Draft 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)

July 2026

Abstract

Draft Supplemental Watershed Plan No. 1 and Environmental Assessment
for
Rehabilitation of the Matanzas Creek Dam
of the
Central Sonoma Watershed
Sonoma County, California

Prepared by:
U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)
in cooperation with:
Sonoma County Water Agency

Authority:

This plan is prepared under the authority of the Watershed Protection and Flood Prevention Act of 1954 (Public Law 83-566) as amended. This Plan-EA has also been prepared in accordance with the National Environmental Policy Act (NEPA) of 1969, PL 91-190, as amended (42 United States Code [U.S.C.] 4321 et seq.).

Abstract:

The Matanzas Creek Dam currently provides flood protection for the City of Santa Rosa and adjacent unincorporated areas in Sonoma County, California. It also captures approximately 3.8 acre-feet of sediment annually. Based on recent assessments, the dam does not currently meet federal and state standards. The purpose of the project is to continue to provide flood protection and sediment reduction downstream of Matanzas Creek Dam in the most efficient manner. The project Sponsor proposes to fully rehabilitate the dam, including raising the dam crest by 7.4 feet, raising the auxiliary spillway crest by 11.4 feet, and removing accumulated sediment from the inundation area. The total project construction cost is estimated to be $32,025,000.

Comments:

The NRCS has completed this Draft Supplemental Plan-Environmental Assessment (EA) in accordance with the National Environmental Policy Act (NEPA) and NRCS guidelines and standards. Reviewers should provide their comments to NRCS during the allotted Draft Supplemental Plan-EA review period. Comments must be submitted by August 25, 2026, to become part of the Administrative Record. Please send comments to:

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Cover Photo: Matanzas Creek Dam embankment, January 13, 2021

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Summary Supplemental Watershed Plan No. 1 and Environmental Assessment
for the
Central Sonoma Watershed
Sonoma County, California
California Congressional District 5

Unique Identification Number: EAXX-005-53-006-1126918456

Authorization: Public Law 83-566 Stat. 666 as amended (16 U.SC. Section 1001 et. seq.) 1954; National Environmental Policy Act (NEPA) of 1969, PL 91-190, as amended (42 United States Code [U.S.C.] 4321 et seq.)

Sponsor: Sonoma County Water Agency (Sonoma Water)

Proposed Action: The Proposed Action is rehabilitation of the Matanzas Creek Dam.

Purpose and Need for Action: The purpose of the project is to continue to provide flood protection and sediment reduction downstream of Matanzas Creek Dam in the most efficient manner. The Matanzas Creek Dam facility currently provides flood protection for the City of Santa Rosa and adjacent unincorporated areas in Sonoma County, California. It also captures approximately 3.8 acre-feet of sediment annually. Based on recent assessments, the dam does not meet NRCS and California Division of Safety of Dams (DSOD) standards. The need is to bring the dam into compliance with current standards while maintaining flood protection and sediment reduction services.

Description of the Preferred Alternative/Plan: The Preferred Alternative consists of full rehabilitation of the Matanzas Creek Dam. Rehabilitation includes raising the dam crest by 7.4 feet, raising the auxiliary spillway crest by 11.4 feet, grading the spillway to a uniform 200-foot width, removing accumulated sediment from the inundation area, installing embankment stability buttresses, and extending the primary spillway to accommodate the new buttresses.

Resource information:

- Latitude and Longitude: 38.448000°, -122.652071°
- Eight-Digit Hydrologic Unit Number: 18010110 (Russian)
- Climate (Western Regional Climate Center 2022): July average high/low: 83°F / 51°F; January average high/low: 57°F / 37°F
    - Annual precipitation / snowfall: 31 inches / 0 inches
- Topography: Mountain foothills and fluvial valley
- Watershed Plan size: 49,445 acres (comprised of the Hydrologic Unit Code {HUC} 12 Upper Santa Rosa Creek [180101100702] and Lower Santa Rosa Creek [180101100703] subwatersheds)
- Land uses (Sonoma Veg Map 2022): Urban (14,980 acres), agriculture (2,784 acres), woodland/forest (20,075 acres), undeveloped (11,374 acres), water (232 acres)

- Land ownership – Private (84.2%); California Department of Parks and Recreation (9.3%), local government (5.9%), other state lands (0.4%), non-profit conservancies and trusts (0.1%), California Department of Fish and Wildlife (0.1%)
- Population (Watershed Plan Area; EPA 2022a): 132,744
- Demographics (Watershed Plan Area; EPA 2022a): White alone = 63%; Hispanic or Latino = 26%; High school graduate = 90%; Unemployment = 3%; Per capita income = $43,579
- Relevant resource concerns that have been identified through scoping: Air quality, cultural resources, endangered and threatened species, environmental justice and civil rights, fish and wildlife, floodplain management, invasive species, land use, migratory birds, noise levels, prime farmlands, public health and safety, riparian areas, socioeconomic factors, soil resources, vegetation, water quality, waters of the U.S., and wetlands.

Alternative plans considered: Alternatives that were analyzed in detail include the No Action Alternative, Alternative 1 (Structural Auxiliary Spillway), Alternative 2 (Dam Crest Raise to 431 Feet), and Alternative 3 (Dam Crest Raise to 435 Feet). Alternative 3 (Dam Crest Raise to 435 Feet) is the Preferred Alternative.

No Action Alternative (Future without Federal Investment [FWOFI])

The No Action Alternative considered that no federally funded project measures would be implemented. The existing storage capacity is sufficient to route storms up to the 25-year 24-hour storm event without use of the auxiliary spillway. The partially filled sediment pool would continue to impound sediment for approximately 22.6 years; upon reaching storage capacity, sediment would no longer be impounded by the dam but would route through the principal spillway and be conveyed downstream. Sonoma Water would continue to maintain the dam in its current condition.

Alternative 1 (Rehabilitate the dam with a Structural Auxiliary Spillway)

Alternative 1 considered construction of a structural auxiliary spillway to bring the dam into compliance with current standards. A 6-foot-tall labyrinth weir would be installed on the auxiliary spillway. The spillway would be graded to a uniform 200-foot width and a stilling basin would be installed near the end of the spillway. The spillway would be lined with concrete. This alternative would route storms up to the 25-year 24-hour storm event without use of the auxiliary spillway. Accumulated sediment would be removed from the inundation area to allow for an additional 50 years of sediment storage capacity. Embankment stability buttresses would be constructed on each side of the dam and the primary spillway would be extended to accommodate the new buttresses.

Alternative 2 (Rehabilitate with a dam crest raise to 431 feet)

Alternative 2 considered full rehabilitation of the dam by raising the dam crest by 3.4 feet, raising the auxiliary spillway crest by 7.4 feet, and grading the spillway to a uniform 200-foot width. The storage capacity would be increased to route up to the 50-year 24-hour storm event without use of the auxiliary spillway. Accumulated sediment would be removed from the inundation area to allow for an additional 50 years of sediment storage capacity. Embankment stability buttresses would be constructed on each side of the dam and the primary spillway would be extended to accommodate the new buttresses.

Alternative 3 (Rehabilitate with a dam crest raise to 435 feet)

Alternative 3 (the Preferred Alternative) considered similar measures to Alterative 2, except that the dam would be raised by 7.4 feet and the auxiliary spillway crest would be raised by 11.4 feet. The auxiliary spillway would be graded to a uniform 200-foot width. The storage capacity would be increased to route up to the 100-year 24-hour storm event without use of the auxiliary spillway. Accumulated sediment would be removed from the inundation area to allow for an additional 50 years of sediment storage capacity. Embankment stability buttresses would be constructed on each side of the dam and the primary spillway would be extended to accommodate the new buttresses.

Alternatives Considered but Eliminated from Detailed Study

Two alternatives and multiple design configurations were eliminated from detailed study; these alternatives considered decommissioning of the dam and floodproofing downstream, removal of the population downstream of the dam, and a number of design configurations were considered for full dam rehabilitation. These alternatives were variously deemed to be inefficient and unacceptable or ineffective and incomplete. They did not align with the Federal Objective and PR&G Guiding Principles, or were considered unreasonable due to costs or environmental reasons, and were not considered further.

Project costs by purpose and funding source: The project component breakdown of the estimated installation costs for the Preferred Alternative is summarized in Table S-1. NRCS design engineering, construction management, and administration costs are not cost-shared by the Sponsor. Any costs incurred for administration and permitting by the Sponsor would not be cost-shared by NRCS.

Table S-1. Estimated Installation Costs[1]

Project task	PL 83-566 funds	Other funds	Total
Construction	$18,109,000 (65%)	$9,751,000 (35%)	$28,860,000 (100%)
Engineering	$2,985,000 (100%)	$0 (0%)	$2,985,000 (100%)
Technical Assistance	$0	$0	$0
Relocation	$0	$0	$0
Real Property (Flood easements)	$0 (0%)	$350,000 (100%)	$350,000 (100%)
Project Administration/Permits	$415,000 (50%)	$415,000 (50%)	$830,000 (100%)
Total Costs	$21,509,000 (67%)	$10,516,000 (33%)	$32,025,000 (100%)

[1] 2022 price level. Estimates are rounded to the nearest hundred; numbers may not sum correctly due to rounding.

Project benefits: Project benefits are based on the average annual damages that would be avoided if project measures were constructed. The Preferred Alternative would avoid an estimated $22,000 in costs per year.

Number of direct beneficiaries: Direct beneficiaries consist of property owners and residents of at least 62 buildings within the modeled inundation area for a 500-year event.

Beneficial effects: The Preferred Alternative would provide the greatest reduction in flood damage risk, resulting in beneficial impacts to public health and safety. The facility would

also provide 50 years of sediment storage capacity, resulting in beneficial impacts to downstream water quality.

Benefit to Cost Ratio (Authorized Rate): 2.75%

Benefit to Cost Ratio (Current Rate): 2.75%

Net economic benefits: The estimated annual net economic benefit for the Preferred Alternative is summarized in Table S-2.

Table S-2. Estimated Annual Net Economic Benefits[1]

Average Annual Benefit	Average Annual Cost	Annual Net Economic Benefits	Benefit/Cost Ratio
$22,000	$1,006,000	-$984,000	0.02:1

[1] 2022 price level, amortized using a 2.5 percent discount rate over a 52-year period. Estimates are rounded to the nearest thousand; numbers may not sum correctly due to rounding.

Funding schedule: The estimated funding schedule for the Preferred Alternative is summarized in Table S-3. These estimates assume that engineering, permitting, and 50 percent of the administration efforts are completed in the first year, and construction and the remaining administration efforts are completed in the following years.

Table S-3. Estimated Funding Schedule

Budget Year	PL-566 federal funds	Other (non-federal) funds	Total
2025	$3,192,500	$207,500	$3,400,000
2026-2027	$18,316,500	$10,308,500	$28,625,000

Period of analysis: The Preferred Alternative was analyzed for a period of 52 years and includes the implementation period.

Project life: The Preferred Alternative is anticipated to have a life span of at least 50 years.

Environmental impacts: Table S-4 lists the resources of concern and impacts associated with the Preferred Alternative.

Table S-4. Summary of Resource Concerns and Impacts

Resource of Concern	Summary of Concern	Effects Summary for Preferred Alternative
Air quality	Emissions from construction activities	The watershed area is within an area designated as moderate nonattainment for $PM_{2.5}$ (2006 standard) and marginal nonattainment for ozone (2008 and 2015 standards). Operation of heavy equipment for implementation of the project measures would result in mobile equipment emissions and particulate emissions resulting from ground-disturbing activities. Emissions would be minimized by applying project conservation measures, which would stabilize disturbed soils in the short and long term, which would reduce the suspension of dust particles. Equipment operation emissions would be localized to the project area and would only occur during construction and maintenance. Fugitive dust emissions would be localized to the project area and would be temporary and short-term; dust emissions would reduce as vegetation established on disturbed areas. Construction activities are not expected to violate air quality standards based on the implementation of best management practices and the short and temporary duration of construction. The project would be in compliance with the Clean Air Act.
Coastal zone management areas	No concern	The nearest coastal zone management area is over 12 miles away from the watershed area (State of California 2019).
Coral reefs	No concern	Coral reefs do not occur within the watershed area, which is in an upland area over 14 miles away from the nearest coast.
Cultural and historic resources	Potential impacts to historically important resource from demolition, inundation, or modifications of the Matanzas Creek Dam facility	A total of eight cultural resources were identified within the area of potential effect (APE); two of the sites were determined to be Historic Properties: the Central Sonoma Watershed Project Historic District and a complex lithic scatter. The Matanzas Creek Dam facility, a contributing resource of the NRHP-eligible historic district, would be modified but the modification would not adversely affect the district. Temporary inundation of the complex lithic scatter would not be an adverse impact due to previous data recovery of all surface materials.
Endangered and Threatened Species	Potential impacts to listed species or critical habitat	Several federally listed species were identified as potentially occurring within the Watershed Plan area. Suitable habitat for the threatened California red-legged frog (*Rana draytonii*) occurs in association with Matanzas Creek within the project area; however, focused surveys did not detect the frog. Suitable habitat for other listed species was not identified within the project area. Critical habitats for three species (California red-legged frog, California tiger salamander, and northern spotted owl) occur within the Watershed Plan area. Implementation of the Preferred Alternative may affect but is not likely to adversely affect California red-legged frog. There would be no effect to critical habitats. The Preferred Alternative would be in compliance with the Endangered Species Act.
Essential fish habitat	No concern	The watershed area is within the boundaries of essential fish habitat for coho and Chinook salmon; however, Matanzas Creek is not considered essential fish habitat for these species.

Resource of Concern	Summary of Concern	Effects Summary for Preferred Alternative
Fish and wildlife (including migratory birds)	Impacts to fish and wildlife species and habitat	Various species of concern are known to occur within the Watershed Plan area and could occur in the localized area of project disturbance. Species of concern include migratory birds, California threatened and endangered species, California "species of concern," California "fully protected species," and migratory birds. Mountain lions (*Puma concolor*) were specifically noted as a species of interest during public scoping. There would be no adverse impacts to populations of any species of concern. Disturbance to individuals of any species would be temporary and no populations would be adversely affected.
Floodplain management	Changes to floodplain function	The Federal Emergency Management Agency (FEMA) has designated 100-year and 500-year floodplains within the watershed. The mapped floodplains mainly occur in association with Matanzas Creek, Spring Creek, and lower Santa Rosa Creek. Matanzas Creek Dam and the reservoir are not within the mapped floodplain. The Preferred Alternative would continue to provide at least the current level of protection and would not substantially change flood patterns from existing conditions. The Preferred Alternative would "improve the resilience of communities and Federal assets against the impacts of flooding" and would "avoid, to the extent possible, the long- and short-term adverse impacts associated with occupancy and modification of floodplains"; therefore, it would be consistent with E.O. 13690 and E.O. 11988.
Forest resources	No concern	Forest resources, such as timber, occur in the higher elevations of the watershed area but would not be impacted by dam rehabilitation.
Invasive species	Increased potential for spreading of invasive species	Invasive species occur throughout the watershed and have been observed in association with Matanzas Creek. Invasive Harding grass (*Phalaris aquatica*) is widespread around the dam, spillway, and inundation area. Crayfish (either *Pacifastacus leniusculus* or *Procambarus clarkia*) have been observed in standing water immediately downstream of the dam, and bullfrogs (*Lithobates catesbeiana*) and invasive fish may be able to move into the reservoir during the wet season. Disturbed areas are at increased risk of invasive weed establishment. Project conservation measures would reduce the risk of spreading invasive weed species. The Preferred Alternative would not facilitate or inhibit the movement of invasive animal species, including crayfish, bullfrogs, and invasive fish.
Land use	Potential changes in land use	Land ownership within the watershed is approximately 84 percent private. Land uses consist of native forest at higher elevations and development at lower elevations. The existing dam and inundation area are on property largely owned by Sonoma Water. The maximum inundation area of Matanzas Creek Reservoir would increase by 16.3 acres; additional flood easements would be required. Land use would not change based on existing zoning and development in the vicinity of the facility.
Natural areas	No concern	Natural areas (land and water units where natural conditions are maintained) likely occur within the watershed area but would not be impacted by dam rehabilitation.

Resource of Concern	Summary of Concern	Effects Summary for Preferred Alternative
Noise levels	Increased noise during construction	The existing dam is in a relatively isolated area, with wineries and forest surrounding the area. The nearest home is approximately 300 feet west of the dam. There would be a temporary construction-period increase in daytime noise levels for up to 24 months during daylight hours. A noise analysis per CEQA guidelines would be prepared prior to implementation of the project and additional mitigation measures may be identified at that time. Due to uncertainty in the project schedule, the analysis will be completed closer to the initiation of the construction process.
Parklands	No concern	Portions of Trione-Annadel State Park, Sugarloaf Ridge State Park, Hood Mountain Regional Park, Taylor Mountain Regional Park, and the entirety of Spring Lake Regional Park occur within the watershed area; however, no parklands would be affected by dam rehabilitation.
Prime and unique farmlands	Potential impacts to classified farmlands	Classified farmlands occur within the watershed; soils classified as prime farmland and farmland of statewide importance occur upstream and downstream of the dam. Approximately 9.1 acres of soils classified as farmland of statewide importance occur within the maximum inundation area; these areas are not currently farmed. Temporary flooding would not constitute an unnecessary and irreversible conversion of farmlands to non-agricultural uses.
Public health and safety	Risks to public health and safety from flooding	The dam is currently classified as High Hazard per NRCS criteria and Extremely High Hazard per California DSOD. A dam breach analysis for the hydrologic failure mode indicates that a significant number of structures could be impacted by breach flooding. The hydrologic breach inundation map results in a population at risk of 28,680. Using a fatality rate of 0.007, this breach would result in an estimated loss of life of 200 persons. There would be benefits to public health and safety by reducing the risk of dam breach flooding and increasing the flood storage capacity to route the 100-year 24-hour storm through the primary spillway.
Recreation	No concern	The existing dam and appurtenances are not used for recreation; dam rehabilitation would not affect recreation uses within the watershed area.
Regional water resource plans	No concern	Based on a review of numerous planning documents, there are no regional water resource plans that are relevant to rehabilitating the existing dam.
Riparian areas	Impacts to riparian areas	Riparian areas occur in association with Matanzas Creek up and downstream of the dam. There would be a permanent loss of approximately 0.3 acres of riparian vegetation and a temporary loss of 6.6 acres of riparian vegetation.
Scenic beauty	No concern	The existing facility does not have high scenic value and is not readily visible to most casual observers.

Resource of Concern	Summary of Concern	Effects Summary for Preferred Alternative
Scientific resources	No concern	Geologic resources (e.g., faults, folds, discontinuities, or mineral deposits), paleontological resources (e.g., fossils and surrounding rocks), caves, waterfalls, and gorges are not known to occur within the area.
Socioeconomic factors	Impacts to socioeconomic factors	Socioeconomic factors such as education, employment, income, crime rate, and health could be affected by disasters such as flooding within a community. Operation of the Preferred Alternative would reduce the risk of flood-associated impacts to social and economic structures within and around the City of Santa Rosa. Construction would temporarily increase employment and incomes locally for businesses that were hired to complete the project. The Preferred Alternative would provide the greatest amount of protection to downstream properties.
Soil resources	Impacts to soils	The watershed area is located within the foothills and valleys of the California Coast Ranges north of San Francisco Bay. The foothills are predominantly composed of Sonoma Volcanics (e.g., andesite, basalt, tuff), while surficial alluvium deposits make up the valley bottoms (Graymer et al. 2007). A majority of soils in the watershed area are classified as clay loams and are generally less susceptible to water erosion but have high runoff potential (NRCS 2022). The dam currently captures approximately 3.8 acre-feet of sediment each year. Up to 48.2 acres would be disturbed during construction; reclamation measures would stabilize soils long term. The dam would continue to capture 3.8 acre-feet of sediment annually for the sediment storage design life of 50 years.
Sole source aquifers	No concern	The nearest sole source aquifer is over 90 miles away from the watershed area.
Vegetation	Impacts to vegetation	Riparian communities are located along Matanzas Creek and a marsh is located on the upstream side of the dam. The predominant community in the area is grasslands, with oak (*Quercus*) alliances located in patches along the creek. Trees that qualify as “heritage” or “landmark” trees per Sonoma County Code (Chapter 26D) may occur within the area but have not been identified to date. Lobb’s aquatic buttercup (*Ranunculus lobbii*) was observed in two vernal pools in the auxiliary spillway and one isolated pool in the southwest portion of the inundation area. There would be temporary construction-related impacts on up to 48.2 acres of vegetation. With implementation of project conservation measures, vegetation would be expected to re-establish in most areas within 2 years after disturbance. Lobb’s aquatic buttercup habitat on the auxiliary spillway would be avoided by project activities; there would be no change to occupied habitat within the inundation area.

