedestal securely fastened?			X		
k. Stem bent?		X			
l. Stem guides operational?			X	Did not operate during inspection	
m. Stem handwheel present?	X			No handwheel attached to stem	
n. Do metal parts require painting?		X			
o. Was gate determined not operational			X	Date gate last operated:	Cycling noted in 2018 CA DSOD inspectio
p. Has inlet been modified to alter water surface?		X			
q. Is there structural movement?		X			
r. Is access door missing?		X			
5. Abutment Contacts					
a. Erosion, cracks, or slips?	X			Minor erosion on groins; sporadic riprap observed	
b. Seepage?		X		Estimated gpm	
c. Gutters intact?			X		
d. Trees encroaching?		X			
6. Auxiliary Spillway					
a. Obstructions?		X			
b. Erosion, cracks, or slips?		X			
c. Rodent holes?	X			A few rodent burrows were observed.	
d. Roads, vehicle ruts, or animal trails?		X			
e. Low areas or ditches?	X			Channel is large, small natural drainage channels have formed	
f. Seepage?		X		Estimated gpm	

7. PSW Conduit concrete___X metal___				Tailwater Elevation[1/]/Flow
a. Spalling, cracking, &scaling?			X	Conduit was not inspected; CCTV inspection to be provided at
b. Exposed reinforcement?			X	later date.
c. Joints displaced or offset?			X	
d. Joint material lost?			X	
e. Leakage?			X	
f. Conduit misaligned?			X	
g. Was pipe inspected internally?			X	
8. Stilling Basin__ Plunge Pool__				
a. Spalling, cracking, &scaling?		X		
b. Exposed reinforcement?		X		
c. Joints displaced or offset?	X			Some joints have expanded approx. one inch over time
d. Joint material lost?		X		
e. Joints leak?		X		No water flowing to observe
f. Dissipater deteriorating?			X	Beneath water pool; no observation made
g. Dissipater clean of debris?			X	Beneath water pool; no observation made
h. Toe drains visible?	X			Drain riprap shown, but outfall of 8-inch perforated pipe not found
i. Toe drains flowing?		X		Estimated gpm
j. Toe drain animal guards in place?			X	Outfall of 8-inch perforated pipe not found
k. Toe drains damaged?		X		
l. Earth erosion?		X		
m. Adequate and sound riprap?	X			Riprap needed at stilling basin wingwalls (see note 4)
9. Principal Spillway Release Channel				
a. Does scour hole appear unstable?		X		
b. Any boils observed?		X		
c. Is riprap inadequate?	X			Riprap needed at stilling basin wingwalls (see note 4)
d. Any seepage observed?		X		
e. Is conduit outlet submerged?		X		
f. Is conduit outlet not properly supported?		X		
g. Is outlet channel obstructed?		X		
h. Is outlet channel degrading?		X		
i. Is foundation drain submerged?		X		
j. Is foundation drain rodent barrier missing?			X	Outfall of 8-inch perforated pipe not found
k. Is foundation drain not functional?		X		

10. Reservoir at ___Above ___X Below ___Normal Pool / Water Surface Elevation[1/] _____Reservoir was empty				
a. Buildings in flood pool?	X			Camper trailer observed upstream of dam
b. Slips or erosion on banks?		X		
c. Debris?		X		
d. Unsecured boats/docks?			X	
e. Sediment deposits?	X			Deposited sediment observed; removed frequently by SCWA
11. Instrumentation				
a. Structure instrumented?		X		Level sensor installed at low level inlet (see note 5)
b. Monitoring performed?		X		Level sensor installed at low level inlet (see note 5)
12. Development				
a. New development upstream of dam?		X		
b. New development downstream of dam?		X		
c. EAP plan and mapping adequate?			X	

[1/] Datum used for Elevations: NAVD 88

REMARKS: 1. DS embankment slope changes slope (appears across the entire width of dam). Doesn't appear to be from movement since it is very uniform. Possibly from construction methods.
2. Overall, concrete appears to be in good condition. There are a few places of spalling, exposed rebar, and concrete erosion (see photos a points 37 and 38 on photo map).
3. Auxiliary spillway channel largely consists of tall grasses; brushes and trees in lower portion of the channel. Natural drainage channels were observed in the mid to lower portions of spillway. Accumulated sediment on right side of spillway crest.
4. Various sizes of riprap observed on left wingwall of stilling basin. Scour observed on both wingwalls. Recommend design and installation of riprap for both wing walls. Also, slough and steep slopes observed on right bank above right wingwall.
5. Level sensor located at low-level inlet. Conduit runs up upstream embankment slope to a radio tower which transmits data to SCWA. Staff gauges located on upstream embankment slope near the intake structure. "USGS Surge Sensor" was observed on one staff gauge and on a tree trunk located near the right abutment.
6. Tree growing and sediment located around intake structure. North slope near intake appears to be eroding; possible steep slope from excavation.
7. Two water marks observed on stilling basin walls: 45" and 88" below top of wall elevation (survey shot showed elevation is 332.66')

Present During Inspection:

NAME	TITLE	ORGANIZATION
Ricky Anderson	Hydraulic Engineer	Jones & DeMille Engineering
Hayden Coombs	Hydraulic Engineer	Jones & DeMille Engineering
Ben Aldridge	Geo-Engineer	AECOM

ACTIONS NEEDED: identify items by priority:
Low (next 12 months); High (as soon as possible). Indicate date assistance requested; technical or financial.

Low:

Design and installation of riprap for stilling basin wingwalls (Low to High priority)

Repair expanding joints at stilling basin and spalling concrete at the principal spillway intake structure

Remove tree growing near principal intake structure, remove sediment and debris around structure annually

Monitor animal burrow activity on embankment and auxiliary spillway. If it increases, control measures may be needed.

O&M Non-Compliance Issues

	1. Human Safety (such as missing access cover(s).		7. Drain pipe problems.
	2. Trash rack or parts of trash rack missing.		8. Severe embankment erosion.
	3. Trash rack debris blockage.		9. Flood pool storage alteration.
	4. Principal spillway clogged.		10. Severe tailwater issues.
	5. Severe erosion of principal spillway outlet.		11. Auxiliary spillway blockage (usually fence or trees in spillway).
	6. Auxiliary spillway without complete dense permanent vegetative cover in the control or exit sections (lack of vegetation or irregularity such as a road in the control or exit section).		12. Severe woody vegetative growth on principal spillwa outlet or along permanent pool of dam.

Documents included (circled as appropriate):

This checklist	Y	N	N/A	
Pictures	Y	N	N/A	See "Matanzas Creek Dam Site Field Photo Locations" and photos
Surveys	Y	N	N/A	Topo to be provided in TM001 - Existing Conditions Assessment Repor
Other (Please specify)	Y	N	N/A	
Other (Please specify)	Y	N	N/A	
Other (Please specify)	Y	N	N/A	

Dam Inspected by:

ENGINEER (NRCS or OTHER): Ricky Anderson PROFESSIONAL ENGINEER SEAL (IF OTHER)

DATE: 12-Jan-21

Inspection Acknowledged by:

SPONSOR REPRESENTATIVE: _____

TITLE: _____

DATE: _____

Checklist Reviewed and Approved by:

STATE CONSERVATION ENGINEER: _____ PROFESSIONAL ENGINEER SEAL

DATE: _____

DISTRIBUTION:
Original - State Conservation Engineer (with documentary photos and surveys)
Copies - Sponsor or Owner, Field Office, Responsible Resource Engineer, Area Engineer, ASTC-FO

AECOM

EARTH DAM INSPECTION CHECKLIST

Client: Natural Resources Conservation Service
Project: Matanzas Creek Dam (AECOM No. 60647670)

DAM INFORMATION:

Name of Dam: Matanzas Creek Dam

Year Built: 1964

Location: Outside Santa Rosa, CA

Type of Dam: Earth Fill

Reservoir Size (acre-ft): 2,225

Height of Dam: 95 feet

Dam Owner: NRCS/Sonoma County Water Agency

Dam Operator: Sonoma County Water Agency

INSPECTION INFORMATION:

Date of Inspection: January 12, 2021

Weather: Cloudy with occasional light rain, ~45-50°F

Pool Level at Inspection: Dry

Tailwater Level at Inspection: Dry (except for small pool in stilling basin)

PERSONS PRESENT AT INSPECTION:

Name	Title/Position	Representing
Ben Aldridge	Geo-Engineer	AECOM
Ricky Anderson	Hydraulic Engineer	Jones & DeMille Engineering
Hayden Coombs	Hydraulic Engineer	Jones & DeMille Engineering

OTHER NOTES:

This inspection log is DRAFT and does not include any recommendations

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
EMBANKMENT: CREST					
1	Surface Cracking	None observed	☐	☐	☐
2	Sinkhole, Animal Burrow	None observed	☐	☐	☐
3	Low Area(s)	One minor depression and possible downslope expression observed at approximately the middle of the embankment. See Photo 1.	☐	☐	☐
4	Horizontal Alignment	Straight	☐	☐	☐
5	Ruts and/or Puddles	None observed (see low areas above)	☐	☐	☐
6	Vegetation Condition	Little to none (gravel road surface)	☐	☐	☐
7	Warning Signs	No signs present	☐	☐	☐
8	Access Road	Gravel road seemed adequate for general traffic	☐	☐	☐

Additional Comments (Refer to item number if applicable):

No additional comments. See Photo 2 for overview of embankment crest.

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
EMBANKMENT: UPSTREAM FACE					
10	Slide, Slough, Scarp	None observed	☐	☐	☐
11	Slope Protection	None present except sporadically in groins. It appears the rock placed in the groins may be to limit erosion (see abutment contact discussion below)	☐	☐	☐
12	Sinkhole, Animal Burrow	A few small animal burrows were observed (example shown in Photo 3)	☐	☐	☐
13	Emb.-Abut. Contact	Some erosion appeared to have occurred along the groin on the left abutment (see Photo 4)	☐	☐	☐
14	Erosion	No significant erosion on face of embankment. See abutment contact for discussion of erosion in left abutment groin.	☐	☐	☐
15	Vegetation Condition	Decent coverage present. Vegetation is present across the upstream face of the embankment, although the vegetation becomes less grassy and more sporadic at lower elevations (see Photo 5).	☐	☐	☐
16	Access Road	None	☐	☐	☐

Additional Comments (Refer to item number if applicable):

At lower elevations, where the embankment face is more typically subject to standing water, the soil becomes a little softer and potentially higher plasticity. In addition, high amounts of debris were observed including wood and trash. See Photo 6.

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
EMBANKMENT: DOWNSTREAM FACE					
18	Wet Area(s) (No Flow)	None observed	☐	☐	☐
19	Seepage	None observed	☐	☐	☐
20	Slide, Slough, Scarp	No significant signs of sloughing observed. Some small depressions (less than 0.5 to 1-foot deep) were observed but may be from construction/settlement instead of soil movement.	☐	☐	☐
21	Emb. - Abut. Contact	Left and right abutment groins had rock placed to potentially limit/stop erosion. On the left abutment groin there was significantly more rock placed, and erosion appeared to be minimal. See Photo 7.	☐	☐	☐
22	Sinkhole, Animal Burrow	Some small animal burrows were observed, as shown in Photo 8. In addition, some potential Gopher mounds were observed near the left abutment groin but within the embankment. See Photo 9. In most cases, these mounds were wetter and softer than the surrounding soils and sometimes showed different materials at the ground surface compared to the surrounding surface embankment material. See Photo 10.	☐	☐	☐
23	Erosion	None observed on the downstream embankment face	☐	☐	☐
24	Unusual Movement	None observed. However, it was noted that the slope flattened a little below the embankment crest and then steepened above the downstream bench. This feature continues across the entire width of the embankment and seems to likely be a feature from construction or very old since there are no signs of differential movement along the abutment contacts. See Photo 11.	☐	☐	☐
25	Vegetation Control	Good vegetation was present.	☐	☐	☐
26	Access Road	None	☐	☐	☐

Additional Comments (Refer to item number if applicable):

A tilted 2-inch standpipe was observed on the left side of the downstream bench. According to as-builts, the standpipe was placed during construction, indicating that movement may have occurred in the past. However, it is also possible that the standpipe was installed tilted or was hit by a piece of equipment or similar and became tilted at that time. See Photo 12.

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
EMBANKMENT: INSTRUMENTATION					
28	Piezometers/Observ. Wells	Potentially three 2-inch observation wells (standpipes) are present on the downstream face, closer to the left abutment. The standpipes are shown on the as-builts from 1964 and consist of a 2-inch diameter steel pipe. At the ground surface (and possibly deeper), the standpipe is attached to a railroad rail with some barbed wire fencing. Some dried grout was observed at the ground surface at one of the standpipes. See photo in discussion of downstream face conditions.	☐	☐	☐
29	Staff Gauge and Recorder	Staff gauges were observed along the upstream face of the dam near the intake structure. See Photo 13. What appeared to be a recently installed piezometer or similar water pressure sensing device was observed at the lower level outlet on the control structure, with conduit seen extending up to an antenna on the upstream face of the embankment. See Photo 14. In addition to these instruments, a 'USGS Surge Sensor' was observed attached to one of the staff gauges. It was not apparent if this unit was operational.	☐	☐	☐
30	Weirs	None, except for the one within the intake tower.	☐	☐	☐
31	Survey Monuments	None observed, although the surveyors onsite were utilizing benchmarks at the site so some are present.	☐	☐	☐
32	Drains	None observed, however as-builts show that a relief trench is present underneath the embankment, with an 8-inch perforated pipe present to convey flow. The outfall of this pipe could not be observed/was not seen.	☐	☐	☐
33	Low Flow Release	None observed	☐	☐	☐
34	Frequency of Readings	Unknown	☐	☐	☐
35	Location of Records	Unknown	☐	☐	☐

Additional Comments (Refer to item number if applicable):

None

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
DOWNSTREAM/SURROUNDING AREA					
38	Abutment Leakage	None observed	☐	☐	☐
39	Foundation Seepage	None observed	☐	☐	☐
40	Slide, Slough, Scarp	Small slumps and erosion were observed in the area around the outlet structure/stilling basin. See discussion on the outlet works for details on erosion/slumping in that area. The photo below shows erosion observed in the channel downstream of the stilling basin. See Photo 15.	☐	☐	☐
41	Drainage System	None observed	☐	☐	☐
42	Boils	None observed	☐	☐	☐
43	Wet Areas	None observed	☐	☐	☐
44	Reservoir Slopes	Not observed in detail during site visit, but no obvious signs of instability observed	☐	☐	☐
45	Access Roads	Access roads to the site and downstream area appear adequate for general use. Access to the dam is accessible with a 2-wheel drive vehicle.	☐	☐	☐
46	Security Devices	Gate to main road is locked with a standard set of padlocks. No other security was observed.	☐	☐	☐

Additional Comments (Refer to item number if applicable):