Resource of Concern	Summary of Concern	Effects Summary for Preferred Alternative
Water quality	Impacts to water quality	Tributaries to Santa Rosa Creek water bodies (including Matanzas Creek) are on the Clean Water Act Section 303(d) list for sediment, pathogens, and temperature. The dam currently captures approximately 3.8 acre-feet of sediment per year. There would be a temporary increase in turbidity due to disturbance of up to 48.2 acres; reclamation measures would stabilize soils and protect water quality long term. The dam would continue to capture 3.8 acre-feet of sediment annually for the sediment storage design life of 50 years.
Waters of the U.S.	Impacts to jurisdictional waters	Matanzas Creek is a perennial tributary to Santa Rosa Creek, which flows into the Laguna de Santa Rosa, which is a tributary to the Russian River. Waters of the U.S. associated with the dam include Matanzas Creek and the conduit and spillway that it may flow through, and unnamed intermittent tributaries that flow into Matanzas Creek. Wetlands may also be waters of the U.S. and will be addressed separately. There would be a permanent loss of approximately 1,534 linear feet (or 0.2 acres) of jurisdictional waters. The placement of fill material within the channel would require a Clean Water Act Section 404 permit from the U.S. Army Corps of Engineers (USACE) in compliance with the Clean Water Act. Compensatory mitigation may be required.
Wetlands	Impacts to wetlands	Approximately 0.95 acres of freshwater emergent marsh wetlands were delineated within the inundation area and another 0.15 acres were delineated along the outlet channel out of the dam. An area of approximately 0.14 acres of forested/shrub wetlands was also delineated within the inundation area. An isolated freshwater marsh of approximately 0.01 acres was delineated on the south side of the inundation area, and approximately 0.15 acres of isolated seasonal wetlands were delineated in the auxiliary spillway. There would be a permanent loss of approximately 0.62 acres and a temporary loss of approximately 0.37 acres of wetlands. Clean Water Act Section 404 permitting and compensatory mitigation may be required.
Wild and scenic rivers	No concern	Wild and scenic rivers do not occur in Sonoma County. Nationwide Rivers Inventory segments do not occur within 4 miles of the watershed area.

Major conclusions: Alternative 3 (dam crest raise to 435 feet) meets the purpose and need, is the locally preferred alternative, and best addresses the PR&G guiding principles and ecosystem services. This alternative is the Preferred Alternative.

Areas of controversy: There are no known areas of controversy for the implementation of the Preferred Alternative.

Issues to be resolved: The following issues would be resolved for the implementation of the Preferred Alternative:

- Acquisition of necessary federal, state, and local permits
- Acquisition of flood easements

- Agency approval for dam design
- Sponsor's responsibility to update Emergency Action Plan (EAP)

Evidence of unusual Congressional or local interest: There is no evidence of unusual congressional or local interest.

Compliance: Is this report in compliance with executive orders, public laws, and other statutes governing the formulation of water resource projects? X YES __NO

Chapter 1. Introduction

The U.S. Department of Agriculture Natural Resources Conservation Service (NRCS), with the Sonoma County Water Agency (Sonoma Water) as the sponsoring local organization (Sponsor), has initiated a Supplemental Watershed Plan and Environmental Assessment (Plan-EA) to evaluate environmental impacts associated with rehabilitation of the Matanzas Creek Dam within the Hydrologic Unit Code (HUC) 8 Russian Watershed (18010110). The NRCS is the lead federal agency for this Supplemental Plan-EA, and there are no cooperating agencies.

The Watershed Plan and Environmental Assessment (Plan-EA) for this project are combined into a single document. This Plan-EA was prepared under the authority of the Watershed Protection and Flood Prevention Act, Public Law 83-566 (PL-566), as amended by Section 313 of Public Law 106-472, the Small Watershed Rehabilitation Amendments of 2000, and in accordance with Section 102(2)(c) of the National Environmental Policy Act (NEPA) of 1969, Public Law 91-190, as amended (42 USC 4321 et seq.).

This Plan-EA was also prepared in accordance with NEPA and in compliance with all applicable regulations and laws passed subsequently, including the Council on Environmental Quality's (CEQ) regulations outlined in 40 CFR parts 1500 -1508, hereafter referred to as the CEQ regulations, the NRCS procedures for implementing NEPA found at 7 CFR Part 650, NRCS General Manual Part 410, and the NRCS National Environment Compliance Handbook. As this is also a Supplemental Watershed Plan, the Supplemental Plan-EA will be developed in accordance with the NRCS National Watershed Program Manual (NWPM-390-500-M, 4th Ed., Apr 2014, as amended January 2015) and Guidance for Conducting Analyses Under the Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies and Federal Water Resource Investments (PR&G; USDA 2017).

The format of this Supplemental Plan-EA follows the plan format as outlined in the NRCS National Watershed Program Manual (NRCS 2014) Parts 501 through 505 and NRCS National Watershed Program Handbook (NRCS 2014) Parts 600 through 606.

This Plan-EA adheres to the planning procedures identified in the NRCS National Planning Procedures Handbook (NPPH). Specifically, Section 600.50 in the NPPH (Areawide Conservation Planning) has been considered in the development of this Plan-EA. The NRCS planning process consists of nine steps, divided into three phases, which cover development, implementation, and evaluation of an Areawide Conservation Plan. The three phases and nine steps are identified below:

Phase 1 - Collection and Analysis

Step 1 - Identify problems and opportunities
Step 2 - Determine objectives
Step 3 – Inventory resources
Step 4 – Analyze resource data

Phase 2 Decision Support

Step 5 – Formulate alternatives
Step 6 – Evaluate alternatives
Step 7 - Make decisions

Phase 3 Application and Evaluation

Step 8 – Implement the plan
Step 9 – Monitor the plan

The nine-step NRCS planning process for Watershed Plans is considered and incorporated into this Plan-EA as follows:

Table 1-1. Crosswalk of NRCS Nine-Step Planning Process and NEPA Requirements for this Plan-EA

Planning Step	NEPA Requirement	Chapter in this Plan-EA
Identify Problems and Opportunities	Purpose and Need	Chapter 1
Determine Objectives	Purpose and Need	Chapter 2
Inventory Resources	Affected Environment	Chapter 3 and Chapter 4
Analyze Resource Data	Affected Environment	Chapter 3 and Chapter 4
Formulate Alternatives	Alternatives	Chapter 5
Evaluate Alternatives	Environmental Consequences	Chapter 6
Make Decisions	Preferred Alternative and Decision Document	Chapter 8
Implement Plan	Mitigation and Monitoring	-
Evaluate Plan	Supplemental Plan-EA/EIS (Adaptive Management)	-

1.1 Changes Requiring Preparation of a Supplement

The Central Sonoma Watershed Work Plan was originally developed by the Soil Conservation Service (now NRCS) in 1958. The 49,445-acre "work plan" area identified in the 1958 Plan consisted of the HUC 12 Upper Santa Rosa Creek (180101100702) and Lower Santa Rosa Creek (180101100703) subwatersheds within the HUC 8 Russian Watershed (see Map C-1 in Appendix C).

The 1958 Plan determined that a 50-year storm event caused flooding in both Santa Rosa Creek and Matanzas Creek, and Matanzas Creek was determined to be a particularly major sediment source affecting the greater Santa Rosa Creek system. The Matanzas Creek Dam was constructed in 1964 to mitigate potential damages from future flood events and to capture sediment. The watershed area for the dam is approximately 11.45 square miles. The current flood storage capacity is 1,445 acre-feet.

The earthen embankment dam has a crest length of approximately 685 feet, a crest top width of 24 feet, a total height of approximately 95 feet, and a crest elevation of 427.63 feet. The dam features a 10-foot by 10-foot principal spillway intake structure, which reduces down to a 5.25-foot by 5.25-foot reinforced concrete conduit that runs through the embankment to the outlet structure. The auxiliary spillway is a vegetated earthen spillway with a crest elevation of 412.63 feet and a weir length of 200 feet. The designed sediment storage capacity for the dam is 245 acre-feet. For additional background information, past analyses, inspections, and photos of the dam, refer to *TM001 – Existing Conditions Assessment* in Appendix D.1.

The dam is currently owned, operated, and maintained by Sonoma Water, and is currently classified as a high hazard dam for NRCS and an extremely high hazard dam for California DSOD. In 2016, the dam was evaluated according to California DSOD criteria and the 2005 version of NRCS TR-210-60 criteria, which has since been superseded by the more recent 2019 version (NRCS 2019). The 2016 dam assessment determined that Matanzas Creek Dam met California DSOD and NRCS criteria except for routing the principal spillway hydrograph (PSH) through its existing principal spillway without operating the auxiliary spillway; therefore, the dam was determined to be out of compliance with TR-210-60 requirements. The 2016 assessment did not include a seismic evaluation of the dam, but Matanzas Creek Dam is within a high seismic region. The analyses conducted for this planning effort confirm that the existing dam does not meet the NRCS PSH criteria, nor does it meet NRCS and California DSOD requirements for seismic stability. For additional information, refer to *TM002 – Geologic Investigation Report* in Appendix D.1.

The auxiliary spillway crest elevation was originally designed to route the 100-year 24-hour storm event through the principal spillway; however, the current hydrologic and hydraulic analyses of the dam (see *TM005 – Existing Hydrology Analysis* and *TM008 – Frequency Flood Routing* in Appendix D.1) have determined that the flood storage capacity of the dam is limited to routing the 25-year 24-hour storm event through the principal spillway.

Measures to bring the dam into compliance with current standards would require changes to Matanzas Creek Dam, which is considered a major feature of the existing plan. This supplement would modify the existing plan by achieving agreed-upon objectives (flood control and sediment capture) through changed methods (new dam design criteria) without changes in purpose or scope.

Chapter 2. Purpose and Need

2.1 Purpose and Need for the Proposed Action

The purpose of the project is to bring the Matanzas Creek Dam into compliance with NRCS and state standards to continue to provide flood protection and sediment reduction downstream of Matanzas Creek Dam in the most efficient manner. The Matanzas Creek Dam currently provides flood protection for the City of Santa Rosa and adjacent unincorporated areas in Sonoma County, California. It also captures approximately 3.8 acre-feet of sediment annually. Based on recent assessments, the dam does not meet NRCS and California DSOD standards. The need is to bring the dam into compliance with current standards while continuing to provide flood protection and sediment reduction services. The project would address the PL 83-566 Authorized Project Purpose – Watershed Structure Rehabilitation – as listed in Title 390, NWPM, Part 500, Subpart A, Section 500.3.

2.2 Decision to be Made

The NRCS will decide whether to approve technical and financial assistance through the PL-566 Program for implementing the alternative selected by the Sponsor. The NRCS must decide if the selected alternative would or would not constitute a major federal action significantly affecting the quality of the environment. If the NRCS State Conservationist (responsible federal official) determines that the selected alternative would not significantly affect the quality of the environment, then the NRCS State Conservationist will prepare and sign a Finding of No Significant Impact (FONSI), and the project may proceed. If the NRCS State Conservationist determines that the selected alternative would significantly affect the quality of the environment, then an EIS and a Record of Decision (ROD) would be prepared and signed before the project could proceed.

2.3 PR&G Analysis

The purpose of the PR&G analysis is to ensure that alternatives contribute to the Federal Objective and Guiding Principles. The Federal Objective "specifies that federal water resource investments shall reflect national priorities, encourage economic development, and protect the environment;" the Guiding Principles are Healthy and Resilient Ecosystems, Sustainable Economic Development, Floodplains, Public Safety, and Watershed Approach (USDA 2017). Additional details on the Federal Objective are provided in the *PR&G Report* in Appendix D.2.

The PR&G study area considered the 49,445-acre "work plan" area as described in the 1958 Plan (which consists of the HUC 12 Upper Santa Rosa Creek [180101100702] and Lower Santa Rosa Creek [180101100703] subwatersheds within the Russian Watershed) and areas that hydraulic modeling indicated would be impacted by flooding. The boundaries of the study area are shown on Map C-1 in Appendix C. This area is large enough to identify cause and effect relationships among affected resources both upstream and downstream of the dam, particularly the downstream floodplain. Stakeholders were identified through the scoping process for this Plan-EA.

Chapter 3. Scope of the EA

The scope is the range of actions, alternatives, and impacts to be considered in this Supplemental Plan-EA.

3.1 Project Setting

The watershed area is within the North Coast Ranges region of the Pacific Border physiographic province. More specifically, the watershed area is located around the City of Santa Rosa and includes portions of the Sonoma Mountains and the Santa Rosa Plain in the Northern Bay Area of California. Elevation in the watershed area ranges between 60 feet above sea level in the valley bottom and 2,450 feet in the mountains. Matanzas Creek Dam is located on the eastern foothills of Taylor Mountain, along the western edge of Bennett Valley; the elevations of the dam and reservoir are between 300 and 450 feet. The climate is coastal, with average total annual precipitation of over 30 inches; over 80 percent of the precipitation falls between November and March. Temperatures range between winter lows of 37°F and summer highs of 83°F (WRCC 2022).

3.2 Scoping

An initial scoping process was used to determine the significant issues to be analyzed in detail, and to eliminate from detailed study the issues that are not significant. A *Public Participation Plan* was developed to outline the outreach methods and timing of public participation throughout the planning and NEPA process. Scoping efforts included public meetings in the spring of 2021, written requests for input from state, local, and federal agencies, written requests for input from Tribes, and coordination with potential cooperating agencies. Scoping efforts are detailed in the *Scoping Report*. The *Public Participation Plan* and *Scoping Report* are provided in Appendix A.1 and Appendix A.2, respectively.

The following list summarizes the comments and concerns that were expressed during the scoping process:

- Project financing (would parcel taxes increase?)
- Agency coordination (compliance with Fish and Game Code section 1602)
- Potential impacts to individuals or habitat of numerous wildlife species
- Creation or enhancement of wildlife habitat
- Available water supply
- Public acquisition of excavated soil material
- Rehabilitation and revegetation of the project area
- Noise impacts from project implementation
- Risk of dam failure and design need
- Sedimentation/siltation impacts
- Listed species and migratory birds
- Air quality
- Environmental Justice
- Cultural and Historic Resources

3.3 Issues

Based on the results of the initial scoping process, issues relevant in defining the problems and formulating and evaluating alternative solutions were identified for further assessment in this Plan-EA. Table 3-1 indicates which resources of concern are present in the watershed area and relevant to the Proposed Action, and are further analyzed in this document. Resources that are not present or not relevant are eliminated from further analysis.

Table 3-1. Summary of Resource Concerns and Issues Considered

Resource	Relevant to the Plan? Yes/No	Rationale
Air quality	Yes	Air pollutant emissions are likely to result from construction activities.
Coastal zone management areas	No	The nearest coastal zone management area is over 12 miles away from the watershed area (State of California 2019).
Coral reefs	No	Coral reefs do not occur within the watershed area, which is in an upland area over 14 miles from the nearest coast.
Cultural and Historic Resources	Yes	Modification of the Matanzas Creek Dam facility could impact cultural and historic resources. Dam failure (No Action) could impact cultural and historic resources in the breach inundation area.
Ecologically critical areas	Yes	Ecologically critical areas include riparian areas, natural areas, and special aquatic sites (e.g., wetlands). Riparian and natural areas and wetlands are addressed individually and will not be further addressed collectively as ecologically critical areas.
Endangered and threatened species	Yes	A species list was acquired from the USFWS IPaC System on April 11, 2025 (see Appendix D.3); endangered and threatened species and critical habitats may occur within the watershed area.
Essential fish habitat	No	The watershed area is within the boundaries of essential fish habitat for coho and Chinook salmon (NOAA 2022); however, Matanzas Creek is not considered essential fish habitat for these species (see *Summary of Existing Environmental Conditions* in Appendix D.4).
Fish and wildlife	Yes	State species of concern, including state-listed endangered and threatened species, protected, rare, and species of special concern occur within the watershed area (see *Summary of Existing Environmental Conditions* in Appendix D.4). Mountain lion was specifically noted as a species of concern during public scoping.
Floodplain management	Yes	Federal Emergency Management Agency (FEMA)-designated floodplains and functional floodplains occur throughout the watershed area; floodplain management could be affected by flood control measures.
Forest resources	No	Forest resources such as timber occur in the higher elevations of the watershed area but would not be impacted by dam rehabilitation.
Invasive species	Yes	Invasive species are known to occur within the dam and inundation area (see *Summary of Existing Environmental Conditions* in Appendix D.4).
Land use	Yes	Project activities could impact land uses within the watershed area.
Migratory birds	Yes	Migratory birds are likely to occur within the watershed area. The group will be addressed with “Wildlife.”

Resource	Relevant to the Plan? Yes/No	Rationale
Natural areas	No	Natural areas (land and water units where natural conditions are maintained) likely occur within the watershed area but would not be impacted by dam rehabilitation.
Noise levels	Yes	Noise is likely to result from project activities.
Parklands	No	Portions of Trione-Annadel State Park, Sugarloaf Ridge State Park, Hood Mountain Regional Park, Taylor Mountain Regional Park, and the entirety of Spring Lake Regional Park occur within the watershed area; however, no parklands would be affected by dam rehabilitation.
Prime and unique farmland, and farmland of statewide significance	Yes	Prime farmlands and farmlands of statewide importance are classified throughout the watershed area and occur near the existing dam and inundation area.
Public health and safety	Yes	The purpose of the project is to protect public health and safety by preserving flood protection. Potential hazardous material sites (service stations) occur within the breach inundation area.
Recreation	No	The existing dam and appurtenances are not used for recreation; dam rehabilitation would not affect recreation uses within the watershed area.
Regional water resource plans	No	Based on a review of numerous planning documents, there are no regional water resource plans that are relevant to rehabilitation of an existing dam.
Riparian areas	Yes	Riparian areas occur in association with Matanzas Creek.
Scenic beauty	No	The existing facility does not have high scenic value and is not readily visible to most casual observers.
Scientific resources	No	Geologic resources (e.g., folds, discontinuities, or mineral deposits), paleontological resources (e.g., fossils and surrounding rocks), caves, waterfalls, and gorges are not known to occur within the area, but the Matanzas Creek Fault occurs along the southeast end of the reservoir. The fault is not considered active.
Socioeconomic factors	Yes	Flood damage may affect socioeconomic factors.
Soil resources	Yes	The dam currently captures approximately 3.8 acre-feet of sediment each year. Soil disturbance would occur as a result of the project.
Sole source aquifers	No	The nearest sole source aquifer is over 90 miles away from the watershed area (EPA 2022b).
Vegetation	Yes	Rare plants are known to occur within the dam and inundation area (see *Summary of Existing Environmental Conditions* and *Botanical Assessment* in Appendix D.4 and Appendix D.5). Impacts to heritage oaks were specifically noted as a concern during public scoping. Scope of temporary and permanent impacts to vegetation are described in Table 5-2.
Water quality	Yes	Soil disturbance as a result of project activities could affect water quality, and the dam currently captures sediment.
Waters of the United States, including special aquatic sites	Yes	The channel in and out of the dam may be a jurisdictional water of the U.S. (see *Aquatic Resources Delineation Report* in Appendix D.6).

Resource	Relevant to the Plan? Yes/No	Rationale
Wetlands	Yes	Wetlands occur in association with the dam facilities (see *Aquatic Resources Delineation Report* in Appendix D.6).
Wild and scenic rivers	No	Wild and scenic rivers do not occur in Sonoma County (National Wild and Scenic Rivers System 2022). Nationwide Rivers Inventory segments do not occur within 4 miles of the watershed area (National Park Service 2022).

Resources which could potentially be impacted to a level requiring further analysis are described in Chapter 4 and impacts on these resources are analyzed in Chapter 6.

3.3.1 PR&G Analysis

The resources listed in Table 3-1 were considered for their role in the ecosystem and possible services provided. Ecosystem services that are likely to meaningfully change as a result of the project are:

- Urban flood damage reduction; this service is considered through the analyses of floodplain management and public health and safety.
- Water quality; this service is considered through the analysis of water quality.