None

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
AUXILLIARY SPILLWAY					
50	Slide, Slough, Scarp	No large (greater than 1-foot deep) sloughs or slides were observed within the spillway. However, a large slough was noted above the spillway on the right side. See Photo 16.	☐	☐	☐
51	Erosion	Erosion was noted in a natural drainage feature that runs down the middle of the lower approximately ½ to ¾ of the spillway. See Photo 17.	☐	☐	☐
52	Vegetation Condition	Sometimes thick vegetation was observed within the spillway, including large trees, tall grass, and thick brush. See Photo 18.	☐	☐	☐
53	Debris	Minor amounts of debris were observed within the spillway. See example in Photo 19. A small abandoned structure was observed on the left side of the spillway, approximately halfway down, although it may be outside the flow path. See Photo 20.	☐	☐	☐
54	Sidewalls	The spillway is earthen so there are no typical sidewalls, however the sides of the spillway appear to have been graded to better transmit flows through the spillway. Along the right side, the slope appears to have been graded and curved to match the bend in the spillway, with a dike added at the end of the spillway to keep water from going into private property on that side. See Photo 21 for an example of the graded earthen 'wall'. There is a gap in the earthen 'wall' where the drainage feature mentioned in the erosion portion enters the spillway channel. The dike was well vegetated and appeared to be in relatively good condition, although some small rodent and Gopher holes were observed. See Photo 22. The left wall consists of the right abutment of the embankment. At the top of the spillway, the 'wall' is lined with riprap and what appears to be a cutoff wall can be seen. See Photo 23. Near the bottom of the spillway, the hill that makes the right abutment of the embankment extends out in front of the downstream toe of the embankment, making the left wall. See Photo 24.	☐	☐	☐
55	Channel Floor	The channel floor is earthen and in good condition. Vegetation is generally thick. Some rodent and Gopher holes were observed.	☐	☐	☐
56	Unusual Movement	No unusual movement was observed within the spillway	☐	☐	☐
57	Approach Area	The approach area consists of the gravel road that provides access to the embankment crest. No observed issues in this area.	☐	☐	☐
58	Weir or Control	No weir or control is present on the spillway	☐	☐	☐

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
59	Discharge Channel	The spillway discharges directly into the creek, roughly perpendicular to the creek.	☐	☐	☐
60	Boils	None observed	☐	☐	☐

Additional Comments (Refer to item number if applicable):

Ponded water was observed within the spillway, particularly in the upper portion of the spillway, where the ground surface is relatively level.

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
OUTLET WORKS/PRIMARY SPILLWAY					
80	Intake Structure	The intake structure appears to consist of: 1) An upper level weir that is 10'x10' and narrows to 5'x5' 2) A lower level outlet consisting of an 18" diameter pipe with a slide gate See Photo 25 for an overview photo of the intake structure. Spalling was observed around the trash racks, with some rebar exposed and showing signs of corrosion. Concrete appears in decent shape for its age, with no signs of significant cracking. See Photo 26. Small slumps/sloughing were observed on the hillside immediately adjacent to the intake tower, like due to oversteepening the slope when the reservoir was dredged. See Photo 27. Some sediment was present within the intake structure, particularly on the lower portion, where a tree was observed growing out of an opening. See Photo 28.	☐	☐	☐
81	Trashrack	Trashrack appeared to be in decent condition, except for spalling noted above. One of the bars over the lower level outlet was bent out of shape. Minor amounts of corrosion were observed on the trashrack bars.	☐	☐	☐
82	Stilling Basin	The stilling basin had water pooled at the bottom, as shown in Photo 29. In addition, erosion/sloughing was observed on the slopes near the end of the concrete stilling basin. Some attempts to place rock over the slopes appeared to have been made. See Photo 30 and 31.	☐	☐	☐
83	Primary Closure	None	☐	☐	☐
84	Secondary Closure	None	☐	☐	☐
85	Control Mechanism	Only control mechanism observed is on the lower level outlet on the intake structure.	☐	☐	☐
86	Outlet Pipe	Not observed	☐	☐	☐
87	Outlet Tower	None	☐	☐	☐

ITEM	CONDITION	COMMENTS	MONITOR	INVESTIGATE	REPAIR
88	Outlet Structure	The outlet structure appeared to be in decent condition for its age. Expansion joints did not have filling and some appeared to have expanded about and inch over time. Staining was observed on the concrete but no significant cracking was observed, although we were unable to walk onto the structure for a closer look. The wing walls ranged from 10 to 15 feet tall, dropping to a few feet tall in the middle of the chute. See Photo 31 and Photo 32.	☐	☐	☐
89	Seepage	None was observed, although a weep hole located on the right side of the chute had staining below the opening, indicating past seepage.	☐	☐	☐
90	Unusual Movement	None observed except for previously noted erosion around the stilling basin.	☐	☐	☐
91	Toe Drain	A seepage drain/filter is present underneath the embankment, with a relief trench also installed during construction. An 8-inch perforated pipe was also installed into the relief trench. The outfall of this pipe was not found during this visit. It may be buried underneath riprap and/or vegetation at the downstream toe, or the pipe may never reach the ground surface.	☐	☐	☐

Additional Comments (Refer to item number if applicable):

None

Photos



Photo 1: Minor depression observed along embankment crest, with possible upstream expression.



Photo 2: Looking across the embankment crest from the right abutment



Photo 3: Small animal burrow observed on the upstream face of the embankment



Photo 4: Erosion and rock protection along left groin on the upstream face of the embankment



Photo 5: Vegetation covering upstream slope of embankment



Photo 6: Debris on lower portion of upstream face of embankment



Photo 7: Rock protection and minor erosion along left abutment groin, downstream face of embankment



Photo 8: Small animal burrow noted on downstream face of embankment



Photo 9: Gopher mounds on the downstream face of the embankment near the left abutment contact



Photo 10: Area of Gopher mounds showing higher moisture and different material type than the surround fill material (as a note, these mounds had been dug into with the shown rock hammer prior to this photo being taken). Mounds were located on the downstream face of the embankment near the left abutment contact.



Photo 11: Observed change in slope above bench



Photo 12: 2-inch standpipes observed on downstream bench, with the standpipe in the background showing signs of tilt. Looking towards right abutment on downstream bench.



Photo 13: Staff gauges on upstream face of embankment near intake structure



Photo 14: Antenna for instrument on intake structure (likely piezometer or similar)



Photo 15: Channel immediately downstream of stilling basin



Photo 16: Slough located above the auxiliary spillway



Photo 17: Erosion in a drainage feature within the auxiliary spillway



Photo 18: View of vegetation within the lower half of the auxiliary spillway



Photo 19: Example debris within auxiliary spillway



Photo 20: Abandoned structure within a dense patch of brush on the left side of the auxiliary spillway



Photo 21: Example of earthen 'wall' along right side of auxiliary spillway (taken looking at upper portion of spillway)



Photo 22: Gopher mound and view of dike located along the right side of the auxiliary spillway, immediately before discharging to the creek



Photo 23: Riprap and cutoff wall along left wall of auxiliary spillway near the top of the spillway



Photo 24: View of end of auxiliary spillway, with left wall of spillway, right abutment of embankment, and embankment shown.



Photo 25: Overview of intake structure (facing towards upstream face of embankment)



Photo 26: Spalling and exposed rebar on intake structure around the upper level weir trash rack.



Photo 27: Minor sloughing/erosion around hillside near intake structure. Facing towards right abutment.



Photo 28: Tree observed growing out of opening in intake structure (lower level outlet in lower left corner for reference)



Photo 29: Ponded water in base of stilling basin



Photo 30: Looking upstream towards the stilling basin. Erosion and sloughing was noted on the left and right sides of the channel/stilling basin.



Photo 31: Overview of outlet structure showing wing walls, stilling basin, and erosion with some rock protection on left side of stilling basin.