Chapter 4. Affected Environment

This section describes the current physical, biological, ecological, economic, and social environment for the watershed area. This provides the context for determining the effects of alternatives.

4.1 Status of the Existing Dam

4.1.1 Operation and Maintenance

Based on the observations from a January 2021 site inspection, the overall condition of the dam was noted as good with no items of immediate concern. The most significant maintenance concerns were sediment buildup at the upstream end of the principal spillway conduit since the existing sediment pool level is near the low-level outlet.

No immediate concerns have been identified from the California DSOD annual dam inspections, and Sonoma Water has complied with requested maintenance items.

Current maintenance for the dam consists of mowing or grazing of vegetation on the embankment and auxiliary spillway, periodic removal of impounded sediment, and removal of debris at the principal spillway outlet and dam drains. Sonoma Water regularly checks the functionality of the spillways and low-level outlet and has installed piezometers in the reservoir that continually collect reservoir level data for the dam. Additional detail is available in in Appendix D.1.

4.1.2 Sedimentation Rates

The 1958 Plan estimated an annual sedimentation rate of 0.18 acre-feet per square mile for the watershed and a rate of 0.8 acre-feet per square mile for slides and gullies located within the watershed. Sonoma Water completed several sediment removal projects between 2006 and 2019, and removed an estimated total of 74.5 acre-feet of sediment. Based on the sediment removal volumes and 2020 LiDAR data, the approximate annual sedimentation rate for the dam is 3.8 acre-feet per year. Additional detail is available in in Appendix D.1.

4.1.3 Breach Analysis

Dam breach parameters were determined using TR-210-60 guidelines (NRCS 2019). Dam breach hydrographs were produced for the hydrologic, static, and seismic failure modes. The U.S. Army Corps of Engineers (USACE) River Analysis System (HEC-RAS version 5.0.7) was used to complete the hydraulic modeling. The peak breach flow for the hydrologic failure mode was determined to be approximately 173,550 cubic feet per second (cfs). Additional detail is available in in Appendix D.1.

4.1.4 Hazard Classification

Matanzas Creek Dam is currently classified as a High Hazard dam per NRCS criteria and Extremely High Hazard per California DSOD criteria. The results of the dam breach analysis agree with the current respective hazard classification for both agencies' criteria. Additional detail is available in Appendix D.1.

4.1.5 Potential Modes of Dam Failure

Based on the integrity analysis for the existing earthen auxiliary spillway, the spillway will erode and a headcut may progress back to the crest, resulting in a breach during the 24-hour freeboard hydrograph (FBH); however, data for the geotechnical parameters for the integrity analysis were limited, and a sensitivity analysis concluded that the auxiliary spillway may pass the integrity requirements if the geotechnical parameters were more favorable than the assumptions made during the analysis. Additional geologic investigation of the spillway would serve to reduce uncertainty in geotechnical parameters and improve confidence in the results of spillway headcutting failure mode analysis. The scope of any future investigation and supplemental analysis would be based on guidance in NRCS NEH Part 628 Chapter 52, NEH Part 631 Chapter 2, and NEM Part 531. Additional details on the results of and limitations associated with the spillway integrity analysis can be found in Appendix D.1.

Recent studies indicate that the existing dam embankment does not meet current NRCS and California DSOD requirements for seismic stability. Liquefaction and seismic deformation are predicted within the embankment fill, filter/drain, and alluvium, which would compromise function of the dam. Additional detail is available in Appendix D.1.

4.1.6 Consequences of Dam Failure

In general, dam breach flows would be conveyed through the City of Santa Rosa and eventually drain towards the Laguna de Santa Rosa. The hydrologic and static breaches warrant a NRCS high hazard classification and a California DSOD extremely high hazard classification to public safety and damage to infrastructure in Santa Rosa. Breach flood depths range from 0.5 to greater than 5 feet through residential neighborhoods and commercial buildings. For the seismic breach, the inundation zone includes Bennett Valley Golf Course and residential neighborhoods along Yulupa Avenue; however, the breach flows become contained within Matanzas Creek approximately 0.4 miles upstream of California Highway 12. The population at risk for the hydrologic, static, and seismic failures are 28,680, 16,938, and 184, respectively. Additional detail is available in Appendix D.1.

4.2 Air Quality

The Environmental Protection Agency (EPA) designates areas in the U.S. for "attainment" or "non-attainment" of National Ambient Air Quality Standards (NAAQS). The criteria pollutants include nitrogen oxides (NO_x), sulfur oxides (SO_x), particulate matter (PM), ozone (O_3), carbon monoxide (CO), and lead (Pb). According to the EPA's AirData Air Quality Monitors app (EPA 2022c), the watershed area is within an area designated as moderate nonattainment for $PM_{2.5}$ (2006 standard) and marginal nonattainment for ozone (2008 and 2015 standards). Due to the non-attainment status of the area, the annual threshold for determining if a conformity analysis will be required is 100 tons of the relevant criteria pollutant each year per 40 CFR 93.153(b)(1).

The project is in the San Francisco Bay Area Air Basin, which is currently designated a nonattainment area for the California air quality standards for ozone and particulate matter (Bay Area Air Quality Management District 2022). The Bay Air Quality Management District has identified project-level thresholds of significance to determine if an individual project's emissions would result in a significant adverse air quality impact; the thresholds are summarized in Table 4-3.

Table 4-1. Air Quality Thresholds of Significance (Project Level)

Criteria Air Pollutants and Precursors (Regional)	Construction-related Average Daily Emissions (lb/day)
Reactive organic gases (ROG)	54
NO_X	54
PM_{10}	82 (exhaust)
$PM_{2.5}$	54 (exhaust)
$PM_{10}/PM_{2.5}$ (fugitive dust)	Best management practices
Local CO	None

For a project to have a less-than-significant criteria air pollutant impact for construction-related fugitive dust emissions, it must implement the basic best management practices (BMPs) listed in Table 4-2.

Table 4-2. Basic Best Management Practices for Construction-Related Fugitive Dust Emissions

BMP ID	Basic Best Management Practice
B-1	All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.
B-2	All haul trucks transporting soil, sand, or other loose material off-site shall be covered.
B-3	All visible mud or dirt trackout onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
B-4	All vehicle speeds on unpaved roads shall be limited to 15 mph.
B-5	All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.
B-6	All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 mph.
B-7	All trucks and equipment, including their tires, shall be washed off prior to leaving the site.
B-8	Unpaved roads providing access to sites located 100 feet or further from a paved road shall be treated with a 6- to 12-inch layer of compacted layer of wood chips, mulch, or gravel.
B-9	Publicly visible signs shall be posted with the telephone number and name of the person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's General Air Pollution Complaints number shall also be visible to ensure compliance with applicable regulations.

For additional details on existing air quality conditions, see the *Summary of Existing Environmental Conditions* in Appendix D.4.

4.3 Cultural and Historic Resources

Cultural and historic resources are tangible and nontangible evidence or expressions of human activity. Such resources include culturally significant landscapes, historic buildings/structures and districts, archaeological sites, traditional cultural properties, Native American and other sacred places, and artifacts and documents of cultural and historic significance. Section 106 of the National Historic Preservation Act (NHPA) of 1966 (54 U.S.C. 300101), as amended, mandates that federal agencies consider the potential effects of a proposed federal undertaking on historic properties.

Historic properties are defined as any prehistoric or historic district, site, building, structure, or object greater than 50 years of age that are included in, or eligible for, inclusion in the National Register of Historic Places (NRHP) (36 CFR 800.16(l)). The criteria for evaluating the eligibility of a cultural resources site for the listing on the NRHP is summarized as: "The quality of significance in American history, architecture, archaeology, and culture is present in districts,

sites, buildings, structures, and objects of State and local importance that possess integrity of location, design, setting, material, workmanship, feeling, and association, and that they:

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

NRCS defined the area of potential effect (APE) as 120.7 acres, which includes the dam facility, the maximum inundation area, all access roads, stagings areas, and potential project measures. This is the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist (36 CFR 800.16(d)). The APE is shown on Map C-10 in Appendix C.

Approximately 110.1 accessible acres were surveyed for cultural resources on February 22, February 25, and April 8, 2021, by personnel that meet the Secretary of the Interior's qualifications in archaeology. Eight cultural resource sites were identified. In accordance with 36 CFR Section 800.4, the NRCS, in consultation with the California State Historic Preservation Officer (SHPO) and Tribes, evaluated the sites for NRHP eligibility. The Tribes that were consulted were:

- The Cloverdale Rancheria of Pomo Indians
- The Cortina Rancheria – Kletsel Dehe Band of Wintun Indians
- The Dry Creek Rancheria of Pomo Indians
- The Federated Indians of Graton Rancheria
- The Kashia Band of Pomo Indians of the Stewarts Point Rancheria
- The Koi Nation of Northern California
- The Lytton Rancheria
- The Middletown Rancheria
- The Mishewal-Wappo Tribe of Alexander Valley

The NRCS letter initiating Section 106 consultation is provided in Appendix A.3.

The results of the identification effort are summarized in Table 4-3.

Table 4-3. Summary of cultural and historic resources identified within the APE

Type	NRHP Eligibility Determination	Location
Road grade and tree alignment	Not eligible	Within current auxiliary spillway
Well shed and wooden platform	Not eligible	Within current auxiliary spillway
Mid 20th-century farmstead	Not eligible	South bank of Matanzas Creek, within current inundation area

Type	NRHP Eligibility Determination	Location
Sparse lithic scatter	Not eligible	Slope on the western bank of the inundation area
Matanzas Creek Dam	Not eligible	Existing dam and associated facilities. The facility is a contributing resource of the Central Sonoma Watershed Project Historic District.
Central Sonoma Watershed Project Historic District	Eligible – Criterion A	Historic district comprised of Matanzas Creek Dam and other flood control facilities of the Central Sonoma Watershed Project
Complex lithic scatter (P-49-1109)	Eligible – Criterion D	Matanzas Creek vicinity
Late 19th century farmstead (P-49-1864)	Not eligible	Adjacent to Bennett Valley Road

Of the eight sites, two were determined eligible for listing on the NRHP: the Central Sonoma Watershed Project Historic District and a complex lithic scatter. The Matanzas Creek Dam facility, built in 1963, was evaluated for NRHP eligibility as part of the larger Central Sonoma Watershed Project and found not individually eligible, but is a contributing resource of the Central Sonoma Watershed Project Historic District, which was evaluated to be eligible for listing on the NRHP.

The City of Santa Rosa was settled in the early 1800s and was incorporated in 1867 (Advisory Council on Historic Preservation 2024). There are currently eight designated Preservation Districts in Santa Rosa: Burbank Gardens, Cherry Street, McDonald, Olive Park, Railroad Square, Ridgway, St. Rose, and West End (Historical Society of Santa Rosa 2016; City of Santa Rosa 2007). The Matanzas Creek Dam facility currently provides protection to most of the area within these districts.

The NRCS consulted with the California State Historic Preservation Officer (SHPO) on determination of site eligibility in letter dated February 5, 2025. The SHPO concurred with the determinations of eligibility in a letter dated February 14, 2025; the letters are provided in Appendix A.3.

4.4 Endangered and Threatened Species

A list of federally listed species that may occur in the watershed area was obtained from the U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) system on April 11, 2025; the list is provided in Appendix D.3. The National Oceanic and Atmospheric Administration (NOAA) Fisheries website was also reviewed for species under their jurisdiction. Additional life history characteristics and known occurrences are disclosed in the *Summary of Existing Environmental Conditions* and the *Botanical Assessment* prepared for the project in Appendix D.4 and Appendix D.5, respectively.

4.4.1 Species

- Steelhead (*Oncorhynchus mykiss*) - Central California Coast Distinct Population Segment (DPS); Threatened: Steelhead are known to occur in the Russian River and Santa Rosa Creek, but barriers currently preclude anadromy in Matanzas Creek. Critical habitat for steelhead does not occur in Santa Rosa Creek or Matanzas Creek. Impacts to water

quality in downstream waters could affect occupied habitat for steelhead; therefore, the species will be carried forward for further analysis.

- Salt marsh harvest mouse (*Reithrodontomys raviventris*); Endangered: The salt marsh harvest mouse is generally "restricted to the tidal and brackish marshes of San Francisco, San Pablo, and Suisun Bay areas" (USFWS 2013). The bays and associated marshes are over 10 miles away from the watershed area, and suitable habitat does not occur in association with Matanzas Creek. The species will not be considered further.
- Northern spotted owl (*Strix occidentalis caurina*); Threatened: A polygon of critical habitat is designated in the extreme northeastern portion of the watershed area, over 7 miles from Matanzas Creek Dam. There is a single activity center east of the project in Trione-Annadel State Park and five associated positive survey records within 5 miles of the Matanzas Creek Dam. Suitable habitat is characterized as old growth and mature redwood or coniferous forests. The area around Matanzas Creek Dam is primarily vegetated by grassland, oak woodland, and riparian habitats that are unsuitable for northern spotted owl. The species will not be considered further.
- Yellow-billed cuckoo (*Coccyzus americanus*); Threatened: The nearest critical habitat is over 55 miles to the northeast of the watershed area, along the Sacramento River. Breeding is not known to occur in the area. Due to a lack of recent recorded occurrences in Bennett Valley and the greater region around Santa Rosa, the species will not be considered further.
- Green sea turtle (*Chelonia mydas*); Threatened: Green sea turtles are found in open water marine habitats and sandy beaches. Suitable habitat does not occur within the watershed area, and there are no recorded occurrences for the species within 5 miles of Matanzas Creek Dam. The species will not be considered further.
- Northwestern pond turtle (*Actinemys marmorata*); Proposed Threatened: The species has been recorded in Matanzas Creek as recently as 2006. Uplands around the creek contain riparian and oak woodland habitat that may provide nesting habitat for the species. Suitable aquatic habitat is intermittently present in Matanzas Creek and the reservoir. The species will be carried forward for further analysis.
- California red-legged frog (*Rana draytonii*); Threatened: Critical habitat is mapped just over 1 mile east of Matanzas Creek Dam. Suitable habitat may occur in association with Matanzas Creek. Protocol surveys were conducted from January to July of 2022; no California red-legged frogs were detected during surveys. Due to the presence of suitable habitat and the possibility of migration into the area, the species will be carried forward for further analysis.
- California tiger salamander (*Ambystoma californiense*); Endangered: California tiger salamanders are known to occur on the Santa Rosa Plain, in the western portion of the watershed area where critical habitat is also designated. The species is not known to occur in Bennett Valley, where Matanzas Creek Dam is located. The species will not be considered further.
- Monarch butterfly (*Danaus plexippus*); Proposed Threatened: Monarchs require milkweed (*Asclepias* spp.), nectar sources, overwintering habitat, and migration habitat (USFWS 2020). Botanical surveys conducted in 2021 did not detect milkweed in the study area. Matanzas Creek Dam is also well outside of the wintering range (up to 1 mile from the coast) at approximately 20 miles from the coast. The species will not be considered further.

- Burke's goldfields (*Lasthenia burkei*); Endangered: The species is known to occur within the watershed in vernal pool habitats where natural clay soils have formed and the species was seeded. Suitable soils do not occur in association with Matanzas Creek Dam, and the plant was not observed during a site visit in the spring of 2021. The species will not be considered further.
- Clara Hunt's milk-vetch (*Astragalus clarianus*); Endangered: There are no recorded occurrences within the watershed area, and the five known localities in grassland habitats are outside the watershed area. The plant was not observed during a site visit in the spring of 2021. The species will not be considered further.
- Kenwood Marsh checker-mallow (*Sidalcea oregana ssp. valida*); Endangered: There are no recorded occurrences within the watershed area, and the two known localities in freshwater marsh habitat are outside the watershed area. The plant was not observed during a site visit in the spring of 2021. The species will not be considered further.
- Loch Lomond coyote-thistle (*Eryngium constancei*); Endangered: There are no recorded occurrences within the watershed area, and the known vernal pool localities are outside the watershed area (USFWS 2005). The plant was not observed during a site visit in the spring of 2021. The species will not be considered further.
- Many-flowered navarretia (*Navarretia leucocephala ssp. plieantha*); Endangered: There are no recorded occurrences within the watershed area, and the known vernal pool localities are outside the watershed area (USFWS 2005). The plant was not observed during a site visit in the spring of 2021. The species will not be considered further.
- Pitkin Marsh lily (*Lilium pardalinum ssp. pitkinense*); Endangered: Suitable habitat may occur at the extreme western end of the watershed area, in shaded riparian areas (USFWS 2019). Suitable habitat does not occur in association with Matanzas Creek Dam. The plant was not observed during a site visit in the spring of 2021. The species will not be considered further.
- Sebastopol meadowfoam (*Limnanthes vinculans*); Endangered: The species is known to occur within the watershed in created vernal pool and seasonal wetland habitats within the Santa Rosa Plain. The plant was not observed in association with Matanzas Creek Dam during a site visit in the spring of 2021. The species will not be considered further.
- Showy Indian clover (*Trifolium amoenum*); Endangered: Suitable habitat of wet swales, grasslands, and grassy hillsides occurs within the watershed area; however, there are no known occurrences within the watershed (USFWS 2012). The plant was not observed during a site visit in the spring of 2021. The species will not be considered further.
- Sonoma alopecurus (*Alopecurus aequalis var. sonomensis*); Endangered: There is a known occurrence within the watershed inside Trione-Annadel State Park, in a shallow, semi-upland area at the border of a seasonal marsh. The plant was not observed in association with Matanzas Creek Dam during a site visit in the spring of 2021. The species will not be considered further.
- Sonoma spineflower (*Chorizanthe valida*); Endangered: Suitable habitat of well-drained sandy coastal prairie grassland soils may occur within the watershed area, but only historical records occur within Sonoma County, and the species is considered extirpated at these localities (USFWS 2010). The plant was not observed during a site visit in the spring of 2021. The species will not be considered further.

- Sonoma sunshine (*Blennosperma bakeri*); Endangered: The species is known to occur in created vernal pool and seasonal wetland habitats surrounded by grazed grassland within the Santa Rosa Plain. The plant was not observed in association with Matanzas Creek Dam during a site visit in the spring of 2021. The species will not be considered further.
- White sedge (*Carex albida*); Endangered: Suitable habitat may occur at the extreme western end of the watershed area, in a marsh wetland fed by underground seeps. The plant was not observed in association with Matanzas Creek Dam during a site visit in the spring of 2021. The species will not be considered further.
- Yellow larkspur (*Delphinium luteum*); Endangered: The species is known from "rocky areas within coastal scrub plant community, including areas with active rock slides, from sea level to 100 meters (300 feet) in elevation" (USFWS 2011). Suitable habitat does not occur near Matanzas Creek. The plant was not observed during a site visit in the spring of 2021. The species will not be considered further.

4.4.2 Critical Habitat

Although portions of USFWS-designated critical habitat for California red-legged frog, California tiger salamander, and northern spotted owl occur within the watershed area (see Map C-2 in Appendix C), they do not occur within 1 mile of the dam.

4.5 Fish and Wildlife

Fish and wildlife species (including migratory birds) and habitats are managed on multiple federal and state levels. Species of concern that may occur in the watershed area were identified from the California threatened and endangered species list (California Department of Fish and Wildlife [CDFW] 2022a), California Species of Special Concern (CDFW 2022b), California fully protected species (CDFW 2022c), and the USFWS IPaC system. Databases searched included the California Natural Diversity Database (CNDDB), the National Marine Fisheries Service's (NMFS's) California Species List Tool, and eBird, an online database of bird observations made by birdwatchers. Habitat conditions and suitability for species presence were assessed during a site visit to the dam and reservoir area on January 19, 2021. Details on the species considered, habitat requirements, nearby occurrences, and potential for occurrence are provided in the *Summary of Existing Environmental Conditions* in Appendix D.4.

The species to be carried forward for further analysis based on likely presence in the area are Russian River roach (*Lavinia symmetricus* ssp.), Pacific lamprey (*Entosphenus tridentatus*), western river lamprey (*Lampetra ayresii*), western brook lamprey (*Lampetra richardsoni*), foothill yellow-legged frog (northwest/north coast clade; *Rana boylii*), California giant salamander (*Dicamptodon ensatus*), northwestern pond turtle (*Actinemys marmorata*), tricolored blackbird (*Agelaius tricolor*), golden eagle (*Aquila chrysaetos*), white-tailed kite (*Elanus leucurus*), yellow warbler (*Setophaga petechia*), loggerhead shrike (*Lanius ludovicianus*), northern harrier (*Circus cyaneus*), yellow-breasted chat (*Icteria virens*), and pallid bat (*Antrozous pallidus*).

Additionally, concerns regarding potential impacts to mountain lions (*Puma concolor*) and their habitat were specifically noted during public scoping.

4.6 Floodplain Management

E.O. 13690 and E.O. 11988 direct federal agencies to "improve the resilience of communities and Federal assets against the impacts of flooding" and "to avoid, to the extent possible, the long- and short-term adverse impacts associated with occupancy and modification of floodplains."

The Federal Emergency Management Agency (FEMA) has designated 100-year and 500-year floodplains within the watershed; mapped floodplains are shown on Map C-3 in Appendix C. The mapped floodplains mainly occur in association with Matanzas Creek, Spring Creek, and lower Santa Rosa Creek. Matanzas Creek Dam and the reservoir are not within the mapped floodplain; the 100-year floodplain is mapped starting approximately 0.8 mile below the dam (FEMA 2023).

Matanzas Creek Dam is the only flood retarding structure located on Matanzas Creek and, as such, its presence has a direct impact on the regulatory floodplain along Matanzas Creek. The auxiliary spillway currently engages in approximately the 25-year storm, so the 100-year floodplain immediately downstream of the dam is impacted by flows from the auxiliary spillway. If the dam met current NRCS criteria for a high hazard dam, the auxiliary spillway would not be engaged in the 100-year storm event and only flows from the principal spillway would contribute to the 100-year floodplain.

Matanzas Creek is one of multiple tributaries that contribute flow to Santa Rosa Creek within the project model extents. NRCS flood retarding structures have been constructed on some of these tributaries, and while the impacts of these other NRCS flood retarding structures on the floodplain along Santa Rosa Creek were not specifically evaluated as part of this project, the system of flood retarding structures was designed to reduce flooding along the tributaries in which the structures were built on, as well as along Santa Rosa Creek.

4.7 Invasive Species

E.O. 13112 directs federal agencies "whose actions may affect the status of invasive species" to use relevant authorities to "prevent the introduction of invasive species; . . . provide for restoration of native species and habitat conditions in ecosystems that have been invaded; . . . and not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States or elsewhere."

Invasive species occur throughout the watershed and have been observed in association with Matanzas Creek. Invasive Harding grass (*Phalaris aquatica*) is widespread around the dam, spillway, and inundation area. Other invasive plant species around the dam include yellow star thistle (*Centaurea solstitialis*), bull thistle (*Cirsium vulgare*), poison hemlock (*Conium maculatum*), artichoke thistle (*Cynara cardunculus*), medusa head (*Elymus caput-medusae*), fennel (*Foeniculum vulgare*), wild mustard (*Hirschfeldia incana*), pennyroyal (*Mentha pulegium*), Himalayan blackberry (*Rubus armeniacus*), and Spanish broom (*Spartium junceum*).

Crayfish (either *Pacifastacus leniusculus* or *Procambarus clarkia*) have been observed in standing water immediately downstream of the dam. During the wet season, invasive animals such as smallmouth bass (*Micropterus dolomieu*), green sunfish (*Lepomis cyanellus*), bluegill (*Lepomis macrochirus*), fathead minnow (*Pimephales promelas*), largemouth bass (*Micropterus salmoides*), bullhead (*Ameiurus* spp.), western mosquitofish (*Gambusia affinis*), and bullfrogs

(*Lithobates catesbeianus*) could move through the area from permanent water upstream and downstream of the dam.

Additional details about invasive species are provided in the *Summary of Existing Environmental Conditions* in Appendix D.4.

4.8 Land Use

According to data from the California Department of Forestry and Fire Protection (CAL FIRE 2022), land ownership within the watershed includes private land, California Department of Parks and Recreation (Trione-Annadel State Park and Sugarloaf Ridge State Park), local government (Sonoma County and Santa Rosa City facilities), other state lands (California State University Sonoma), non-profit conservancies and trusts, and California Department of Fish and Wildlife land. The area of each land ownership type is summarized in Table 4-4 and shown on Map C-1 in Appendix C.

Table 4-4. Land ownership within the watershed area

Land ownership	Area (acres)	Percentage
Private/Other	41,636	84.2%
California Department of Parks and Recreation	4,596	9.3%
Local Government	2,942	5.9%
Other State Lands	195	0.4%
Non-Profit Conservancies and Trusts	42	0.1%
California Department of Fish and Wildlife	36	0.1%
Total	**49,445**	**100.0%**

Land uses include native forest at the higher elevations, while the valley bottoms are developed for residential, municipal, commercial, industrial, and agricultural uses. Land use types were summarized from Sonoma Veg Map data (Sonoma Veg Map 2022); the area of each cover type is summarized in Table 4-5.

Table 4-5. Land use cover type within the watershed area

Cover type	Area (acres)	Percentage
Forest	20,075	40.6%
Urban	14,980	30.3%
Vegetated	11,374	23.0%
Agriculture	2,784	5.6%
Water	232	0.5%
Total	49,445	100.0%

The dam facility area is zoned as Rural Residential District (RR) and Diverse Agriculture (DA). The current 100-year inundation area of the dam is 70.9 acres; the inundation area is largely undeveloped, though Grange Road crosses the eastern end of the area and Bunnell Road routes along and within the southern edge to provide access to private properties. The dam facility and associated inundation area are on property largely owned by Sonoma Water.

Agriculture crop types within the watershed area and breach inundation area are provided in Appendix E.1.

4.9 Noise Levels

The existing dam is in a relatively isolated area, with wineries and forest surrounding the area. Receptors (land uses that are sensitive to noise impacts) in the area are mainly residences. According to aerial imagery, the nearest home is less than 300 feet west of the dam.

4.10 Prime and Unique Farmlands

Approximately 8,589 acres within the watershed area are classified as farmland of statewide importance, 7,466 acres as prime farmland if irrigated, 1,692 acres as prime farmland if irrigated and either protected from flooding or not frequently flooded during the growing season, and 1,071 acres as prime farmland if irrigated and drained (NRCS 2022). Soils classified as prime farmland and farmland of statewide importance occur upstream and downstream of the dam (see Map C-4 in Appendix C).

4.11 Public Health and Safety

The dam is currently classified as High Hazard per NRCS criteria and Extremely High Hazard per California DSOD. A dam breach analysis for the hydrologic failure mode indicates that 4,165 residential homes, 210 duplexes, 686 apartments, 361 commercial buildings, 10 school buildings, eight critical buildings (e.g., hospitals, assisted living buildings), 78 roads, and 1 railroad, could be impacted by breach flooding (see Map C-5 in Appendix C). The hydrologic breach inundation map results in a population at risk of 28,680. A fatality rate was estimated for the breach scenario using NRCS procedures adopted from *A Procedure for Estimating Loss of Life Caused by Dam Failure* (U.S. Department of the Interior Dam Safety Office 1999). These procedures estimate a fatality rate for the population at risk that is based on an estimate of the depth and velocity of the breach floodplain and the warning time for downstream population at risk. Using a fatality rate of 0.007, this breach would result in an estimated loss of life of 200 persons. Additional detail is available in in Appendix D.1.

There are 119 service stations identified within the maximum inundation area. The California State Water Resources Control Board requires that the owner of a facility with an underground storage tank (UST) prepare a UST Response Plan for that facility. No other potential hazardous materials sites or hazardous waste sites were identified within the maximum inundation area.

4.12 Riparian Areas

Riparian areas occur in association with Matanzas Creek up and downstream of the dam. Approximately 6.9 acres of riparian vegetation were mapped within the study area. The riparian area may provide wildlife habitat and movement corridors and may reduce flow velocities entering the reservoir. Additional details about the riparian areas are provided in the *Summary of Existing Environmental Conditions* in Appendix E.

4.13 Socioeconomic Factors

Socioeconomic factors such as education, employment, income, crime rate, and health could be affected by disasters such as flooding within a community. Comparable relevant data for the watershed area, Sonoma County, and the State of California are provided in Table 4-6.

Table 4-6. Demographic and socioeconomic factor data for Watershed Area, Sonoma County, and California

Factor	Watershed Area[1]	Sonoma County	California
Total Population Estimate [1,2]	132,744	485,887	39,237,836
Percent Female [1,2]	52%	51.2%	50.3%
Race – percent white alone [1,2]	73%	86.8%	71.9%
Race – percent Black or African American alone [1,2]	2%	2.1%	6.5%
Race – percent American Indian alone [1,2]	1%	2.2%	1.6%
Race – percent Asian alone [1,2]	4%	4.6%	15.5%
Race – percent Pacific Islander alone [1,2]	1%	0.4%	0.5%
Race – percent two or more races [1,2]	3%	4.0%	4.0%
Race – percent Hispanic [1,2]	26%	27.3%	39.4%
Race – percent white alone, not Hispanic or Latino [1,2]	63%	62.9%	36.5%
Race – percent minority [1,2]	37%	37.1%	63.5%
Owner-occupied housing unit rate – percent [1,2]	56%	61.3%	55.3%
Persons per household [1,2]	2.6	2.58	2.94
Highschool graduate – percent [1,2]	90%	89.1%	83.9%
Unemployment – percent [3]	3%	2.7%	4.0%
Life expectancy – years [3]	Not Available	82.2	81.7
Violent crime rate – per 100,000[3]	Not Available	368	421
Per capita income [1,2]	$43,579	$44,071	$38,576

[1] EPA 2022a
[2] U.S. Census Bureau 2022a
[3] County Health Rankings 2022

Based on socioeconomic factors, the watershed area is fairly representative of Sonoma County; population data for race and socioeconomic factors for each geographic area are closely matched. Both the watershed area and Sonoma County have a similar percentages of white and minority populations; however, the minority populations in the watershed area and county makes up a much smaller proportion of the total population than that for the entire State of California. The per capita income is also higher in the watershed area and Sonoma County than the state overall.

The main employment sectors in Sonoma County are government and public education, education and health services, professional and business services, retail, manufacturing, leisure and hospitality, construction, and agriculture (Sonoma County 2022a).

4.14 Soil Resources

The watershed area is located within the foothills and valleys of the California Coast Ranges north of San Francisco Bay. The foothills are predominantly composed of Sonoma Volcanics (e.g., andesite, basalt, tuff), while surficial alluvium deposits make up the valley bottoms (Graymer et al. 2007). A majority of soils in the watershed area are classified as clay loams and

are generally less susceptible to water erosion but have high runoff potential (NRCS 2022). The dam currently captures approximately 3.8 acre-feet of sediment each year.

4.15 Vegetation

Numerous vegetation communities are mapped within the area associated with the Matanzas Creek Dam. Riparian communities are located along Matanzas Creek and a marsh is located on the upstream side of the dam. The predominant community in the area is grasslands, with oak (*Quercus*) alliances located in patches along Matanzas Creek and adjacent to Matanzas Reservoir. Trees that qualify as "heritage" or "landmark" trees per Sonoma County Code (Chapter 26D) may occur within the area but have not been identified to date. Additional details about vegetative communities in the area are provided in the *Summary of Existing Environmental Conditions* in Appendix E.

Species of concern that may occur in the vicinity of the dam were identified from the California threatened and endangered species list; species defined as rare or threatened by the California Native Plant Protection Act; plant species listed by the California Native Plant Society as California Rare Plant Rank 1, 2, 3, and sometimes 4; and species that otherwise meet the definition of rare, threatened, or endangered pursuant to Section 15380 of the California Environmental Quality Act (CEQA) Guidelines. Lobb's aquatic buttercup (*Ranunculus lobbii*) was the only species of concern (California Rare Plant Rank [CRPR] 4) identified during blooming-period surveys. The species was observed in two vernal pools in the auxiliary spillway and one isolated pool in the southwest portion of the inundation area. Additional details about special-status plants are provided in the *Botanical Assessment* in Appendix E.

4.16 Water Quality

Tributaries to Santa Rosa Creek water bodies (including Matanzas Creek) are on the Clean Water Act Section 303(d) list (list of waters not meeting water quality standards) for sedimentation, pathogens, and temperature (EPA 2024). A total maximum daily load (TMDL) has not been developed. The dam currently captures approximately 3.8 acre-feet of sediment per year. Operation of the dam may also increase water temperatures and reduce dissolved oxygen (State of California 2024).

4.17 Waters of the U.S.

Waters of the U.S. in the watershed area include the Russian River and its tributaries. Matanzas Creek is a perennial tributary to Santa Rosa Creek, which flows into the Laguna de Santa Rosa, which is a tributary to the Russian River. Waters of the U.S. associated with the dam include Matanzas Creek and the conduit and spillway that it may flow through, and unnamed intermittent tributaries that flow into Matanzas Creek. See the *Aquatic Resources Delineation Report* in Appendix E for more details. Wetlands may also be waters of the U.S. and will be addressed separately.

4.18 Wetlands

Approximately 0.95 acres of freshwater emergent marsh wetlands were delineated within the inundation area and up to the dam, and another 0.15 acres were delineated along the outlet channel out of the dam. An area of approximately 0.14 acres of forested/shrub wetlands was also delineated within the inundation area. An isolated freshwater marsh of approximately 0.01 acres

was delineated on the south side of the inundation area and approximately 0.15 acres of isolated seasonal wetlands were delineated in the auxiliary spillway. See the *Aquatic Resources Delineation Report* in Appendix E for more details.

4.19 PR&G Analysis

The resources listed in Table 3-1 and described in this chapter were considered for their role in the ecosystem and possible services provided. Ecosystem service flows (the transmission of a service from ecosystems to people) are quantified and monetized when possible, but non-monetary and unquantified effects are also considered. Additional details on the ecosystem services considered are provided in the *PR&G Report* in Appendix D.2. Ecosystem services that are likely to meaningfully change as a result of the project are:

4.19.1 Provisioning Services

Provisioning services are tangible goods provided for direct human use and consumption, such as food fiber, water, timber, or biomass.

- Water: This service will be considered through the analysis of water quality.

4.19.2 Regulating Services

Regulating services maintain a world in which it is possible for people to live, providing critical benefits that buffer against environmental catastrophe such as flood, disease, and climate change.

- Urban flood damage reduction. This service will be considered through the analyses of floodplain management and public health and safety.

4.19.3 Supporting Services

Supporting services are underlying processes that maintain conditions for life on Earth, including nutrient cycling, soil formation, and primary production.

- No supporting services were identified for this project.

4.19.4 Cultural services

Cultural services make the world a place in which people want to live, and include recreational use, cultural heritage values, and spiritual, aesthetic, and artistic values.

- No cultural services were identified for this project.

The ecosystem services and respective resources considered for analysis are summarized in Table 4-7.

Table 4-7. Summary of Ecosystem Services and Corresponding Resource Analyses

Category	Resource
Provisioning Services	Water quality
Regulating Services	Floodplain management
	Public health and safety

Chapter 5. Alternatives

This section describes the range of alternatives to be addressed in the environmental analysis. A range of alternatives were considered and objectively evaluated. Alternatives that were determined to be infeasible or did not meet the purpose and need were eliminated from further analysis. The No Action Alternative is considered and analyzed to provide a baseline for comparison of the impacts of the proposed alternatives.

5.1 Formulation Process

The formulation process is the basis for selecting combinations of measures to include as alternatives.

The process for this project followed procedures outlined in the National Watershed Program Manual (NRCS 2015) Parts 500 through 506, and National Watershed Program Handbook (NRCS 2014) Parts 600 through 606, Guidance for Conducting Analyses Under the Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies and Federal Water Resource Investments (USDA 2017), and other NRCS watershed planning policy.

No alternatives were identified in response to issues raised during project scoping. Possible alternatives were developed by the project team based on the ability to address the purpose and need of the project and were formulated in consideration of four criteria: completeness, effectiveness, efficiency, and acceptability. In accordance with NEPA (40 CFR 1502.14), two alternatives (Federal Decommissioning and Non-Structural alternatives) and multiple design configurations were eliminated from further analysis; the rationale is detailed below. The project team analyzed three dam rehabilitation alternatives and the No Action Alternative.

For more information regarding the development and evaluation of all alternatives considered, refer to in Appendix D.1.

5.2 Alternatives considered but eliminated from detailed study

The following alternatives were considered but eliminated from detailed study.

5.2.1 Federal Decommissioning

The Federal Decommissioning Alternative considered decommissioning and removal of the dam, with acquisition, relocation, or dry floodproofing of downstream structures and improvements to stream channel crossings to maintain the current level of flood protection that the dam currently provides.

The following measures would be implemented under this alternative:

1. Partial removal of the dam embankment with slopes stabilized to a 3:1 (H:V) side slope.
2. Removal of the low-level drawdown pipe, concrete riser, and concrete outlet pipe.
3. Reconnection of the channel to the floodplain and re-establishment of riparian vegetation along the channel.
4. Installation of a grade stabilization structure to prevent stream headcutting.
5. Seeding of all disturbed areas to stabilize soils.

6. Acquisition or relocation of any downstream structure that is impacted by a greater depth of flooding than with the dam in place in order to provide continued flood protection.
7. Improvements to any downstream stream crossings that are impacted by a greater depth of flooding than with the dam in place in order to provide continued flood protection.
8. Installation of several small sediment capture basins along Matanzas Creek to provide sediment capture capacity.

Based on the anticipated high implementation cost, inefficiency of flood protection and sediment capture, and the social impacts associated with acquisition, relocation, or dry floodproofing of such a large number of private and public structures, this alternative was determined to be inefficient and unacceptable and was eliminated from further study.

5.2.2 Non-structural Alternative

The Non-structural Alternative considered improvements that would not require rehabilitation of the existing structure; this alternative would consist of acquiring or relocating all properties within the extents of the dam breach inundation area and modifying the zoning ordinances to prevent future development within this area. If the population-at-risk could be removed, then it is possible that Matanzas Creek Dam could be re-classified as a low hazard dam and would meet the corresponding NRCS and California DSOD criteria. This alternative would require that approximately 4,100 residential homes, 210 duplexes, 686 apartment buildings, 361 commercial buildings, 10 school buildings, and eight critical buildings (e.g., hospitals, assisted living buildings) be acquired or relocated. Considering the 4,100 residential structures alone and assuming an average structure and property value of $400,000, the Non-structural Alternative would cost at least $1.6 billion dollars. Based on the high implementation cost and the social impacts associated with acquisition or relocation of such a large number of structures, this alternative was determined to be inefficient and unacceptable and was eliminated from further study and not considered in the economic analysis.

5.2.3 Design Configurations for Full Dam Rehabilitation

A number of design configurations were considered for full dam rehabilitation that were ultimately eliminated from detailed consideration based on hydraulic and flood protection conditions; see *TM007 – Alternative Development and Evaluation* in Appendix D.1 for more details. A description and the rationale for elimination are summarized in Table 5-1.

Table 5-1. Design Configurations Eliminated from Detailed Study

Configuration Number[1]	Configuration Description	Justification for Elimination
1	Increase principal conduit spillway size from 5.25’ x 5.25’ to 7.5’ x 7.5’ with a 12’ x 12’ riser	Would increase the frequency of downstream flooding. Would not maintain existing level of flood protection and therefore would not meet the purpose and need.
2	Add secondary principal spillway with 10’ x 10’ riser and 5’ x 5’ conduit	Would increase the frequency of downstream flooding. Would not maintain existing level of flood protection and therefore would not meet the purpose and need.