Photo 32: Overview of outlet structure, showing chute and sidewalls

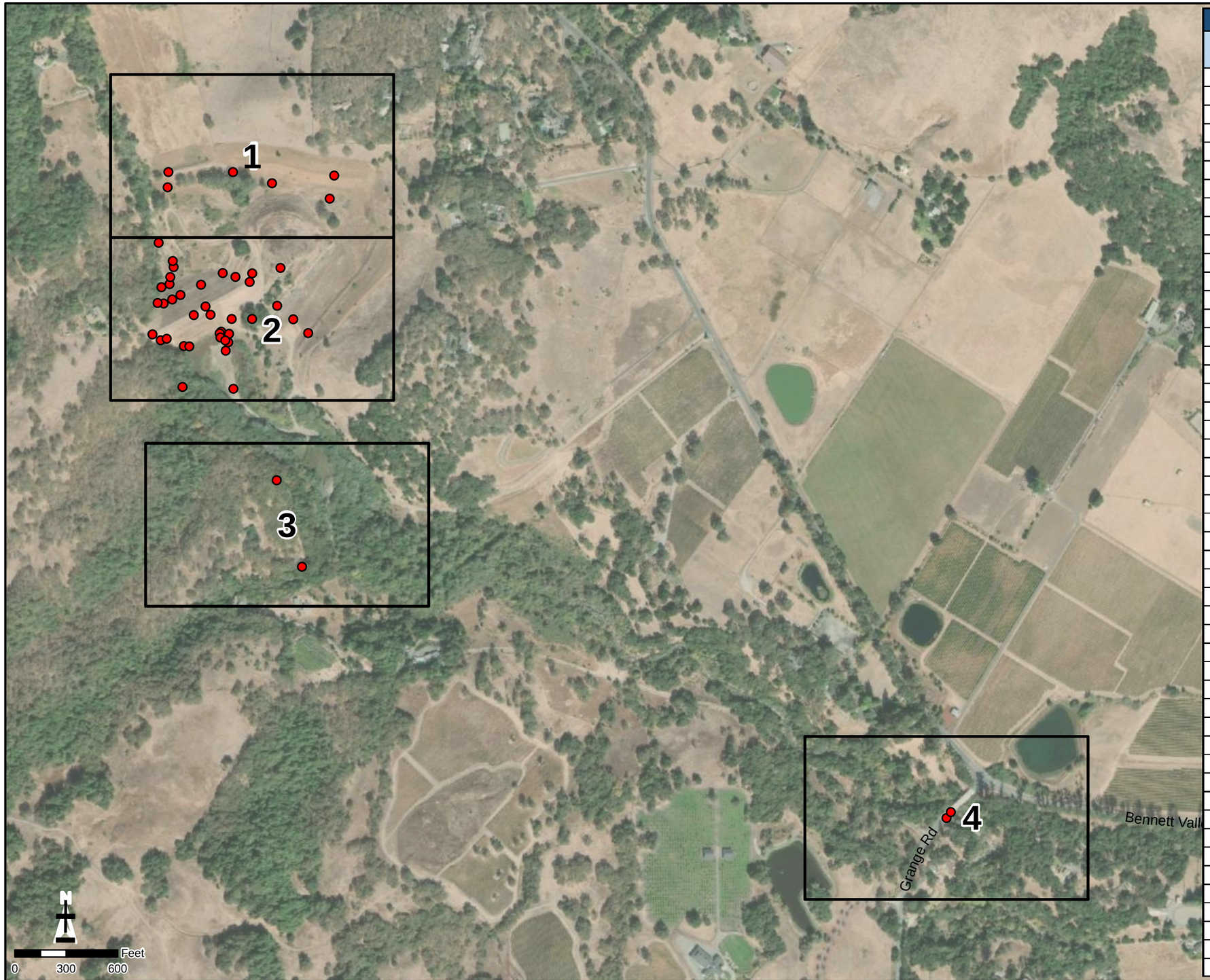


Photo Locations		
Feature Number	Photo Number(s)	Feature Description
1	1, 2, 3, 4	Dike crest, downstream auxiliary cannel
2	1, 2, 3, 4, 5, 6	Auxiliary spillway channel; 4
3	1, 2	Auxiliary spillway channel; 3
4	1, 2	Auxiliary spillway channel; 2
5	1, 2	Auxiliary spillway right channel bank
6	1, 2, 3	Auxiliary spillway channel; 1
7	1, 2, 3	Riprap near downstram toe
8	1	Standpipe #3, lower stability berm on downstream face
9	1	Downstream lower stability berm, lef groin
10	1, 2, 3	Disturbed soil, sof material
11	1, 2, 3	Downstream lef groin
12	1	Standpipe #2 on downstream face
13	1	Standpipe #1 on downstream face
14	1	Animal burrow on downstream face
15	1	Downstream upper stability berm, right groin
16	1, 2	Downstream right groin
17	1	Suvery control for LiDAR fight
18	1, 2, 3	Dam crest at right abutment
19	1	Radio tower NE of dam crest
20	1, 2, 3	Dam crest at principal spillway alignment
21	1, 2, 3	Small depression on dam crest
22	1	Instrumentaton tower on US face
23	1	Upstream lef groin
24	1	SGS Storm Surge Sensor
25	1	Aux. spillway cutof wall/crest - lef bank
26	1, 2	Aux. spillway cutof wall/crest - center
27	1, 2	Aux. spillway cutof wall/crest - right bank
28	1, 2, 3	Dam crest at lef abutment
29	1, 2	Oversized material at upstream right groin
30	1	Small ruts on upstream face of dam
31	1, 2	Upstream right groin
32	1	Upstream stability berm at right groin
33	1, 2, 3, 4	Irr. box for electrical conduit to instrumentaton tower
34	1	Upper most staf gage on upstream face
35	1	Ladder access for principal spillway
36	1, 2	USGS surge storm sensor on staf gauge
37	1, 2, 3, 4, 5, 6	Principal spillway
38	1, 2, 3, 4, 5	Low level outlet 18" slide gate
39	1, 2, 3	Tree and sediment near principal spillway
40	1, 2, 3	View of principal spillway
41	1	Tree cover around road upstream of dam of dam
42	1, 2, 3	View of upstream slope of dam
43	1, 2	Tree cover upstram of dam
44	1, 2	House upstream of dam
45	1, 2	Grange Road - botom of bridge and channel
46	1	Grange Road - top of bridge
47	1, 2, 3, 4	Principal spillway stlling basin - lef wall
48	1, 2, 3, 4	Downstream of principal spillway stlling basin
49	1, 2, 3	Channel downstream of principal spillway stlling basin

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Photo Locations - Point

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Natural Resource Conservation Service (NRCS)

Matanzas Creek Dam Site
Field Photo Locations

Map Name: H:\JD\Proj\2006-048\Design\GIS\Projects\2006-048_Water\2006-048_Water.aprx - Exh Field Photo Locations Index

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Scale: 1" = 600'