Configuration Number[1]	Configuration Description	Justification for Elimination
3	Lower principal spillway crest by 5’ (from 375 feet (msl) to 370 feet)	Crest cannot be lowered enough to meet NRCS PSH criteria and would result in principal spillway being engaged more frequently. Would not eliminate auxiliary spillway breach risk and would not maintain existing level of flood protection, so would not meet the purpose and need.
4	Armor (articulated concrete blocks [ACB] or riprap) existing auxiliary spillway	Does not meet NRCS PSH criteria, as armoring the spillway is not considered structural by TR210-60 and armored spillway would be engaged in event more frequent than 100-year event. Would not eliminate risk of an auxiliary spillway breach, so would not meet the purpose and need.
5	Armor (articulated concrete blocks [ACB] or riprap) existing auxiliary spillway and raise crest	Does not meet NRCS PSH criteria, as armoring the spillway is not considered structural by TR210-60 and armored spillway would be engaged in event more frequent than 100-year event. Would not eliminate risk of auxiliary spillway breach, so would not meet the purpose and need.
7	Roller-compacted concrete embankment overtopping spillway and raised auxiliary spillway crest at location of existing auxiliary spillway	Embankment overtopping spillways are not considered favorable by California DSOD.[1]
8	Roller-compacted concrete embankment overtopping spillway and raised auxiliary spillway crest at location adjacent to existing auxiliary spillway	Embankment overtopping spillways are not considered favorable by California DSOD. [1]
9	Roller-compacted concrete and armor auxiliary spillway, raised auxiliary spillway crest	Would provide similar impacts with equal or less benefits at a higher cost than other design configurations considered.
10	Roller-compacted concrete drop spillway at bend of existing auxiliary spillway, armor auxiliary spillway, and raise auxiliary spillway crest	Would require 60- to 80-foot-high retaining walls and other design features due to topography and it is expected that California DSOD would not view roller-compacted concrete drop spillway favorably. Would provide similar impacts with equal or less benefits at a higher cost than other design configurations considered.
11	Inset structural auxiliary spillway channel within existing auxiliary spillway that would be engaged more frequently than vegetated portion of spillway	Would increase the frequency of downstream flooding. Would not maintain existing level of flood protection and therefore would not meet the purpose and need.
12	Structural broad-crested weir on existing auxiliary spillway, raised auxiliary spillway and dam crest	Did not meet NRCS freeboard requirements for high hazard dam. Risk of overtopping and breach would remain, so would not meet the purpose and need.
13	Structural labyrinth weir on existing 200’ wide auxiliary spillway, raise weir crest elevation	Can pass PSH without structural spillway improvements. Would provide similar impacts with equal or less benefits at a higher cost than other design configurations considered.

Configuration Number[1]	Configuration Description	Justification for Elimination
16	Roller-compacted concrete overtopping spillway, raised dam crest	Overtopping spillway not favorable to California DSOD. [1]
17	New structural spillway adjacent to existing auxiliary spillway, raised dam crest	Overtopping spillway not favorable to California DSOD. [1]

[1] The Configuration Number matches the table in TM007; missing alternatives in this table were carried forward for detailed analysis.
[2] Information is based on previous project experience with California DSOD.

5.3 Alternatives Studied in Detail

5.3.1 No Action

The No Action Alternative would not include technical and financial assistance through the Watershed Protection and Flood Prevention Program for implementation of any part of the proposed project; there would be no federally funded project measures implemented. The No Action Alternative considers the future-without-federal-investment (FWOFI) conditions and provides a basis for comparison with the action alternatives.

The No Action Alternative assumes that the Sponsor would continue to maintain the dam in the same manner that they have been and that no modifications would be made to the dam. The existing deficiencies would remain. Without sediment removal, the sediment storage would reach capacity in approximately 22.6 years. At that point, sediment would no longer be impounded by the dam but would route through the principal spillway and be conveyed downstream.

The Sponsor does not currently have funds allocated for any specific modifications to the dam, and this alternative does not consider any potential future modifications to the dam. California DSOD could require that action be taken to comply with seismic requirements, but such measures are not considered in this analysis. As such, an assumption is made that without future modifications, the dam would fail at a future date.

The potential failure modes include failure of the auxiliary spillway due to potential integrity issues with the water surface elevation at the level associated with the storm estimated to cause auxiliary spillway failure or failure of the dam embankment due to seismic activity with the water surface elevation at the normal pool level, which would be considered the principal spillway crest elevation.

Maintenance would generally consist of the following items:

- The dam and appurtenances would be inspected annually and after critical events (e.g., severe rain, earthquakes, high-storage periods).
- A periodic engineer inspection would be conducted annually by California DSOD .
- Deep-rooted vegetation (trees and shrubs) would be removed from the embankment and abutments annually.
- Erosional channels would be repaired annually through grading, seeding, or riprap placement.

- Sediment would be removed from intake structures and conduit outlets as needed based on inspection.
- Seepage and drain lines would be monitored at least annually and after critical events.

5.3.2 Proposed Action - Structural Auxiliary Spillway (Alternative 1)

Alternative 1 is designed to bring the dam into compliance with NRCS and California DSOD standards by installing a structural auxiliary spillway and structural concrete lining over the existing auxiliary spillway and installing upstream and downstream earthen embankment stabilization buttresses (see Map C-6 in Appendix C). Alternative 1 includes the following measures:

1. Construction of a 6-foot-tall labyrinth weir on the existing earthen auxiliary spillway, which would raise the effective auxiliary spillway crest by 5.25 feet to an elevation of 417.88 feet. The labyrinth weir would increase the efficiency of the spillway, preventing the need to raise the dam crest.
2. Regrade the entire auxiliary spillway to a uniform width of 200 feet.
3. Install a structural stilling basin near the end of the auxiliary spillway to dissipate energy.
4. Line the auxiliary spillway between the weir and stilling basin with structural concrete.
5. Remove approximately 104 acre-feet of accumulated sediment from within the impoundment area behind the dam to establish 50 years of future sediment capacity. Excavated sediment would be exported to existing permitted or commercial sites.
6. Install upstream and downstream embankment stability buttresses to address seismic and liquefaction issues and bring the embankment in compliance with NRSC and California DSOD seismic criteria. Suitable material would be imported from an existing permitted or commercial source.
7. Extend the primary spillway conduit by 175 feet upstream and 181 feet downstream and construct a new inlet and stilling basin on the primary spillway conduit as required due to accommodate installation of embankment stability buttresses.

Alternative 1 would disturb approximately 48.2 acres. The project site would be accessed by an existing road off of Bennett Valley Road. Project activities would take up to 24 months to complete. In-stream project activities would likely take place between June 15 and October 15.

This alternative would increase the flood storage capacity to 1,821 acre-feet, which is sufficient for the dam to route the 25-year 24-hour storm event through the principal spillway; this is an increase of 376 acre-feet from the existing condition. Part 7 of NRCS TR210-60 specifies that structural auxiliary spillways may also serve a dual purpose as a principal spillway, so this alternative would meet NRCS PSH criteria for a high hazard dam. The 100-year inundation area behind the dam would be 77.0 acres, an increase of 6.1 acres from the existing condition (see Map C-7 in Appendix C). The inundation area would drain within 4 days after the 100-year 24-hour event.

Alternative 1 would not modify the dam's high hazard potential classification; however, it would reduce the risk of catastrophic failure by reducing the risk for breach of the auxiliary spillway and improving seismic stability. The service life of the dam would be extended for a minimum of 50 additional years.

Project Conservation Measures

Project conservation measures for Alternative 1 are listed in Table A-1 in Appendix A.1. These features were developed to avoid or eliminate adverse impacts from project activities and are incorporated as an integrated part of the Proposed Action. Project conservation measures are based upon best management practices (BMPs) and standard operating procedures that have been employed and proven effective in similar circumstances and conditions.

Maintenance

Maintenance for Alternative 1 would consist of the following items:

- The dam and appurtenances would be inspected annually and after critical events.
- A periodic engineer inspection would be conducted by California DSOD annually.
- Deep-rooted vegetation (trees and shrubs) would be removed from the embankment and abutments annually.
- Erosional channels would be repaired annually through grading, seeding, or riprap placement.

5.3.3 Proposed Action - Dam Crest Raise to 431 Feet (Alternative 2)

Alternative 2 would bring the dam into compliance with NRCS and California DSOD standards by raising the auxiliary spillway crest, raising the dam crest, and installing upstream and downstream earthen embankment stabilization buttresses (see Map C-8 in Appendix C). Alternative 2 includes the following measures:

1. Raise the dam crest to 431.0 feet (raise of 3.4 feet). Suitable material would be imported from an existing permitted or commercial source.
2. Raise the auxiliary spillway crest to 420.0 feet (raise of 7.4 feet) while maintaining a 200-foot width. Construct a roller-compacted concrete spillway crest/apron and concrete cutoff wall near the crest.
3. Regrade the spillway to an average -5.5 percent grade and maintain a 200-foot width.
4. Remove approximately 104 acre-feet of accumulated sediment from within the impoundment area to establish 50 years of future sediment capacity. Excavated sediment would be exported to existing permitted or commercial sites.
5. Install upstream and downstream embankment stability buttresses to address seismic and liquefaction issues and bring the embankment in compliance with NRSC and California DSOD seismic criteria. Suitable material would be imported from an existing permitted or commercial source.
6. Extend the primary spillway conduit by 175 feet upstream and 181 feet downstream and construct a new inlet and stilling basin on the primary spillway conduit as required due to accommodate installation of embankment stability buttresses.

Alternative 2 would disturb approximately 48.2 acres. The project site would be accessed by an existing road off of Bennett Valley Road. Project activities would take up to 24 months to complete. In-stream project activities would likely take place between June 15 and October 15.

This alternative would increase the flood storage capacity to 1,986 acre-feet, which is sufficient for the dam to route the 50-year 24-hour storm event through the principal spillway without engaging the auxiliary spillway; this is an increase of 541 acre-feet from the existing condition. The 100-year inundation area behind the dam would be 81.8 acres, which is an increase of 10.9

acres from the existing (see Map C-7 in Appendix C). The inundation area would drain within 4 days after the 100-year 24-hour event.

Alternative 2 would not modify the dam's high hazard potential classification; however, it would reduce the risk of catastrophic failure. The service life of the dam would be extended for a minimum of 50 additional years.

Project Conservation Measures

Project conservation measures for Alternative 2 would be the same as those described above for Alternative 1 (see Appendix A.1).

Maintenance

Maintenance actions for Alternative 2 would be the same as those described above for Alternative 1.

5.3.4 Proposed Action - Dam Crest Raise to 435 Feet (Alternative 3)

Alternative 3 would bring the dam into compliance with NRCS and California DSOD standards by raising the auxiliary spillway crest, raising the dam crest, and installing upstream and downstream earthen embankment stabilization buttresses (see Map C-9 in Appendix C). Alternative 3 includes the following measures:

1. Raise the dam crest to 435.0 feet (raise of 7.4 feet). Suitable material would be imported from an existing permitted or commercial source.
2. Raise the auxiliary spillway crest to 424.0 feet (raise of 11.4 feet) while maintaining a 200-foot width. Construct a roller-compacted concrete spillway crest/apron and concrete cutoff wall near the crest.
3. Regrade the spillway to an average -5.8 percent grade and maintain a 200-foot width.
4. Remove approximately 104 acre-feet of accumulated sediment from within the impoundment area to establish 50 years of future sediment capacity (approximately 240 acre-feet of sediment storage required). Excavated sediment would be exported to existing permitted or commercial sites.
5. Install upstream and downstream embankment stability buttresses to address seismic and liquefaction issues and bring the embankment in compliance with NRSC and California DSOD seismic criteria. Suitable material would be imported from an existing permitted or commercial source.
6. Extend the primary spillway conduit by 175 feet upstream and 181 feet downstream and construct a new inlet and stilling basin on the primary spillway conduit as required due to accommodate installation of embankment stability buttresses.

Alternative 3 would disturb approximately 48.2 acres. The project site would be accessed by an existing road off of Bennett Valley Road. Project activities would take up to 24 months to complete. In-stream project activities would likely take place between June 15 and October 15.

This alternative would increase the flood storage capacity to 2,322 acre-feet, which is sufficient for the dam to route the 100-year 24-hour storm event through the principal; this is an increase of 877 acre-feet from the existing condition. The 100-year inundation area behind the dam would be 87.2 acres, which is an increase of 16.3 acres from the existing (see Map C-7 in Appendix C). A majority of the proposed inundation area is contained within Sonoma Water's property or

existing flood easements; less than 5 acres of additional easement would be required to cover the increased area. The inundation area would drain within 4 days after the 100-year 24-hour event.

The top of dam elevation includes freeboard above the maximum WSE to protect the dam embankment from overtopping and based on the modeling results for this alternative, the design storm would be contained within the impoundment area upstream of the dam. Based on topographic data available for this analysis, it appears that there is a depression along the boundary of the maximum impoundment area extent for this alternative that is lower than the proposed top of dam elevation. It should also be noted that a ground-based survey of the upstream impoundment area was not performed as part of this study and should be completed during the design phase to verify elevations of habitable structures that are adjacent to impoundment area and verify containment of the design storm.

Alternative 3 would not modify the dam's high hazard potential classification; however, it would reduce the risk of catastrophic failure. The service life of the dam would be extended for a minimum of 50 additional years.

Project Conservation Measures

Project conservation measures for Alternative 3 would be the same as those described above for Alternative 1 (see Appendix A.1).

Maintenance

Maintenance actions for Alternative 3 would be the same as those described above for Alternative 1.

5.4 PR&G Analysis

Probable costs and an economic analysis are provided in *TM007 – Alternative Development and Evaluation* and *TM009 – Economic Analysis*, respectively, in Appendix D.1. Additional details on the PR&G analysis, trade-offs between alternatives, and risk and uncertainty are provided in the *PR&G Report* in Appendix D.2. Alternative trade-offs and ecosystem services are summarized in Table 5-2.

Table 5-2. PR&G Analysis Summary

	No Action (FWOFI)	Alternative 1	Alternative 2	Alternative 3
Brief description	No federal investment; assume eventual failure	Dam rehabilitation with a structural auxiliary spillway	Dam rehabilitation with a dam crest raise to 431 feet	Dam rehabilitation with a dam crest raise to 435 feet
Locally Preferred	No.	No.	No.	Yes.
Environmentally Preferable	No.	No.	No.	Yes.
Non-structural	Yes.	No.	No.	No.
Guiding Principle: Healthy and Resilient Ecosystems	No.	Yes.	Yes.	Yes.
Guiding Principle: Sustainable Economic Development	No.	No.	No.	Yes.
Guiding Principle: Floodplains	No.	Yes.	Yes.	Yes.
Guiding Principle: Public Safety	No.	No.	No.	Yes.
Guiding Principle: Watershed Approach	Yes.	Yes.	Yes.	Yes.
Ecosystem Services: Provisioning Services - Water	Continued sediment capture of 3.8 acre-feet per year for up to 23 years	Continued sediment capture of 3.8 acre-feet per year for up to 50 years	Continued sediment capture of 3.8 acre-feet per year for up to 50 years	Continued sediment capture of 3.8 acre-feet per year for up to 50 years
Ecosystem Services: Regulating Services - Urban flood damage reduction	Risk of dam breach remains unchanged; flood storage capacity up to the 25-year 24-hour storm event	Reduced risk of dam breach; flood storage capacity up to the 25-year 24-hour storm event	Reduced risk of dam breach; increased flood storage capacity up to the 50-year 24-hour storm event	Reduced risk of dam breach; increased flood storage capacity up to the 100-year 24-hour storm event
Ecosystem Services: Supporting Services	Not identified for this project	Not identified for this project	Not identified for this project	Not identified for this project
Ecosystem Services: Cultural Services	Not identified for this project	Not identified for this project	Not identified for this project	Not identified for this project

5.4.1 Risk and Uncertainty

Risk and uncertainty arise from measurement errors and from the underlying variability of complex natural, economic, and social situations. Risk represents variability that can be quantified based on probabilistic analysis using well-known and accepted methods. Uncertainty represents variability that cannot be quantified in the numerical sense and is evaluated subjectively in relative terms.

There is no unusual risk or uncertainty associated with the assumption that the current condition of the dam will continue to deteriorate without intervention, or that the rehabilitated dam will provide the intended benefits for its planned life of 50 years.

The risks associated with hydrologic events used to formulate and evaluate alternatives have been calculated and are described in Appendix D. The annual exceedance probability (AEP) associated with a rainfall event that would activate the auxiliary spillway of Matanzas Creek Dam in its current state is approximately 4 percent; however, the risk associated with failure of the auxiliary spillway for this event (and even up to the 0.2 percent AEP), is extremely low based on the spillway stability and integrity analysis.

Based on the spillway and integrity analysis, there is risk that the auxiliary spillway could breach during the freeboard hydrograph (FBH), which is equivalent to the probable maximum flood (PMF) for Matanzas Creek Dam. PMF events are generally not associated with a probability of occurrence; however, the probability is very low. Existing geologic data for the auxiliary spillway area was limited during this analysis and was supplemented with geophysical mapping (see and in Appendix D.1). Additional detail on the spillway and integrity analysis is provided in in Appendix D.1. If additional geologic investigation of the spillway is completed in the future, it could serve to reduce uncertainty in geotechnical parameters and improve confidence in the results of spillway headcutting failure mode analysis. The scope of the additional investigation and supplemental analysis would be based on guidance in NRCS NEH Part 628 Chapter 52, NEH Part 631 Chapter 2, and NEM Part 531.

The existing storage and discharge capacity of the dam is sufficient to route the FBH event without overtopping the dam; therefore, there is no risk of a hydrologic failure, which is defined as an embankment failure during the FBH peak reservoir elevation.

The risk associated with a seismic event, which is defined as an embankment failure with the reservoir level equivalent to the lowest ungated spillway crest elevation (in this case, it would be the principal spillway crest), was estimated to be 0.1 percent. See in Appendix D.1 for additional details.

During the planning process, decisions are made with information that is uncertain, including assumptions of project costs and with the estimation of economic benefits from alternative measures. These uncertainties are identified in Section D.1.11 of Appendix D. The benefits and costs were evaluated using a 2022 price level and were evaluated over a 52-year period of analysis (24 months of construction and a 50-year evaluation period) using a discount rate of 2.5 percent. Associated monetary flooding impacts on downstream structures and the value of potential damages were based on the national averages using data sources identified in in Appendix D.1. As noted above, actual damages occurring from a specific storm event could realistically be slightly higher or significantly lower, depending on watershed conditions and land use at the time of the event. The prevailing belief is that climate change will result in more frequent and intense flood events.

The Sponsor currently owns the property on which the improvements for the Preferred Alternative would be constructed. The Sponsor has indicated that they would secure additional easements or property to the elevation of the 100-year WSE for the preferred alternative. The potential risks and liability that the Sponsor may be assuming for selecting an easement elevation lower than elevation of the PMF have been discussed with the Sponsor. The 100-year inundation area behind the dam would be 87.2 acres if the preferred alternative is implemented, which is an

increase of 16.3 acres from the existing. A majority of the proposed inundation area is within Sonoma Water's existing property or flood easements; less than 5 acres of additional easement would be required to cover the increased area. Verification or adjustment of the location and area of the easements will be required during final design. There is some uncertainty related to land rights availability, as the Sponsor has not yet approached potentially impacted landowners to discuss the possibility of acquiring land rights for flood easements. There is no uncertainty with the Sponsor's ability to acquire the permits needed to implement any of the alternatives.

There is uncertainty in estimating environmental and social costs associated with each alternative because the values, judgments, and opinions held by interested and affected parties and the community in general may shift over time. Best estimates of these effects were based on observation of past trends, current master planning assumptions, and the limited input received during project scoping opportunities.

Chapter 6. Environmental Consequences

The NRCS has the responsibility under the NEPA to identify and address effects on the environment that may result from the alternative plans. These alternatives include the No Action Alternative and Alternatives 1, 2, and 3. This chapter describes the potential effects of the alternatives within each resource category, as defined in Chapter 4 - Affected Environment.

The potential consequences or effects of each alternative are discussed in this chapter. Impacts may be temporary or permanent. Temporary impacts are those that are not lasting, and the affected resource would be expected to return or be restored to its pre-project state. Permanent impacts are those in which the affected resource would not return to its pre-project state but would remain in the affected condition indefinitely.

Impacts to a resource can be beneficial or adverse over the short or long term. For this evaluation, short-term impacts are those that last for the duration of construction and shortly thereafter; this is estimated to be 2 years based on the time for vegetation to establish on reseeded areas. Long-term impacts are those that last for an extended duration of time. For this evaluation, long-term impacts are considered to be up to 50 years, based on the design life of the rehabilitation alternatives.

Environmental impacts that could result from implementation of any alternative are quantified where possible. In the absence of quantifiable data, the professional judgment of knowledgeable sources was used. Impacts may be described using ranges of potential impacts or in qualitative terms, if appropriate.

Because the project measures associated with each action alternative would be implemented within nearly the same area and with similar methods, a single project area is defined as the approximately 120.2 acres that may be directly disturbed by project activities and the largest maximum inundation area; the project area is shown on Map C-10 in Appendix C. Respective inundation areas would differ slightly for each alternative, and different impacts to specific resources are addressed where relevant. Where appropriate, the impact disclosures for Alternatives 1, 2, and 3 are combined to reduce redundancy.