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Point 01 Photo 01



Point 01 Photo 02



Point 01 Photo 03



Point 01 Photo 04



Point 02 Photo 01



Point 02 Photo 02



Point 02 Photo 03



Point 02 Photo 04



Point 02 Photo 05



Point 02 Photo 06





Point 03 Photo 01



Point 03 Photo 02

Point 04 Photo 01



Point 04 Photo 02



Point 05 Photo 01



Point 05 Photo 02



Point 06 Photo 01



Point 06 Photo 02



Point 06 Photo 03



Point 07 Photo 01



Point 07 Photo 02



Point 07 Photo 03



Point 08 Photo 01



Point 09 Photo 01





Point 10 Photo 01

Point 10 Photo 02



Point 10 Photo 03



Point 11 Photo 01



Point 11 Photo 02



Point 11 Photo 03



Point 12 Photo 01



Point 13 Photo 01




Point 14 Photo 01


Point 15 Photo 01

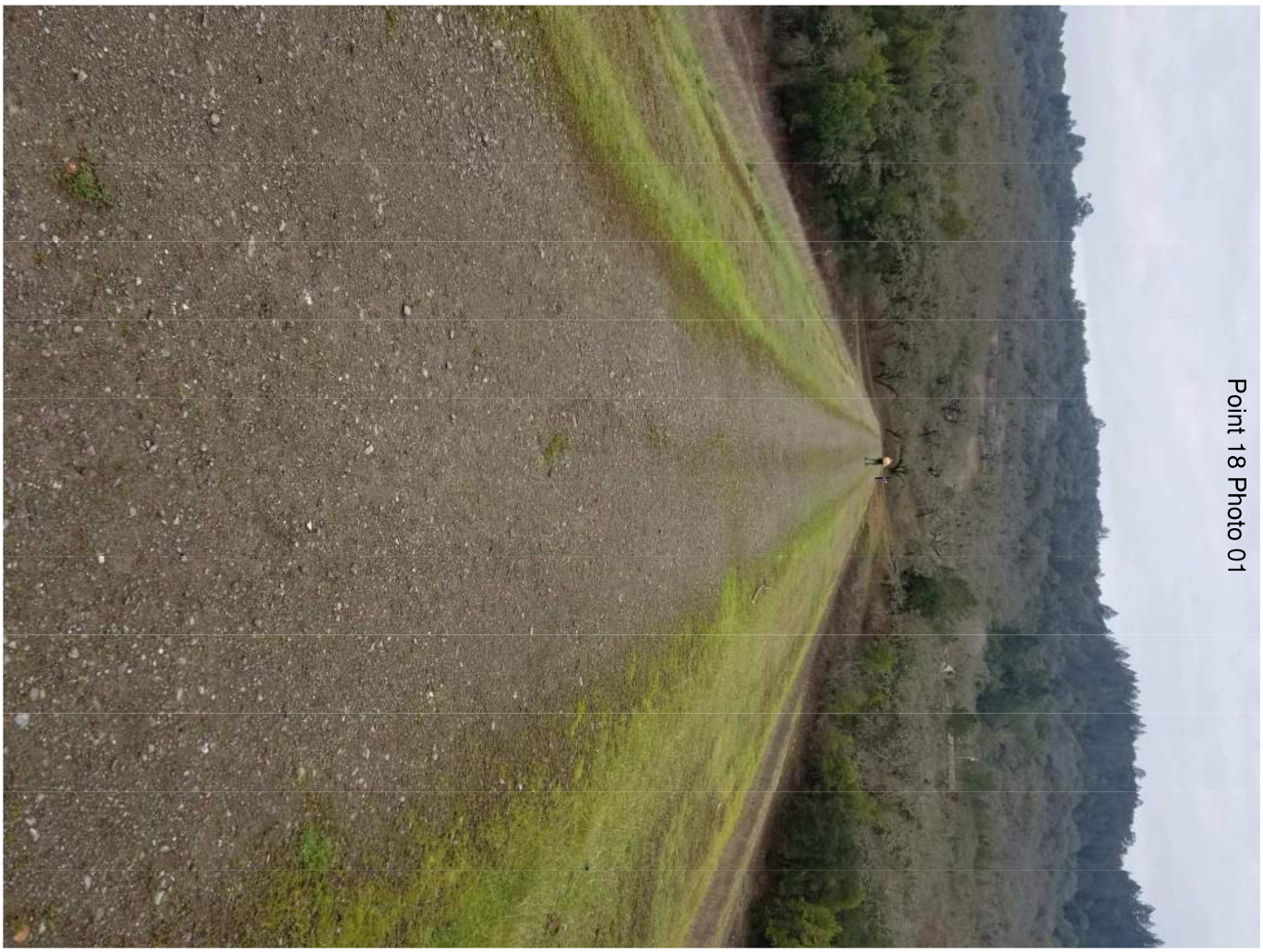
Point 16 Photo 01



Point 16 Photo 02




Point 17 Photo 01


Point 18 Photo 01

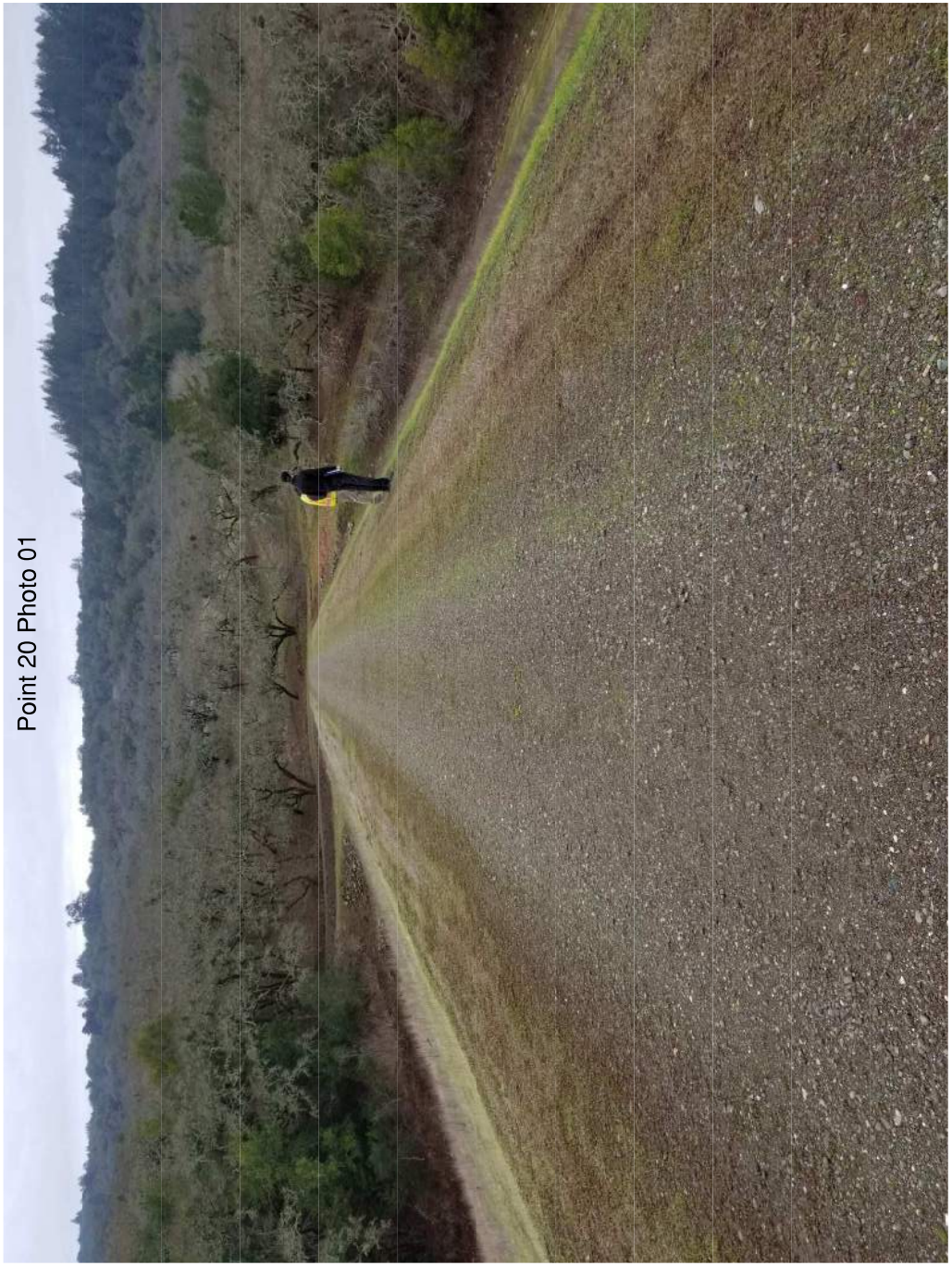
Point 18 Photo 02



Point 18 Photo 03




Point 19 Photo 01


Point 20 Photo 01

Point 20 Photo 02



Point 20 Photo 03





Point 21 Photo 01



Point 21 Photo 02


Point 21 Photo 03


Point 22 Photo 01

Point 23 Photo 01





Point 24 Photo 01

Point 25 Photo 01



Point 26 Photo 01



Point 26 Photo 02



Point 27 Photo 01



Point 27 Photo 02



Point 28 Photo 01



Point 28 Photo 02



Point 28 Photo 03



Point 29 Photo 01



Point 29 Photo 02



Point 30 Photo 01



Point 31 Photo 01



Point 31 Photo 02

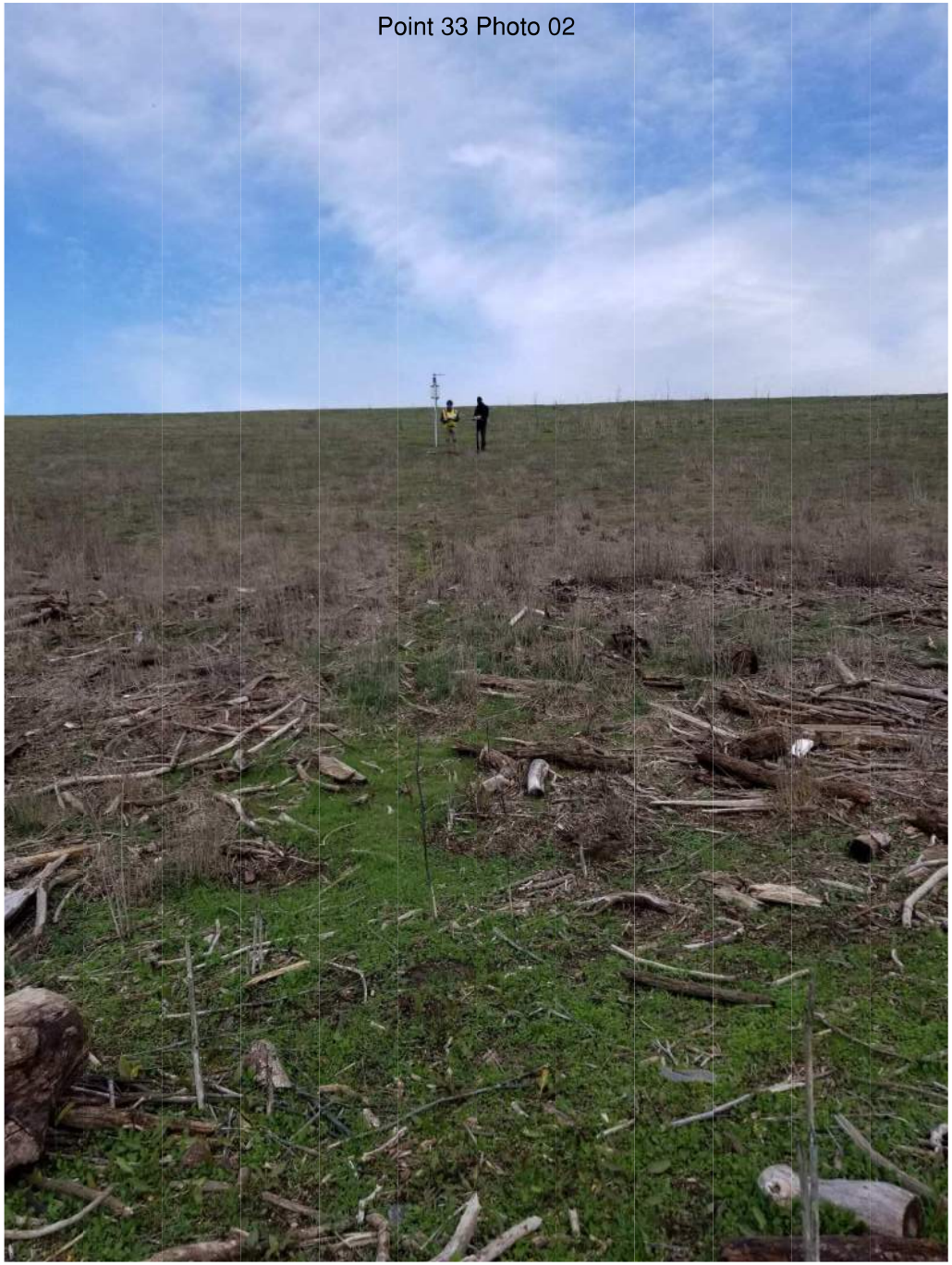


Point 32 Photo 01



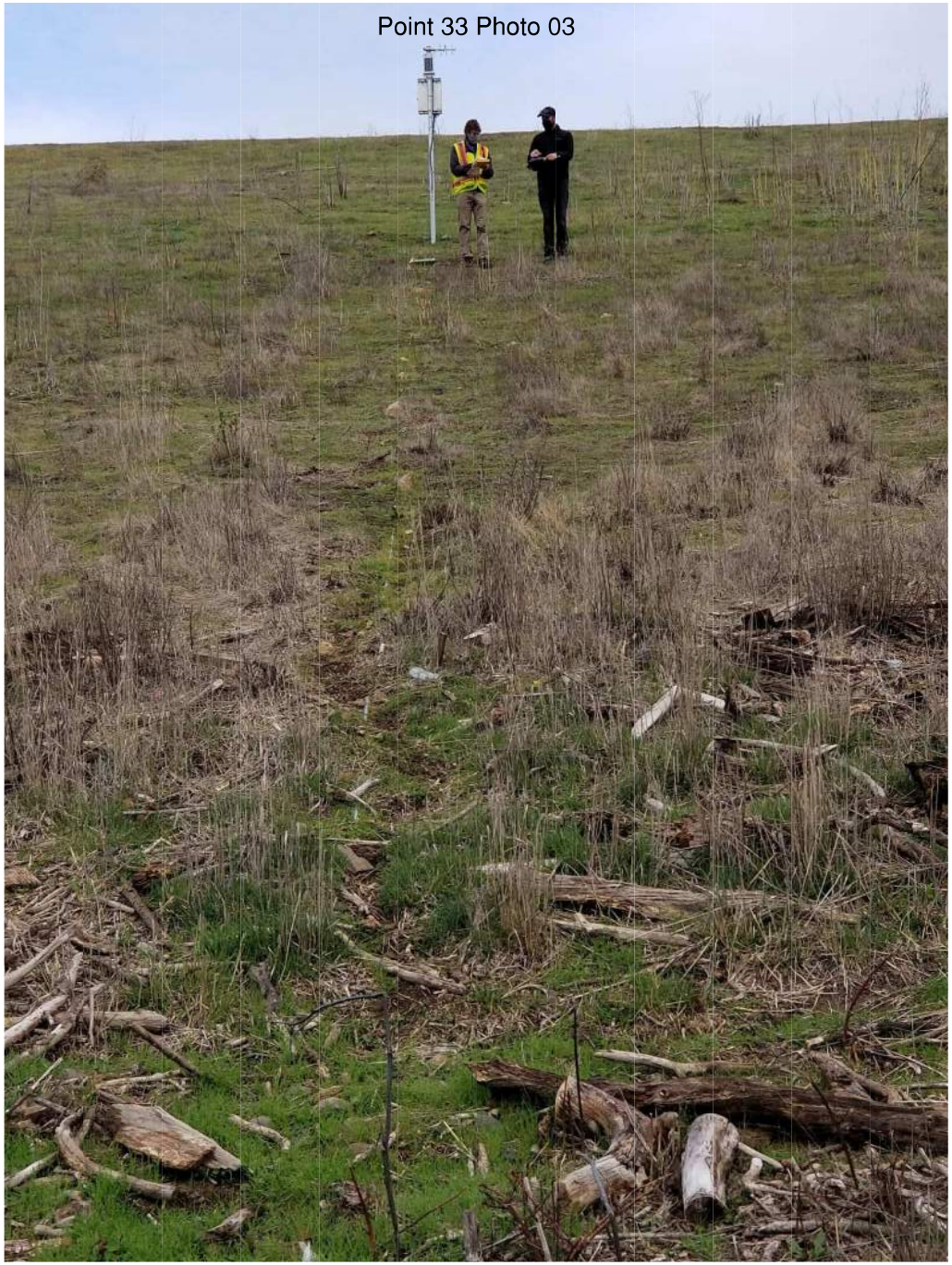


Point 33 Photo 01



Point 33 Photo 02

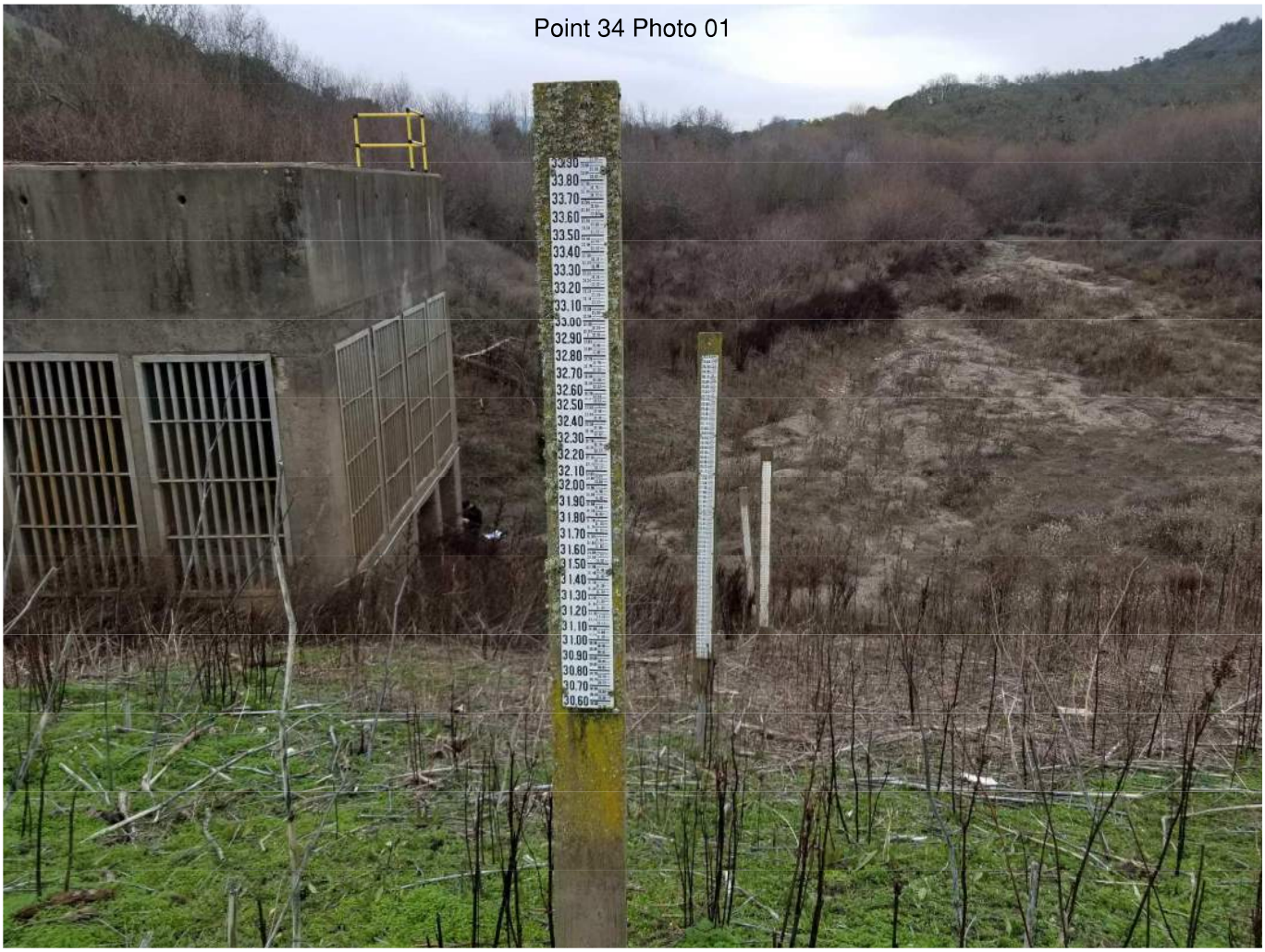
Point 33 Photo 03



Point 33 Photo 04



Point 34 Photo 01





Point 35 Photo 01

Point 36 Photo 01



Point 36 Photo 02



Point 37 Photo 01



Point 37 Photo 02





Point 37 Photo 03

Point 37 Photo 04



Point 37 Photo 05



Point 37 Photo 06



Point 38 Photo 01



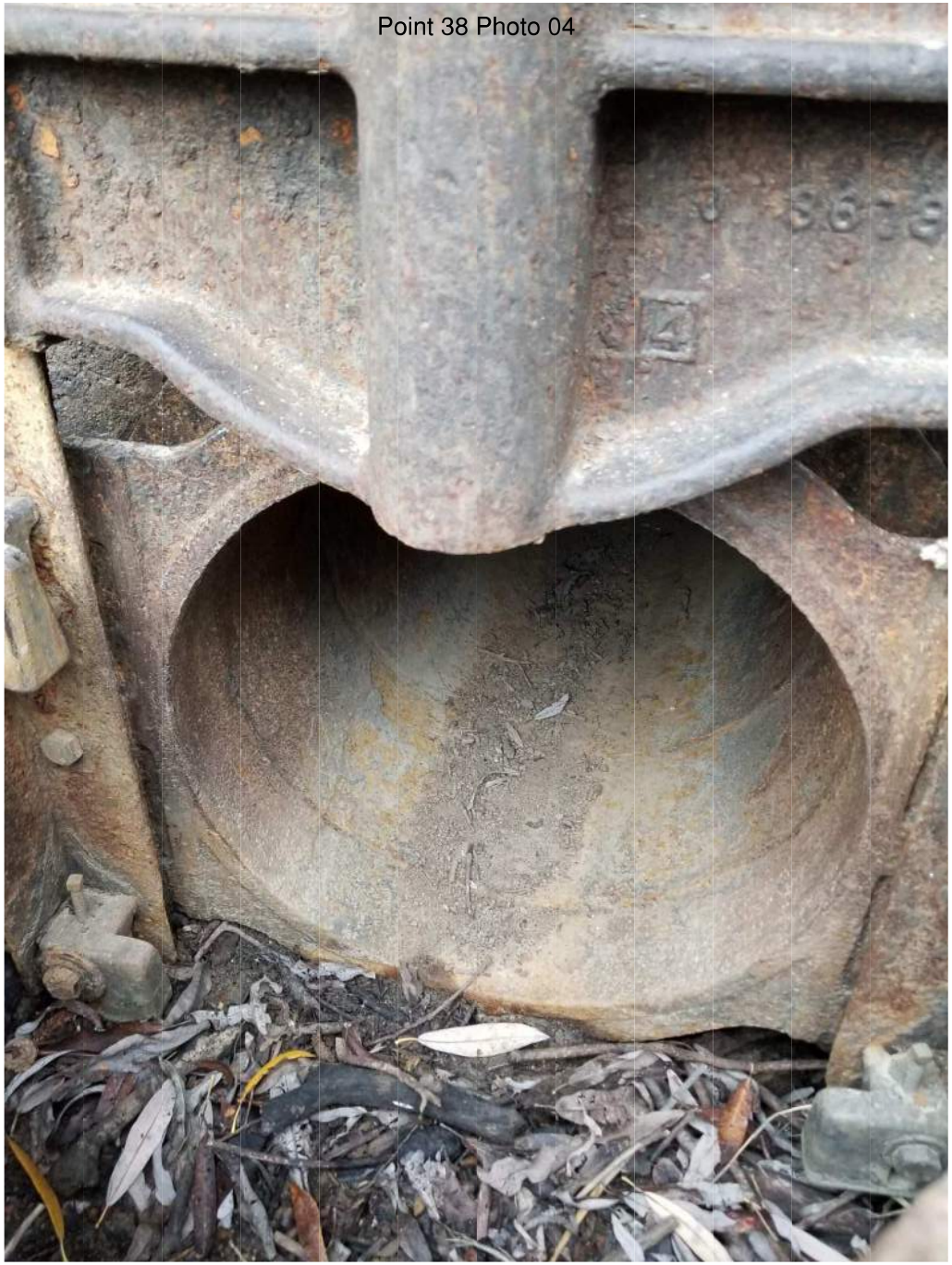
Point 38 Photo 02



Point 38 Photo 03



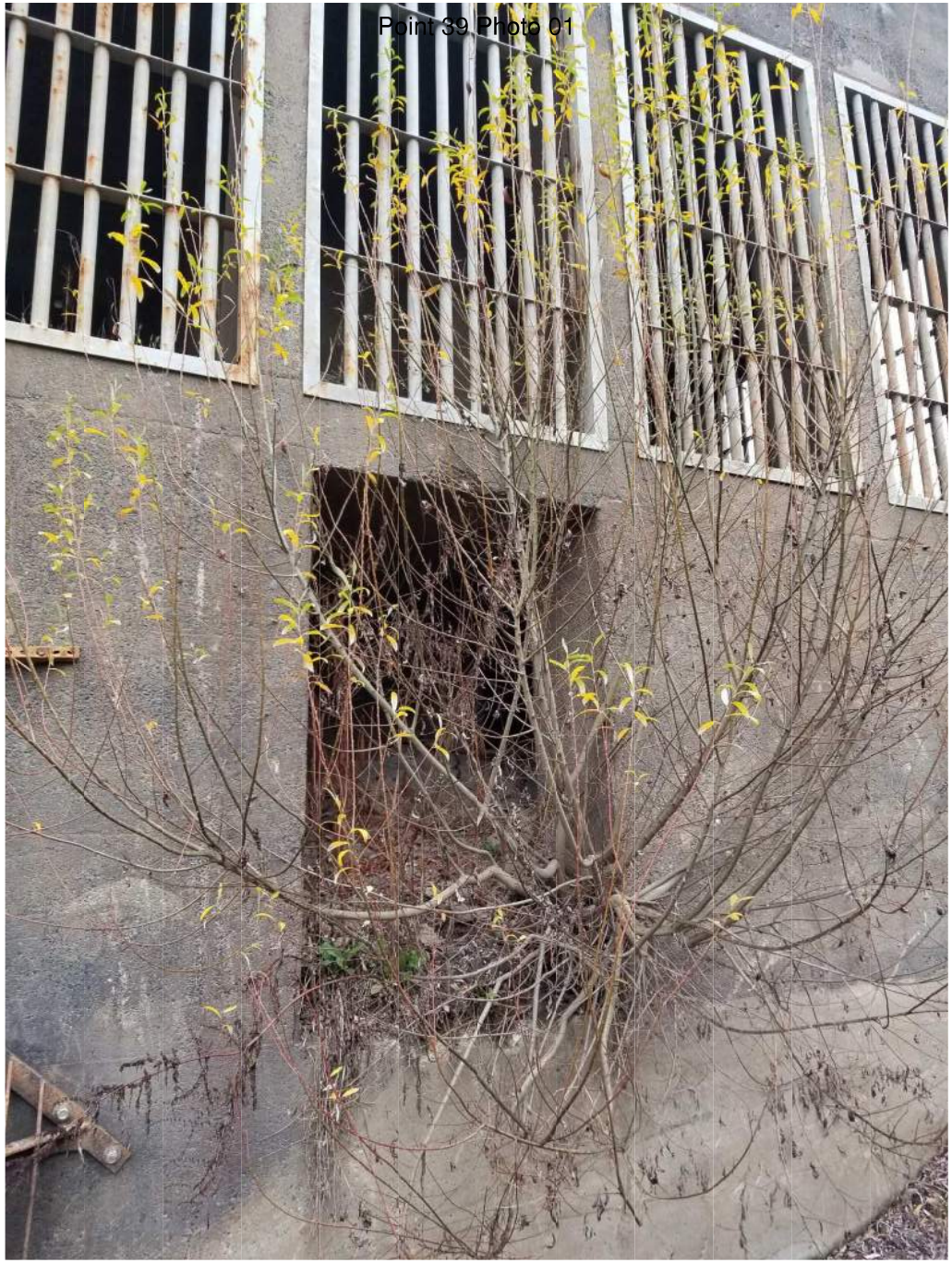