The purpose of the cumulative effects analysis is to describe the interaction among the effects of the alternatives and relevant past, present, and reasonably foreseeable actions. This interaction may be:

- Additive: the effects of the actions add together to make up the cumulative effect.
- Countervailing: the effects of actions balance or mitigate the effects of other actions.
- Synergistic: the effects of the actions together are greater than the sum of their individual effects.

The cumulative impacts area represents a landscape surrounding the project area where past, present, and reasonably foreseeable future management actions have occurred or will occur. The cumulative impacts area varies by resource, and specific geographical boundaries are detailed with each resource where relevant.

Past, present, or reasonably foreseeable projects with potential for cumulative effects were identified through the following methods:

- NRCS internally reviewed projects and activities

- Review of the CEQAnet Web Portal for relevant actions
- Aerial imagery was reviewed to identify current land uses

Relevant known past, present, and reasonably foreseeable future actions in the geographic area of the Watershed Plan are summarized below:

- Central Sonoma Watershed Plan: NRCS and Sonoma Water began conducting a vulnerability assessment of Central Sonoma Watershed Project facilities to develop a new watershed plan in 2021. The purpose of the new plan was to identify and evaluate feasible alternatives that would restore or improve flood protection and mitigate vulnerabilities to increase community resilience over the next 50 years. Matanzas Creek is within the Central Sonoma Watershed Plan area. The new watershed plan project was cancelled; however, individual components of the facilities are being considered.
- Matanzas Creek Dam operation and maintenance: Operation and maintenance actions have included sediment removal, removal of gravel and placement downstream for spawning, construction of permanent access roads or ramps for maintenance, removal of encroaching vegetation, and planting of native riparian and woodland vegetation around the perimeter of the reservoir.
- Residential and commercial development: The population of the City of Santa Rosa was estimated to be 178,155 people as of the 2020 Census; this is an increase of about 6 percent from 2010 (U.S. Census Bureau 2022b). If similar trends continue, residential and commercial development would be anticipated to increase in the watershed area.
- Agricultural development: Due to constraints with existing development, topography, and drought, agricultural land use is unlikely to expand in the future and may decrease and be replaced by residential development. The acreage of farms in Sonoma County decreased by 18 percent from 2017 to 2022 (USDA 2022).

6.1 Air Quality

6.1.1 No Action Alternative

Under the No Action Alternative, there would be no effect to air quality. Maintenance activities would occur on an as-needed basis; the associated increase in emissions would be temporary and localized to the immediate work area. Based on the anticipated short duration of equipment operation to complete the work, maintenance activities would be anticipated to result in negligible emissions and would not be expected to violate air quality standards.

6.1.2 Alternatives 1, 2, and 3

Implementation of Alternatives 1, 2, or 3 would require operation of heavy equipment for implementation of the project measures; such operations would result in mobile equipment emissions and particulate emissions resulting from ground-disturbing activities. PM_{10} emissions would be associated with the fugitive dust created by excavation and access activities. All other pollutants ($PM_{2.5}$, CO, sulfur oxides, nitrous oxides, mobile air source toxins [MSATs], and greenhouse gases [GHGs]) would be generated by the heavy-duty diesel engines used in construction equipment.

Emissions associated with construction of any of the action alternatives would be minimized by implementation of project conservation measures Air Quality 1-9 and Reclamation 1. These

measures would stabilize disturbed soils in the short and long term, which would reduce the suspension of dust particles. Equipment operation emissions would be localized to the project area and would only occur during construction. Fugitive dust emissions would be localized to the project area and would be temporary and short-term; dust emissions from soils disturbed during construction would reduce as vegetation became established on disturbed areas.

The California Emissions Estimator Model (CalEEMod) is a statewide land use emissions computer model designed to provide a uniform platform for government agencies, land use planners, and environmental professionals to quantify potential criteria pollutant emissions associated with both construction and operations from a variety of land use projects. Default data (e.g., emission factors, trip lengths, meteorology, source inventory, etc.) have been provided by the various California air districts to account for local requirements and conditions.

Emissions for each alternative were estimated using CalEEMod based on assumptions regarding the expected construction schedule, construction materials, workers required, and quantity of import/export of materials (including concrete and soil) associated with each alternative. The full air quality results for each alternative are provided in Appendix D.9. The estimated emissions for each alternative relative to relevant federal thresholds are summarized in Table 6-1.

Table 6-1. Estimated emissions for federal thresholds from Alternatives 1, 2, and 3

Criteria Pollutant	Alternative 1 - Calculated Emissions (ton/yr)	Alternative 2 - Calculated Emissions (ton/yr)	Alternative 3 - Calculated Emissions (ton/yr)
$PM_{2.5}$	4.82	4.30	3.98
Ozone	4.57	4.08	3.78

The $PM_{2.5}$ de minimis threshold was calculated by adding together the $PM_{2.5}$ total emissions, SO_2, NO_x, and total organic gases (TOG) results from the analysis. No ammonia is anticipated to be generated as a result of any action alternative. The TOG was considered as an equivalent, or larger, estimation of the total volatile organic compounds (VOC) generated by the project. The ozone de minimis threshold was calculated by adding together the VOC and NO_x quantities. The estimated emissions for all three action alternatives are well below the 100 ton/year federal thresholds for $PM_{2.5}$ and ozone.

The estimated emissions for each alternative relative to relevant state thresholds are summarized in Table 6-2.

Table 6-2. Estimated emissions from Alternatives 1, 2, and 3 compared to the Bay Area Air Quality Management District's thresholds of significance

Pollutant	Alternative 1 - Calculated Emissions (lb/day)	Alternative 2 - Calculated Emissions (lb/day)	Alternative 3 - Calculated Emissions (lb/day)	Average Daily Emissions (lb/day) Threshold
ROG	2.03	1.88	1.65	54
NO_X	22.3	19.8	18.4	54
PM_{10}	0.66	0.60	0.53	82 (exhaust)
$PM_{2.5}$	0.62	0.56	0.50	54 (exhaust)

The emissions calculations for all three alternatives are well below the thresholds set forth under the Bay Area Air Quality Management District's thresholds of significance.

Based on the implementation of the project conservation measures and the temporary nature of construction, emissions from construction activities would not be expected to violate federal or state air quality standards.

Operation of the facility would not result in pollutant emissions, and maintenance actions are anticipated to result in negligible emissions. Such activities would occur on an as-needed basis; the associated increase in emissions would be temporary and localized to the immediate work area. Based on the anticipated short duration of equipment operation to complete the work, maintenance activities are not expected to violate air quality standards; there would be no long-term or permanent emissions as a result of implementation of any action alternative. Any action alternative would be in compliance with the Clean Air Act.

6.1.3 Cumulative Effects

The cumulative impact area for air quality is San Francisco Bay Area Air Quality Management District, which contains the project area.

No Action Alternative

There would be no cumulative effects to air quality with implementation of the No Action Alternative because there would be no direct or indirect effects to baseline air quality.

Alternatives 1, 2, and 3

Adverse impacts to air quality in the Bay Area Air Quality Management District would be temporarily additive during project activities as emissions would increase; however, the effects would be localized and temporary. Based on the anticipated short duration of equipment operation to complete the work for any alternative, project activities are not expected to violate air quality standards in the short or long term in the Bay Area Air Quality Management District; therefore, none of the action alternatives would result in significant cumulative adverse impacts to air quality.

6.2 Cultural and Historic Resources

6.2.1 No Action Alternative

Failure of the Matanzas Creek Dam facility would not alter the characteristics of the Central Sonoma Watershed Project historic district that qualify it for listing on the NRHP; therefore, the NRCS determined that failure of the dam would not result in adverse effects to the historic district.

Under the No Action Alternative, failure of the Matanzas Creek Dam may impact cultural or historic resources downstream of the dam within the breach inundation area (as shown on Map C-5 in Appendix C) by flooding of the historical downtown area of Santa Rosa; the specific impact would depend on the intensity of the failure event, e.g., temporary inundation or destruction of buildings/structures.

6.2.2 Alternatives 1, 2, and 3

Under all action alternatives, the dam facility (including the spillway) would be modified to meet current NRCS and California DSOD standards. Alternatives 1, 2, and 3 would increase the 100-

year maximum inundation area of the reservoir by raising the Matanzas Creek Dam (see Map C-7 in Appendix C); Alternative 1 would increase the area by 6.1 acres, Alternative 2 by 10.9 acres, and Alternative 3 by 16.3 acres.

Table 6-3 discloses the impacts to cultural and historic resources analyzed for each alternative.

Table 6-3. Analysis of impacts to cultural and historic resources from Alternatives 1, 2, and 3

Resource	NRHP Status	Nature of Effect	Determination of Effect
Road grade and tree alignment	Not eligible	Demolished for all alternatives	No significant impact
Well shed and wooden platform	Not eligible	Demolished for all alternatives	No significant impact
Mid 20th-century farmstead	Not eligible	None; within the existing inundation zone	No significant impact
Sparse lithic scatter	Not eligible	Within the inundation zone for all alternatives	No significant impact
Matanzas Creek Dam	Not individually eligible; a contributing resource of the Central Sonoma Watershed Historic District	Modified for all alternatives	No significant impact
Central Sonoma Watershed Project historic district	Eligible – Criterion A	Modification of the Matanzas Creek Dam facility, a contributing resource of the Central Sonoma Watershed Historic District, would not affect the characteristics that determine the district's NRHP eligibility	No adverse effect pursuant to 36 CFR § 800.5
Complex lithic scatter (P-49-1109)	Eligible – Criterion D	Within the temporary inundation zone for all alternatives	No adverse effect pursuant to 36 CFR § 800.5
Late 19th century farmstead (P-49-1864)	Ineligible	None – outside of inundation zone for all alternatives	No significant impact

Adverse effects to historic properties occur when project measures alter any characteristic that qualifies the property for inclusion in the NRHP. Factors considered in determining whether a proposed project would have adverse effects to historic properties include the extent or degree to which its implementation would result in:

1. Damage to, or loss of, a site of archaeological, tribal, or historical value that is listed, or eligible for listing, in the NRHP.
2. Loss or degradation of a TCP or sacred site, or if the property or site is made inaccessible for future use.
3. Disturbance to any human remains, including those interred outside formal cemeteries.
4. Isolation of cultural resources from the context considered significant; and
5. An effect to project elements that would be out of character with the property or site and its setting.

NRCS, in consultation with the California SHPO and applicable Tribes, determined that there would be no adverse effects to historic properties. Modification of the Matanzas Creek Dam facility for Alternatives 1, 2, or 3 would not alter the characteristics of the historic district that qualify it for listing on the NRHP; therefore, the NRCS determined that modification of the dam would not result in adverse effects to the historic district.

The complex lithic scatter is located within the inundation zone for all alternatives. Prior research has recovered important data, including all surface materials from the site. Temporary inundation is therefore not an adverse effect.

The historic viewshed was not a concern given the lack of modern additions to the landscape from this undertaking and use of native earthen materials.

NHPA Section 106 Consultation

Per 36 CFR 800.4, the NRCS consulted with the California SHPO on the determinations of site eligibility and findings of effect to historic properties. The consultation request letter was sent on February 5, 2025. The California SHPO responded on February 14, 2025, stating that they concurred with the determinations of eligibility and findings of effect for the undertaking. The SHPO response letter is provided in Appendix A.3.

Consultation documents and details of the tribal coordination and consultation efforts are summarized in Appendix A.3.

6.2.3 Cumulative Effects

The cumulative impact area for cultural and historic resources is the City of Santa Rosa and surrounding watershed within the "Dam Breach Inundation Area" (see Map C-5 in Appendix C).

No Action Alternative

The Central Sonoma Watershed Project historic district could be impacted by actions that modify other facilities that are contributing elements of the district; however, when considering the importance of the ongoing flood control provided by the facilities, it unlikely that future actions would be allowed that could affect the function of the system.

Flooding of possibly significant historic structures and buildings in the City of Santa Rosa, particularly within the designated preservation districts and surrounding developed areas in the breach inundation zone, could temporarily or permanently impact sites depending on the nature of the event and the distance of the resource to the dam. Reconstruction of infrastructure or buildings/structures after a dam failure could lead to further, cumulative impacts to historical districts, buildings, or unknown archaeological sites.

Alternatives 1, 2, and 3

Impacts to the discrete sites within the APE would be localized to the sites themselves and would not contribute to impacts to other sites; therefore, there would be no cumulative effects to cultural resources with implementation of any action alternative. Because there are no adverse impacts to archeological resources in the APE, continuing to operate the Matanzas Creek Dam facility with expected periodic flood events would not lead to cumulative impacts.

6.3 Endangered and Threatened Species

6.3.1 No Action Alternative

Failure of the dam could impact federally listed species or critical habitat downstream of the dam. Occupied habitat within the breach inundation area (as shown on Map C-5 in Appendix C) could be temporarily inundated after a hydrologic failure.

6.3.2 Alternatives 1, 2, and 3

6.3.2.1 Steelhead

During construction and maintenance activities, erosion, sedimentation, or a hazardous materials spill could degrade water quality and downstream habitat for steelhead that may occupy Santa Rosa Creek. However, with implementation of the project conservation measures (see Table 5-2), the effects of any action alternative on steelhead would be insignificant or discountable.

Operation of the facility would continue to benefit water quality downstream of the dam by capturing sediment and debris after storms; the dam would continue to capture approximately 3.8 acre-feet of sediment annually for the sediment storage design life of 50 years. Potential increases in water temperature or reductions in dissolved oxygen from operation of the rehabilitated dam would not change from the current conditions.

Therefore, implementation of any action alternative would have no effect on steelhead.

6.3.2.2 California red-legged frog

Implementation of any action alternative would result in temporary habitat disturbance to 28.9 acres on and around Matanzas Creek Dam. Temporary access and staging would occur in 21.5 acres around the dam and auxiliary spillway and would consist of vegetation removal in portions of this area to facilitate vehicle and equipment access and staging, vehicles and construction equipment driving on access roads, and equipment and material storage and use in staging and construction areas. An additional 7.4 acres of temporary habitat disturbance would occur due to removal of accumulated sediments in a portion of the reservoir. These temporary habitat disturbances would occur in riparian, freshwater marsh, California bay forest, oak woodland, scrub, and grassland habitats, all of which are suitable California red-legged frog dispersal habitats. Although the potential for California red-legged frog to occur in the project area is low, in the unlikely event that a frog is dispersing through the area during construction, it could encounter temporarily disturbed dispersal habitat conditions, there would be less dispersal habitat available, and dispersal routes through the area would be temporarily impacted.

Implementation would also result in 19.3 acres of permanent impacts, due to adding earthen material to raise the dam crest, installing upstream and downstream earthen embankment stability buttresses, extending the primary spillway conduit by 175 upstream and 181 feet downstream to accommodate the wider dam, constructing a new inlet and stilling basin, and modifying the auxiliary spillway.

There is low potential for California red-legged frogs to disperse through the area during and after project implementation. Most of the permanent impacts would involve placement or redistribution of earthen material; these areas would be revegetated and likely convert to grassland after the completion of construction and would therefore continue to provide suitable

dispersal habitat for California red-legged frog. Limited placement of concrete is consistent with how concrete is used in the existing structures; concrete is already present at the auxiliary spillway crest and throughout the primary spillway conduit. The additional area that would be inundated after a 100-year storm is dispersed around the reservoir and would be impacted very infrequently and for a short duration. Furthermore, brief inundation during a 100-year storm is not likely to adversely affect dispersing California red-legged frogs.

Implementation of any action alternative would not reduce the ability of California red-legged frog to disperse through the area; therefore, the magnitude of impacts resulting from habitat alteration on California red-legged frogs would be insignificant.

Project implementation would cause some noise and visual disturbances, and there is potential that a California red-legged frog could be injured or killed in the unlikely event it is present in the area during construction, or that erosion, sedimentation, or a hazardous materials spill could degrade dispersal habitat for California red-legged frog. However, with implementation of the project conservation measures (see Table 5-2), the effects of any action alternative on California red-legged frog would be insignificant or discountable. Therefore, implementation of any action alternative may affect but would not likely adversely affect California red-legged frog.

6.3.2.3 Northwestern pond turtle

Suitable aquatic and upland habitats for northwestern pond turtle would be impacted by implementation of any action alternative. Approximately 48.2 acres around the dam would be directly disturbed; impacts to northwestern pond turtle could include direct mortality and displacement during project activities, although none were observed during a field visit (see *Summary of Existing Environmental Conditions* in Appendix D.4). Small animal species populations may be affected in direct proportion to the amount of habitat disturbed. Suitable habitats are relatively common throughout the area. Where practicable, disturbed areas would be reseeded after project activities per project conservation measure Reclamation 1; reseeded areas would be expected to provide suitable cover and forage as soon as the next growing season.

Due to the localized disturbance area and the temporary timeframe of disturbance, implementation of any action alternative could impact individual turtles but would not adversely affect populations within the watershed area. All avoidance measures would be determined during the CEQA/state and local permitting process.

6.3.3 Cumulative Effects

The cumulative impact area for federally listed species is the 49,445-acre Watershed Plan area.

No Action Alternative

Federally listed species within the cumulative impact area have been impacted by municipal, urban, residential, and agricultural development. Possible effects of these actions include displacement into less suitable habitats, behavioral disruption, and stress due to noise and human activity. The impacts of habitat disturbance due to flooding could add cumulatively to the disturbance impacts from present and future actions. Due to temporary nature of disturbance associated with breach flooding and the extent of existing human development within the inundation area, the No Action Alternative would not result in significant cumulative adverse impacts to federally listed species.

Alternatives 1, 2, and 3

Although implementation of any action alternative may affect California red-legged frog or northwestern pond turtle, due to the limited potential for adverse impacts in the localized disturbance area, implementation of any action alternative would not result in cumulative impacts to federally endangered or threatened species.

6.4 Fish and Wildlife

6.4.1 No Action Alternative

Failure of the dam could impact fish and wildlife species that occur downstream of the dam. Occupied habitat within the breach inundation area (as shown on Map C-5 in Appendix C) could be temporarily inundated after a hydraulic failure.

6.4.2 Alternatives 1, 2, and 3

Species may be grouped based on similar habitat characteristics and behaviors, as potential impacts are more likely to be similar for those species that share habitats and behaviors.

6.4.2.1 Russian River roach

Although Russian River roach have been observed in Matanzas Creek up and downstream of the dam, per project conservation measure Dewatering 1, aquatic species would be rescued from ponded water within the work area and relocated to a safe location. There would be no adverse impact to the species because construction would occur in dewatered conditions.

6.4.2.2 Lampreys

Although lamprey ammocoetes have been documented in Matanzas Creek downstream of the dam, per project conservation measure Dewatering 1, aquatic species would be rescued from ponded water within the work area and relocated to a safe location. There would be no adverse impact to the species because construction would occur in dewatered conditions.

6.4.2.3 Foothill yellow-legged frog and California giant salamander

Suitable aquatic and upland habitats for amphibian species, including foothill yellow-legged frog and California giant salamander, would be impacted by implementation of any action alternative. Approximately 48.2 acres around the dam would be directly disturbed; impacts to these animals could include direct mortality and displacement during project activities, although none were observed during a field visit (see *Summary of Existing Environmental Conditions* in Appendix D.4). Small animal species populations may be affected in direct proportion to the amount of habitat disturbed. Suitable habitats are relatively common throughout the area. Where practicable, disturbed areas would be reseeded after project activities per project conservation measure Reclamation 1; reseeded areas would be expected to provide suitable cover and forage habitat for foothill yellow-legged frog and California giant salamander as soon as the next growing season.

Due to the localized disturbance area and the temporary timeframe of disturbance, implementation of any action alternative could impact individual amphibians but would not

adversely affect populations within the watershed area. All avoidance measures would be determined during the CEQA/state and local permitting process.

6.4.2.4 Tricolored blackbird, White-tailed kite, Yellow warbler, Loggerhead shrike, and Yellow-breasted chat

Migratory birds could nest and forage within the project area, which includes suitable habitat for numerous species. Where vegetation would be removed between February 15 and August 15, pre-construction nesting bird surveys and appropriate spatial and temporal buffers would be implemented per project conservation measure Wildlife 1 to minimize adverse impacts to nesting birds. Tree removal within the 48.2 acres of project disturbance would be minimized as much as practicable per project conservation measure Vegetation 1. Similar vegetation would remain adjacent to the project area. Disturbance due to human presence and noise during construction could also affect birds that may nest nearby or forage in the project area; possible effects include displacement into less suitable habitats, behavioral disruption, and stress due to noise and human activity.