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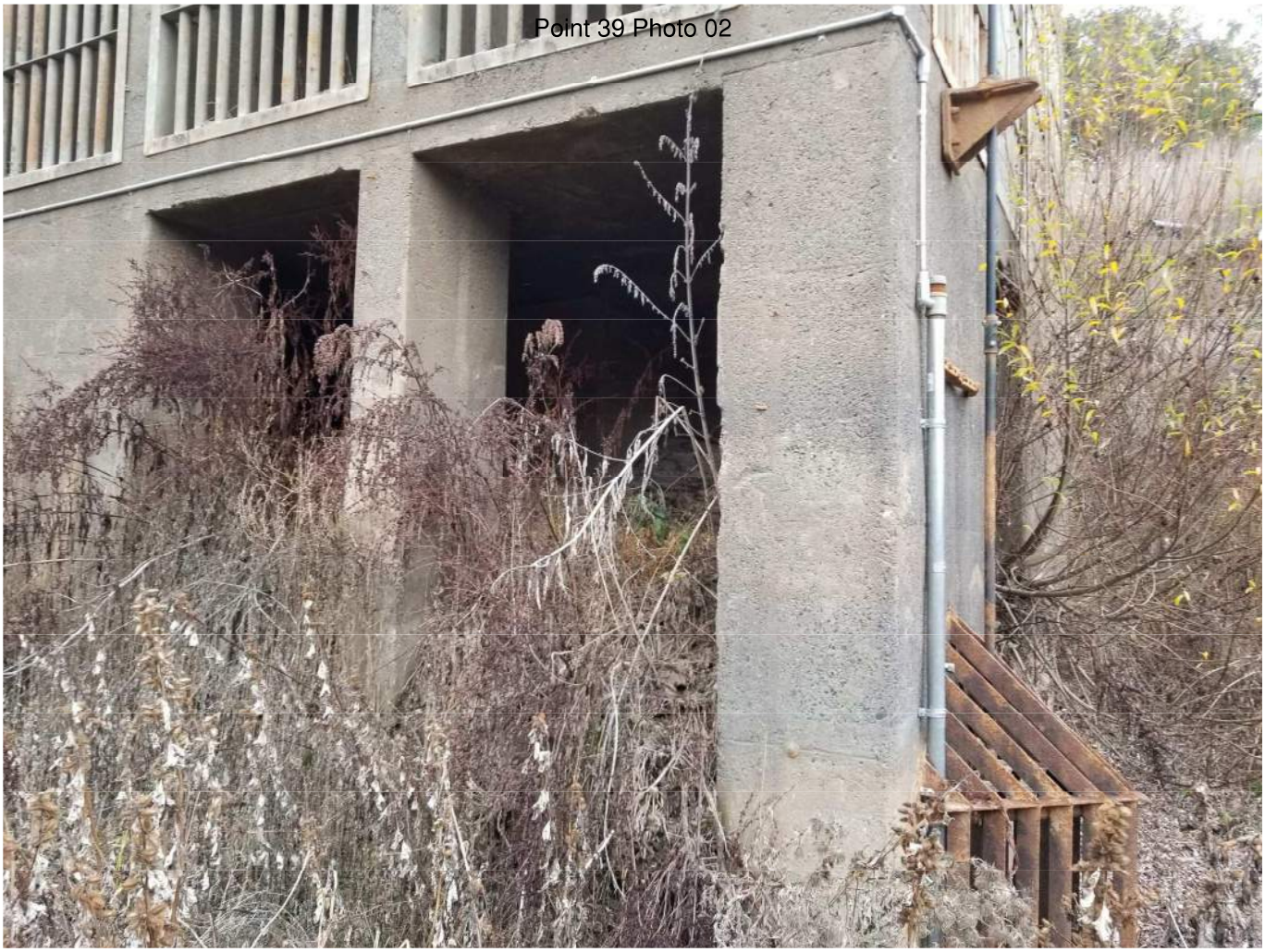
Point 38 Photo 05



Point 39 Photo 01



Point 39 Photo 02





Point 39 Photo 03

Point 40 Photo 01





Point 40 Photo 02

Point 40 Photo 03



Point 41 Photo 01



Point 42 Photo 01



Point 42 Photo 02



Point 42 Photo 03



Point 43 Photo 01




Point 43 Photo 02


Point 44 Photo 01

Point 44 Photo 02



Point 45 Photo 01



Point 45 Photo 02



Point 46 Photo 01



Point 47 Photo 01



Point 47 Photo 02




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Point 48 Photo 01



Point 48 Photo 02



Point 48 Photo 03



Point 48 Photo 04



Point 49 Photo 01



Point 49 Photo 02



Point 49 Photo 03