Maintenance activities would create the same type of disturbance as construction activities. Such activities would occur on an as-needed basis; the associated increase in human presence and noise would be temporary and localized to the immediate work area. There would be no long-term or permanent impacts as a result of maintenance or operations.

With adherence to the project conservation measures, and because disturbance due to human presence and noise would be temporary (during construction or maintenance), implementation of any action alternative would not adversely impact migratory birds.

6.4.2.5 Golden eagle and Northern harrier

Golden eagles and northern harrier could forage throughout the project area, but there are no known nest sites or suitable nesting habitat for these species within the area. Because project activities would be localized to the area surrounding the dam, these raptors could avoid the immediate area of project disturbance and continue to forage during construction, operation, and maintenance. Because the impacts to habitat would be localized to the project area and similar available habitat is abundant in the area, there would be no adverse effect to golden eagle or northern harrier from implementation of any action alternative.

6.4.2.6 Pallid bat

Bats could roost in the oak trees and forage within and around the project area. Tree removal within the 48.2 acres of project disturbance would be minimized as much as practicable by implementation of project conservation measure Vegetation 1. Pre-construction surveys and appropriate buffers would also be applied per project conservation measure Wildlife 2. Bats could continue to forage within the project area; there would be little risk of disturbance as the nocturnal bats would be roosting during daytime activities, and prey insects would be available in both disturbed and undisturbed areas. Implementation of any action alternative would not adversely affect bat species.

6.4.2.7 Mountain lion

Although mountain lions could range through the project area, individuals would likely avoid the localized disturbance around the dam. Implementation of any action alternative would not adversely affect mountain lions, nor increase the risk of human conflict.

6.4.3 Cumulative Effects

The cumulative impact area for fish and wildlife species (including migratory birds) is the 49,445-acre Watershed Plan area. Fish and wildlife species within the cumulative impact area have been impacted by municipal, urban, residential, and agricultural development. Possible effects of these actions include displacement into less suitable habitats, behavioral disruption, and stress due to noise and human activity.

No Action Alternative

The impacts of habitat disturbance due to flooding could add cumulatively to the disturbance impacts from present and future actions. Due to temporary nature of disturbance associated with breach flooding and the extent of existing human development within the inundation area, the No Action Alternative would not result in significant cumulative adverse impacts to fish and wildlife species, including migratory birds.

Alternatives 1, 2, and 3

The impacts of temporary disturbance during construction or maintenance of any action alternative would add cumulatively to the disturbance impacts from present and future actions; however, the species of concern would likely avoid areas where project disturbance was occurring, and abundant suitable habitat would be accessible within the cumulative impact area. Due to temporary nature of disturbance associated with the project and the abundance of accessible alternate habitat, implementation of any action alternative would not result in significant cumulative adverse impacts to fish or wildlife, including migratory birds.

6.5 Floodplain Management

6.5.1 No Action Alternative

Under the No Action Alternative, there would be no immediate effect to floodplain management. The dam would continue to operate as a high hazard dam and would continue to be at unchanged risk of failure. Based on existing conditions modeling, 440 structures are within the 100-year floodplain extents. In the event of failure, the dam would no longer provide flood protection for the City of Santa Rosa. The flood insurance rate maps (FIRMs) for the area would no longer be accurate, as the floodplain mapping considers that the dam controls flows and reduces the floodplain associated with the channel downstream of the structure (see Map C-3 in Appendix C). Reassessment of the floodplain without the dam would likely show existing infrastructure within the flood inundation area. Failure of the dam would not “improve the resilience of communities and Federal assets against the impacts of flooding” or “avoid, to the extent possible, the long- and short-term adverse impacts associated with occupancy and modification of floodplains”; therefore, the No Action Alternative would not be consistent with E.O. 13690 and E.O. 11988.

6.5.2 Alternatives 1, 2, and 3

The project area for all action alternatives is outside of the FEMA-designated floodplain or floodway; there are no mapped floodplains associated with the dam or the channel directly downstream from the dam. Based on proposed conditions modeling, the number of structures within the modeled 100-year floodplain extents for Alternatives 1, 2, and 3 would be 431, 431, and 423, respectively. Any of the action alternatives would continue to provide at least the current level of protection and would not substantially change flood patterns from existing conditions. Maps C-11 through C-18 show the modeled 100-year and 500-year storms for each alternative and illustrate the similarity in expected flooding patterns. The action alternatives would not exacerbate floodplain management or function as compared to existing conditions. Any action alternative would "improve the resilience of communities and Federal assets against the impacts of flooding" and would "avoid, to the extent possible, the long- and short-term adverse impacts associated with occupancy and modification of floodplains"; therefore, any action alternative would be consistent with E.O. 13690 and E.O. 11988.

6.5.3 Cumulative Effects

The cumulative impact area for floodplain management is the is the 49,445-acre Watershed Plan area and areas that hydraulic modeling indicated would be impacted by flooding as shown on Map C-1 in Appendix C.

No Action Alternative

There would be no cumulative effects to floodplain management with implementation of the No Action Alternative because there would be no direct or indirect effects.

Alternatives 1, 2, and 3

Although the change in the maximum flood extents along Santa Rosa Creek resulting from the project would be negligible and the project would not result in a change in floodplain management for Santa Rosa Creek, Matanzas Creek Dam was originally designed in conjunction with flood detention structures on other tributaries to reduce flooding along Santa Rosa Creek. The continued reduction in flood risk achieved by rehabilitating Matanzas Creek Dam to meet current standards and allowing it to remain in place for a service life of 50 years would be additive with other flood protection and mitigation projects in the Watershed Plan area, and there could be a cumulative reduction in floodplain area from implementation of any action alternative.

6.6 Invasive Species

6.6.1 No Action Alternative

The No Action Alternative would not affect invasive species and would not increase the risk of spreading invasive species. This alternative would be consistent with E.O. 13112.

6.6.2 Alternatives 1, 2, and 3

Implementation of any action alternative would result in up to 48.2 acres of ground disturbance, which increases the risk of spreading invasive weed species. No alternative would facilitate or inhibit the movement of invasive animal species, including crayfish, bullfrogs, and invasive fish.

Adherence to project conservation measures Noxious Weeds 1-2, Reclamation 1, and Vegetation 1 would reduce the risk of spreading of invasive weed species by preventing introduction and establishing desirable species in disturbed areas. Implementation of any action alternative would not be anticipated to increase the spreading of invasive species in the short or long term. Due to the limited amount of ground disturbance associated with operation and maintenance activities, there would be no long-term or permanent risk of spreading invasive species as a result of maintenance or operations.

With adherence to the project conservation measures, and because disturbance would be temporary during construction and maintenance, implementation of any action alternative would not increase the spreading of invasive species in the short or long term. Any action alternative would be consistent with E.O. 13112.

6.6.3 Cumulative Effects

The cumulative impact area for invasive species is the 49,445-acre Watershed Plan area. Cumulative impacts are unlikely to spread beyond the topographical boundaries that contain project activities. Most impacts to soils and vegetation in the area are due to surface-disturbing activities associated with municipal and residential development. The area captures similar surface disturbance from motorized vehicles and other surface-disturbing activities that could provide transport for noxious weeds and invasive plants into or from the area.

No Action Alternative

There would be no cumulative effects to invasive species with implementation of the No Action Alternative because there would be no direct or indirect effects.

Alternatives 1, 2, and 3

Disturbance from implementation of any action alternative could add cumulatively to the spread of invasive weeds within the cumulative impact area; however, application of the project conservation measures would decrease the potential spread of weeds into or from the project area. The risk of weed spreading would be temporarily additive during project activities and up to 2 years after but would reduce as reclamation was completed and desirable vegetation was re-established on disturbed surfaces. Therefore, implementation of any action alternative would not result in cumulative long-term adverse impacts to vegetation or permanently increase the risk of spreading weeds.

6.7 Land Use

6.7.1 No Action Alternative

Under the No Action Alternative, there would be no immediate change to land uses; however, eventual failure of the dam and subsequent flooding could impact land uses downstream of the dam within the breach inundation area (as shown on Map C-5 in Appendix C). Buildings, other infrastructure, and land developments could be destroyed or temporarily inundated after a hydrologic failure. Up to 289 acres of crop lands would be inundated; specific details are provided in Appendix E.1. Specific impacts would depend on the mode of failure and intensity of event.

6.7.2 Alternatives 1, 2, and 3

All action alternatives would increase the 100-year maximum inundation area of the reservoir (see Map C-7 in Appendix C); Alternative 1 would increase the area by 6.1 acres, Alternative 2 by 10.9 acres, and Alternative 3 by 16.3 acres. The respective inundation areas would drain within 4 days after the 100 year 24-hour event. The Sponsor currently owns property or holds flood easements up to elevation 420 feet NGVD29 and has indicated that it would secure additional easements if needed to contain the 100-year WSE for the preferred alternative. The current easement is sufficient to contain the 100-year WSE for Alternatives 1 and 2, but the sponsor would need to obtain approximately 5 acres (up to 424 feet NAVD88) in additional flood easements for Alternative 3. The additional easement areas would be subject to development restrictions. Land use would not change based on existing zoning and development in the vicinity of the facility.

Land use downstream of the dam would not change based on current and expected flooding patterns. Maps C-11 through C-18 show the modeled 100-year and 500-year storms for each alternative and illustrate the similarity in expected flooding patterns between all alternatives.

6.7.3 Cumulative Effects

The cumulative impact area for land use is the 49,445-acre Watershed Plan area and areas that hydraulic modeling indicated would be impacted by flooding as shown on Map C-1 in Appendix C.

No Action Alternative

Land uses within the inundation areas would remain at increased risk of flooding impacts from a dam breach. The conversion of agricultural land to residential development would increase the number of buildings and residents at risk from flood events. New development could also alter the current flooding patterns, resulting in flooding of areas that have not typically flooded before. The No Action Alternative would not likely have a significant cumulative impact on land use, as development pressure is likely to be independent of the alternative selected.

Alternatives 1, 2, and 3

Impacts to land use would be localized to the maximum inundation area behind the dam. Up to 16.3 acres (0.03 percent) of the cumulative impact area would be temporarily impacted by the occurrence of a sufficient storm. Because land use is not anticipated to change with floodplain easements, there would be no cumulative effects to land use with implementation of any action alternative.

6.8 Noise Levels

6.8.1 No Action Alternative

Under the No Action Alternative, there would be no effect to current noise levels. Maintenance activities would continue to temporarily increase noise levels in the vicinity of the facility.

6.8.2 Alternatives 1, 2, and 3

Implementation of any action alternative would result in a temporary increase in noise levels during construction, which is estimated to be up to 24 months. Noise level increases could impact sensitive receptors. To reduce noise impacts on nearby receptors, operation of equipment at the site would only occur during daylight hours per project conservation measure Noise 1. A noise analysis would be prepared for the project prior to implementation per project conservation measure Noise 2. The noise analysis would determine if other measures to mitigate noise were needed. Due to uncertainty in the project construction schedule, the analysis would be completed closer to the initiation of the construction process.

6.8.3 Cumulative Effects

The cumulative impact area for noise levels is estimated to be the approximately 2,010 acres within a 1-mile buffer around the dam, as topography and distance typically attenuate noise effects.

No Action Alternative

There would be no cumulative effects to noise levels with implementation of the No Action Alternative because there would be no direct or indirect effects.

Alternatives 1, 2, and 3

Noise from implementation of any action alternative would add to existing noise levels from noise producers such as vehicular traffic and agricultural equipment operation. Given the relatively rural nature of the area, existing noise levels are likely low, and an increase in noise levels due to project implementation could be perceived as louder due to the contrast; however, the effects would be localized and temporary. Based on the temporary timeframe of equipment operation to complete the work for any action alternative, there would be no cumulative impact to noise levels.

6.9 Prime and Unique Farmlands

6.9.1 No Action Alternative

Under the No Action Alternative, there would be no immediate effect to prime or unique farmland. In the event of a dam breach, the flood flows would temporarily impact farmlands downstream of the dam, including important farmlands. However, these impacts would not be expected to constitute an unnecessary and irreversible conversion of farmlands to non-agricultural uses.

6.9.2 Alternatives 1, 2, and 3

Within the project area, approximately 3.3 acres of soils classified as farmland of statewide importance occur north of the dam, largely within the auxiliary spillway; these areas are not currently farmed and would continue to be used for flood control operations under any alternative (see Map C-10 in Appendix C). These lands are already use for “water storage” and are not subject to the provisions of the Farmland Policy Protection Act per 7 CFR 658.2.

Approximately 9.1 acres of soils classified as farmland of statewide importance occur within the maximum inundation area; these areas are not currently farmed (see Map C-10 in Appendix C). Temporary flooding would not constitute an unnecessary and irreversible conversion of farmlands to non-agricultural uses.

6.9.3 Cumulative Effects

Since impacts to classified farmlands would be localized to the project area and there would be no irreversible conversion of farmlands, there would be no cumulative effects to prime and unique farmlands.

6.10 Public Health and Safety

6.10.1 No Action Alternative

The dam would continue to operate as a high hazard dam and would continue to be at unchanged risk of failure. Flood storage capacity would continue to be limited to routing the 25-year 24-hour storm event without activating the earthen auxiliary spillway. In the event of a dam breach, the flood flows would pass through the City of Santa Rosa and drain towards the Laguna de Santa Rosa floodplain. Breach flood depths would be expected to range from 0.5 feet to greater than 5 feet through residential neighborhoods and commercial buildings. The risk of flood could affect the security of human life or health for an estimated 28,680 people within the potential inundation area. Flooding could also jeopardize essential public services for the larger service area due to infrastructure failure or flooding of public safety facilities and roadways. Additional details on the expected impacts based on failure modes and storm events are provided in and in Appendix D.1.

After failure of the dam, the frequency of flooding would increase for infrastructure within the flood inundation area.

6.10.2 Alternatives 1, 2, and 3

Implementation of any action alternative would reduce the risk of dam failure. The dam would continue to operate as a high-hazard dam under any action alternative; in the event of a dam breach, the number of inundated buildings would increase relative to the increased water storage for each alternative. Additional details on the expected impacts based on failure modes and storm events are provided in *TM004 – Hazard Classification* and *TM009 – Economic Analysis* in Appendix D.1.

Alternative 1 would provide flood storage capacity to route the 25-year 24-hour storm event without activating the auxiliary spillway, Alternative 2 would provide flood storage capacity to route the 50-year 24-hour storm event without activating the auxiliary spillway, and Alternative 3 would provide flood storage capacity to route the 100-year 24-hour storm event without activating the auxiliary spillway. Part 7 of TR210-60 specifies that structural auxiliary spillways may also serve a dual purpose as a principal spillway, so Alternatives 1, 2, and 3 would all meet NRCS PSH criteria for a high hazard dam.

The number of structures flooded above the first-floor elevation under different recurrence intervals for each alternative is summarized in Table 6-4; no buildings were flooded above the first floor under the 2-, 5-, or 10-year storms.

Table 6-4. Summary of number of structures flooded above the first-floor elevation

Annual Probability Event	No Action	Alternative 1	Alternative 2	Alternative 3
25-year (4%)	2	2	2	2
50-year (2%)	34	33	33	33
100-year (1%)	150	150	148	148
200-year (0.5%)	417	410	410	412
500-year (0.2%)	802	751	740	736

Implementation of any action alternative would benefit public health and safety by reducing flooding risk and the associated hazards; Alternative 3 reduces the risk to the greatest number of structures for most recurrence intervals. Residents would be less likely to be exposed to contaminated floodwater or the risk of toxic mold from flood water damage. The risk of drowning while attempting to drive through flooded roadways would also be reduced. Essential services would be less likely to be disrupted.

Based on the reduced risk of dam failure, implementation of any action alternative would have an overall beneficial impact on public health and safety. Alternative 3 would provide the greatest amount of flood storage capacity.

6.10.3 Cumulative Effects

The cumulative impact area for public health and safety is the 49,445-acre Watershed Plan area and areas that hydraulic modeling indicated would be impacted by flooding as shown on Map C-1 in Appendix C.

No Action Alternative

The No Action Alternative would not benefit public health and safety and would have a countervailing impact for other flood protection projects in the Watershed Plan area as the current risk of dam breach would remain. The risk to public health and safety would increase with future development in the inundation area.

Alternatives 1, 2, and 3

The reduced risk of flooding would be additive with other flood protection and mitigation projects in the Watershed Plan area. There would be a cumulative beneficial impact to public health and safety from implementation of any action alternative.

6.11 Riparian Areas

6.11.1 No Action Alternative

Under the No Action Alternative, there would be no immediate effect to riparian areas; however, eventual failure of the dam and subsequent flooding could impact riparian areas downstream of the dam within the breach inundation area (as shown on Map C-5 in Appendix C). Riparian areas could be damaged or washed away after a hydrologic failure. Specific impacts would depend on the mode of failure and intensity of event. After dam failure, the riparian area within the reservoir would likely reduce in area as water would still flow through but would not be detained within the basin.

6.11.2 Alternatives 1, 2, and 3

Implementation of any of the action alternatives would disturb or remove up to 6.9 acres of vegetation classified as riparian by Sonoma Veg Map (2022). Approximately 0.3 acres of riparian vegetation would be permanently lost due to upgrades to the dam embankment; riparian vegetation is not likely to re-establish in these areas as the associated channel length would be filled by construction of the buttresses. The vegetation type on the dam structure is expected to become grassland after reseeding. Approximately 6.6 acres of riparian vegetation would be temporarily lost due to measures to increase sediment capacity or to enable access near the spillway. Per project conservation measure Reclamation 1, seeding and planting would be applied to restore vegetative cover to disturbed areas after construction. Early seral riparian species would also be anticipated to re-establish naturally within 2 years after disturbance.

Maintenance activities would occur on an as-needed basis; the associated disturbance would be temporary and localized to the immediate work area. Based on the anticipated short duration of disturbance, operation and maintenance activities are not expected to permanently affect riparian areas.

6.11.3 Cumulative Effects

The cumulative impact area for riparian areas is the 49,445-acre Watershed Plan area. Approximately 765 acres of riparian communities occur within the area.

No Action Alternative

There would be no cumulative effects to riparian areas with implementation of the No Action Alternative because there would be no direct or indirect effects.

Alternatives 1, 2, and 3

Approximately 0.3 acres of riparian area would be permanently lost with implementation of any action alternative; this loss constitutes approximately 0.04 percent of the total riparian area within the cumulative impact area. Another 6.6 acres (0.9 percent) would be temporarily lost during construction. Due to localized loss of riparian vegetation associated with the project and the abundance of riparian vegetation in the Watershed Area, implementation of any action alternative would not result in significant cumulative adverse impacts to riparian areas.

6.12 Socioeconomic Factors

6.12.1 No Action Alternative

In addition to the public health and safety impacts disclosed in Section 6.10.1, the No Action Alternative could impact other social and economic factors. Flooding can directly damage economic facilities such as businesses and social facilities such as schools and churches. Flood damage repair would be paid for with funds that would otherwise be spent on economic or social development. Business disruptions could result in reduced employment opportunities and incomes.

Flooding can also lead to adverse psychological effects as a result of physical danger or economic losses. Stress may affect a person’s ability to recover from losses and may increase

their vulnerability to future hardships. A perceived lack of safety after a flood event may hinder economic development and weaken social ties in the area.

6.12.2 Alternatives 1, 2, and 3

Construction of any action alternative would reduce the risk of flood-associated impacts to social and economic structures within and around the City of Santa Rosa. Construction of the project would temporarily increase employment and incomes locally for businesses that were hired to complete the project. Construction of any action alternative would maintain or improve the current level of protection to downstream properties. Alternative 3 would provide the greatest amount of protection.

6.12.3 Cumulative Effects

The cumulative impact area for socioeconomic factors is the 49,445-acre Watershed Plan area and areas that hydraulic modeling indicated would be impacted by flooding as shown on Map C-1 in Appendix C.

No Action Alternative

Socioeconomic factors such as employment, incomes, and education within the cumulative impact area would remain at increased risk of adverse impacts due to flooding. Residents throughout the area work, use services, and patronize businesses within the flood risk area; disruptions to access within the flood area would also affect area residents who did not directly experience flooding. The No Action Alternative would likely have an adverse cumulative impact on socioeconomic factors in and around the City of Santa Rosa.

Alternatives 1, 2, and 3

Implementation of any action alternative would have an additive beneficial impact within the cumulative impact area when considering increased economic growth from construction activities. Flooding damage risk would be reduced and community services would be less likely to be disrupted. Any action alternative would likely have a beneficial cumulative impact on socioeconomic factors in and around Santa Rosa City.

6.13 Soil Resources

6.13.1 No Action Alternative

Under the No Action Alternative, there would be no immediate effect to soil resources. The dam would continue to capture approximately 3.8 acre-feet of sediment annually for approximately 22.6 years. Sediment would then be released through the principal spillway and conveyed down Matanzas Creek into the downstream watershed rather than being impounded by the dam.

Dam failure would also impact soils through erosion and sedimentation. Depending on the mode and severity of failure, the dam may no longer capture sediment, and the current sediment load could be flushed downstream. Breach inundation flows may increase erosion and sedimentation downstream of the dam.

6.13.2 Alternatives 1, 2, and 3

Implementation of any action alternative would disturb up to 48.2 acres within the project area. Direct impacts to soil would include exposure due to vegetation removal, mixing of soil horizons, loss of topsoil productivity, soil compaction, and increased susceptibility to erosion.

Per project conservation measure Reclamation 1, disturbed areas would be reseeded to stabilize soils and reduce erosion. Impacts to soil resources on the reclaimed areas would be short-term (during construction and up to 2 years after) and would diminish as reclamation was achieved.

Per project conservation measure Water Quality 2, a SWPPP would be prepared prior to construction in compliance with Section 402 of the Clean Water Act and would describe measures to minimize erosion and prevent soils from leaving the site during construction activities. The measures outlined in the SWPPP would stabilize disturbed areas during and after construction.

Operation of the facility would result in temporary inundation of soils within the reservoir area after storms. Maintenance activities would create similar types of disturbance as construction activities consisting primarily of the removal of sediment deposited behind the dam. Such activities would occur on an as-needed basis; the associated disturbance to soils would be temporary and localized to the immediate work area. Based on the anticipated short duration of ground disturbance to complete the work, maintenance activities are not expected to adversely affect soil resources. There would be no long-term or permanent impacts as a result of maintenance or operations.

The dam would continue to capture 3.8 acre-feet of sediment annually for the sediment storage design life of 50 years.

With adherence to the project conservation measure, and because impacts would be temporary and short-term, implementation of any action alternative would not adversely impact soil resources.

6.13.3 Cumulative Effects

The cumulative impact area for soil resources is the 49,445-acre Watershed Plan area. Cumulative impacts are unlikely to spread beyond the topographical boundaries that contain project activities and would not contribute cumulatively to erosion in the larger watershed area. Most impacts to soils in the area are due to surface-disturbing activities associated with development.

No Action Alternative

There would be no cumulative effects to soil resources with implementation of the No Action Alternative because there would be no direct or indirect effects.

Alternatives 1, 2, and 3

Disturbance from implementation of any action alternative could add cumulatively to soil impacts, such as erosion, within the larger area; however, implementation of erosion control measures or project conservation measures would stabilize soils, which would decrease the magnitude of potential effects to soil resources within the project area. A maximum of 48.2 acres (0.1 percent) of the cumulative impact area would be disturbed. Adverse impacts to the soil

resources would be temporarily additive (during construction and up to 2 years after) but would reduce as reclamation was completed and vegetation re-established on disturbed areas. Because of the temporary nature of the disturbance and the limited geographic scope relative to the Watershed Plan area, there would be no cumulative adverse effects to soil resources with implementation of any action alternative.

6.14 Vegetation

6.14.1 No Action Alternative

Under the No Action Alternative, there would be no effect to vegetation.

6.14.2 Alternatives 1, 2, and 3

In addition to the impacts to riparian vegetation disclosed in Section 6.11.2, approximately 41.3 acres of other vegetation types would be impacted by implementation of any action alternative. The anticipated impacts to each vegetation type are summarized in Table 6-5.

Table 6-5. Summary of vegetation impacts (in acres) within the project area

Vegetation class	Area permanent impact (acres)	Area sediment removal (acres)	Area temporary impact (acres)	Total (acres)
Grassland alliance	14.9	0.2	16.3	31.4
Quercus alliances	1.4	0.0	0.7	2.2
Non-native shrub	0.3	0.0	0.2	0.5
Rubus armeniacus alliance	0.7	0.0	0.7	1.4
Forest	0.1	0.0	0.5	0.6
Umbellularia californica alliance	0.1	0.0	0.1	0.1
Riparian	0.3	4.4	2.1	6.9
Marsh	1.5	2.8	0.7	5.0
Total	19.3	7.4	21.5	48.2

Within the 19.3 acres of permanent disturbance, approximately 14.9 acres of grassland would re-establish and 4.4 acres of other vegetation types would likely be converted to grasslands. With the exception of Alternative 1, grasslands would be established on the embankment and spillway after seeding per project conservation measure Reclamation 1; under Alternative 1, approximately 6.0 acres on the spillway would be lined within concrete and vegetation would be permanently eliminated.

Approximately 7.4 acres of vegetation would be removed with sediment from the inundation area. With natural revegetation and planting and reseeding efforts per project conservation measure Reclamation 1, riparian and marsh vegetation would re-establish in the area within 2 years after project completion.

Up to 21.5 acres of vegetation would be removed to facilitate access and equipment operation. These areas would be reseeded or planted per project conservation measure Reclamation 1, and vegetation would be expected to re-establish within 2 years after project completion.

Trees to be removed would be identified, evaluated for protection, and permitted as needed prior to implementation of any action alternative per project conservation measure Vegetation 3.

6.14.2.1 Lobb's aquatic buttercup

The vernal pools adjacent to the proposed auxiliary spillway that are occupied by Lobb's aquatic buttercup would be avoided by project activities through application of project conservation measure Vegetation 2 under any action alternative; environmental fencing or other protective measures would be installed to protect the pools from disturbance during construction activities. Due to topography of the immediate area, the hydrology supporting the pools is not anticipated to change with any action alternative; if this assumption holds true, there would be no adverse effect to the buttercups in the current auxiliary spillway. If hydrology did change as a result of any action alternative, the habitat could be eliminated by dewatering as a result of the changes.

The occupied pool within the inundation limits would remain within the inundation limits for all three action alternatives; there would be no change to the occupied habitat within the inundation area.

6.14.3 Cumulative Effects

The cumulative impact area for vegetation is the is the 49,445-acre Watershed Plan area. Approximately 34,233 acres (69 percent) of the area are vegetated.

No Action Alternative

There would be no cumulative effects to vegetation with implementation of the No Action Alternative because there would be no direct or indirect effects.

Alternatives 1, 2, and 3

Disturbance from implementation of any action alternative could add cumulatively to impacts to vegetation within the larger area. Up to 48.2 acres (0.1 percent) of the vegetation in the cumulative impact area would be removed at one time. Because of the limited geographic scope relative to the cumulative impact area, there would be no cumulative adverse effects to vegetation with implementation of any action alternative.

6.15 Water Quality

6.15.1 No Action Alternative

Under the No Action Alternative, the dam would continue to capture approximately 3.8 acre-feet of sediment annually; however, the remaining sediment storage for the dam would be expended in approximately 22.6 years. Sediment would then be released through the principal spillway and conveyed down Matanzas Creek into the downstream watershed rather than being impounded by the dam.

Dam failure would also impact water quality. Depending on the mode and severity of failure, the dam may no longer capture sediment, and the current sediment load could be flushed downstream. Breach inundation flows may increase erosion and sedimentation downstream of the dam and could pick up pollutants from flooded areas.

6.15.2 Alternatives 1, 2, and 3

Approximately 48.2 acres would be disturbed by implementation of the action alternatives; this disturbance could lead to increased erosion and sedimentation of the disturbed soils and discharge of pollutants from equipment into the waters downstream of the disturbance. Pollutant discharges and increased turbidity associated with construction would be minimized by implementation of project conservation measures Water Quality 1-2. In particular, a SWPPP would be prepared prior to initiation of ground disturbance per project conservation measure Water Quality 2. The SWPPP would detail the best management practices and site-specific measures to prevent sediment and other pollutants from discharging into surface waters during construction. Implementation of the SWPPP would reduce sedimentation and the risk of pollution to surface waters during construction. Seeding disturbed areas per project conservation measure Reclamation 1 would also reduce erosion and sedimentation after construction was completed.

Operation of the facility would continue to benefit water quality downstream of the dam by capturing sediment and debris after storms; the dam would continue to capture approximately 3.8 acre-feet of sediment annually for the sediment storage design life of 50 years. Potential increases in water temperature or reductions in dissolved oxygen from operation of the rehabilitated dam would not change from the current conditions.

Maintenance activities would occur on an as-needed basis; the associated ground disturbance and potential for increased sedimentation would be temporary and localized to the immediate work area. There would be no long-term or permanent adverse impacts to water quality as a result of maintenance.

With adherence to the project conservation measures, and because potential adverse impacts would be temporary (during construction or maintenance), implementation of any action alternative would not adversely affect water quality and would benefit water quality by providing sediment storage capacity for 50 years.

6.15.3 Cumulative Effects

The cumulative impact area for water quality is the 49,445-acre Watershed Plan area. Most impacts to water quality in the area are due to surface-disturbing activities associated with residential, agricultural, and infrastructure development.

No Action Alternative

Impacts from sediment release or dam breach flooding would add cumulatively to increased pollution as a result of future development throughout the area, and may be synergistic as flooding would transport pollutants that might not otherwise reach surface waters. Therefore, the No Action Alternative would likely result in cumulative long-term adverse impacts to water quality within the cumulative impact area.

Alternatives 1, 2, and 3

Ground disturbance from implementation of any action alternative could add cumulatively to water quality impacts, such as sedimentation, within the Watershed Plan area; however, disturbance associated with implementation would be limited to the 48.2-acre disturbance area (0.1 percent of the cumulative impact area). Adverse impacts to the water quality would be

temporarily additive (during project activities and up to 2 years after) but would reduce as vegetation re-established on disturbed areas. Because of the temporary nature of the disturbance and the limited geographic scope relative to the Watershed Plan area, there would be no cumulative adverse effects to water quality with implementation of any action alternative. The increased sediment storage capacity would provide a countervailing effect on sedimentation elsewhere in the Watershed Plan area.

6.16 Waters of the U.S.

6.16.1 No Action Alternative

The No Action Alternative would not affect waters of the U.S.

6.16.2 Alternatives 1, 2, and 3

Construction of the upstream and downstream embankment stability buttresses would require placement of imported fill for approximately 170 feet of the Matanzas Creek channel on each side of the dam; approximately 4,962 square feet (0.1 acres) of channel would be lost. The unnamed intermittent creek that flows east to west down the lower portion of the auxiliary spillway would likely be filled by grading of the spillway; approximately 1,194 linear feet (4,794 square feet; 0.1 acres) of channel would be lost. A total of approximately 1,534 linear feet (9,756 square feet; 0.2 acres) of channel would be lost.

The placement of fill material within Matanzas Creek and the unnamed tributary would require a Clean Water Act Section 404 permit from the USACE; the proposed alternatives may meet the conditions for authorization under Nationwide Permit 43 (Stormwater Management Facilities), and compensatory mitigation may be required. The removal of sediment from the impoundment area would not result in fill but may also require permitting with the USACE.

Maintenance activities would likely be authorized under the maintenance conditions of the permit.

6.16.3 Cumulative Effects

The cumulative impact area for waters is the 49,445-acre Watershed Plan area. Approximately 173.4 miles of channel that maybe waters of the U.S. occur within the area (USGS 2022).

No Action Alternative

There would be no cumulative effects to waters of the U.S. with implementation of the No Action Alternative because there would be no direct or indirect effects.

Alternatives 1, 2, and 3

Approximately 1,534 linear feet (9,756 square feet; 0.2 acres) of waters of the U.S. would likely be lost with implementation of any action alternative; this loss constitutes less than 0.2 percent of the total length of possible waters within the cumulative impact area. Due to localized loss of waters associated with the project and the abundance of waters in the Watershed Area, implementation of any action alternative would not result in significant cumulative adverse impacts to waters of the U.S.

6.17 Wetlands

6.17.1 No Action Alternative

The No Action Alternative would not immediately affect wetlands. After dam failure, the wetland area within the reservoir would likely reduce in area as water would still flow through but would not be detained within the basin.

6.17.2 Alternatives 1, 2, and 3

Construction of the upstream and downstream embankment stability buttresses would require placement of fill in approximately 23,422 square feet (0.54 acres) of freshwater emergent marsh wetland on the upstream side of the dam and 2,910 square feet (0.06 acres) on the downstream side; a total of 0.6 acres of freshwater emergent marsh wetland would be permanently lost. Approximately 720 square feet (0.02 acres) of isolated seasonal wetlands within the auxiliary spillway would be filled and permanently lost by grading of the spillway. A total of approximately 27,052 square feet (0.62 acres) of wetlands would be permanently lost.

These impacts would likely be permitted under the same permit for the jurisdictional waters as discussed in Section 6.16.2; however, Nationwide Permit 43 requires that the action "must not cause the loss of greater than ½-acre of non-tidal waters of the United States." Depending on final design and a jurisdictional determination, if the proposed measures were to result in the loss of more than 0.5 acres of jurisdictional waters and wetlands, an Individual Permit could be required. Compensatory mitigation may also be required.

Approximately 13,582 square feet (0.31 acres) of freshwater emergent marsh wetland and 2,560 square feet (0.06 acres) of forested/shrub wetland would be temporarily impacted as a result of excavation with sediment from the impoundment area; a total of approximately 16,142 square feet (0.37 acres) of wetlands would be impacted. However, wetlands would likely re-establish in these areas throughout operation of the facility, and wetlands may expand as a result of the excavation. The establishment of additional wetland area in the excavation footprint could compensate for the loss of wetlands due to the fill of the embankment stability buttresses.

6.17.3 Cumulative Effects

The cumulative impact area for waters is the 49,445-acre Watershed Plan area. Approximately 753 acres of wetlands may occur within the area (USFWS 2022).

No Action Alternative

There would be no cumulative effects to wetlands with implementation of the No Action Alternative because there would be no direct or indirect effects.

Alternatives 1, 2, and 3

Approximately 27,052 square feet (0.62 acres) of wetlands would be permanently lost and 23,825 square feet (0.55 acres) of wetlands would be temporarily lost with implementation of any action alternative; this loss constitutes less than 0.2 percent of the total area of wetlands within the cumulative impact area. If compensatory mitigation were required, the losses would be offset to ensure that the individual and cumulative adverse environmental effects would be no more than minimal. Due to localized loss of wetlands associated with the project and the

abundance of wetlands in the Watershed Area, implementation of any action alternative would not result in significant cumulative adverse impacts to wetlands.

6.18 Summary and comparison of alternative plans

The alternatives proposed for consideration and analyzed in detail in this Supplemental Plan-EA have been compared against each other to discern the merits and disadvantages of each alternative. The comparison of effects is summarized in Table A-2.

Chapter 7. Consultation, Coordination, and Public Participation

7.1 Initial Request for NRCS Assistance

The initial request for NRCS assistance was submitted in February of 2019. Planning was contracted on March 11, 2021.

7.2 Public Participation

The *Scoping Report* prepared for the project (see Appendix A.2) outlines the scoping efforts and comments received during the scoping process. The formal scoping comment period opened on March 29, 2021, and closed on April 30, 2021.

Two virtual public scoping meetings were held on Tuesday, April 13, 2021; an agency and stakeholder meeting was held in the afternoon, and a public webinar meeting was held in the evening. There were 16 attendees from agencies and stakeholders at the afternoon meeting, including the California Department of Fish and Wildlife (CDFW), Santa Rosa City, the EPA, North Coast Regional Water Quality Control Board, Permit Sonoma, and Sonoma County. There were three public attendees at the evening meeting.

Comments were received from four commenters during the public comment period; the EPA provided comments on May 12, 2021.

A public comment period is offered with publication of this draft supplemental Plan-EA; comments received during the comment period will be included in Appendix A.5.

7.3 Agency Coordination

7.3.1 California State Historic Preservation Officer (SHPO)

In support of the NRCS's Section 106 compliance responsibilities, a Class III cultural resources inventory was conducted between February and April of 2021 to identify historic properties within the APE (see reports in Appendix D.7). The NRCS consulted with the California SHPO on June 17, 2024, regarding the identification of historic properties and effects of the undertaking in accordance with 36 CFR 800.4 through 800.6. The SHPO responded on February 14, 2025, stating that they concurred with the determinations of NRHP eligibility and finding of no adverse effect for the undertaking. NHPA Section 106 consultation documents are provided in Appendix A.3.

7.3.2 USFWS

Based on an analysis of the species and habitat that may occur within the area, a Biological Assessment was prepared for consultation with the USFWS. Consultation was initiated on March 19, 2023. In an email on April 26, 2023, the USFWS determined that the project falls within the effects analyzed in the *Programmatic Formal Consultation on the Natural Resources Conservation Service's Conservation Practices in Four North Bay Area Counties (Napa, Sonoma, Solano, and Marin Counties), California* (May 3, 2018).

After consultation was completed in 2023, the northwestern pond turtle (*Actinemys maramorata*) was proposed for listing as federally threatened species. The NRCS has determined to waive

NRCS policy to conference on potentially listed species. The consultation correspondence and documents are included in Appendix D.8.

7.3.3 Department of the Interior (DOI)

In compliance with Section 12 of the PL-566, NRCS notified the Department of the Interior of the intent to prepare the Matanzas Dam Rehabilitation Plan in a letter to the Sacramento Branch Regional Environmental Officer on July 22, 2024 (see letter in Appendix A.4).

7.3.4 USACE

The USACE was notified of the project in a letter dated January 23, 2025 (see letter in Appendix A.4); no response was received. As required, permitting would be addressed on a case-by-case basis prior to construction.

7.3.5 California Division of Safety of Dams (DSOD)

AECOM staff reached out to California DSOD early in the alternative development process; DSOD declined to collaborate on the project in the planning phase and would be involved in the design process.

7.4 Native American Consultation

7.4.1 Consultation under CEQA, Assembly Bill 52

The CEQA review and notification process requires state entities to consult with Native American Tribes pursuant to Assembly Bill 52. The purpose of the bill is to preserve options for avoiding adverse impact to resources of concern to Tribes. The following Tribes were notified about the project by the Sponsor on December 27, 2021.

- Cloverdale Rancheria of Pomo Indians - Patricia Hermosillo, Chairperson
- Kashia Band of Indians of the Stewarts Point Rancheria - Dino Franklin Jr., Chairperson
- Kashia Band of Indians of the Stewarts Point Rancheria - Anthony Macias, Tribal Historic Preservation Officer (THPO)
- Dry Creek Rancheria Band of Pomo Indians - Chris Wright, Chairperson
- Lytton Rancheria - Marjorie Mejia, Chairperson
- Federated Indians of Graton Rancheria - Gene Buvelot
- Federated Indians of Graton Rancheria - Buffy McQuillen, Tribal Historic Preservation Officer (THPO)
- Federated Indians of Graton Rancheria - Greg Sarris, Chairperson
- Middletown Rancheria - Jose Simon III, Chairperson,
- Mishewal-Wappo Tribe of Alexander Valley - Scott Gabaldon, Chairperson,
- Guidiville Band of Pomo Indians - Merlene Sanchez, Chairperson,
- Pinoleville Pomo Nation - Leona Williams, Chairperson,
- Ya-Ka-Ama Indian Education & Development, Inc.

7.4.2 Consultation under Section 106 NHPA

Section 106 of the National Historic Preservation Act requires federal agencies to consult with federally-recognized Native American Tribes on a government-to-government basis regarding historic properties of cultural or religious significance within a defined area of potential effects (APE). Pursuant to Section 106 regulations at 36 CFR § 800.4, the NRCS initiated Section 106 consultation with the following Tribes on February 16, 2023.

- Koi Nation of Northern California - Chairperson Darin Beltran
- Mishewal-Wappo Tribe of Alexander Valley - Chairperson Scott Gabaldon
- Cloverdale Rancheria of Pomo Indians - Chairperson Patricia Hermosillo
- Federated Indians of Graton Rancheria - Tribal Heritage Preservation Officer Buffy McQuillen
- Lytton Rancheria - Chairperson Margorie Mejia
- Middletown Rancheria – Tribal Historic Preservation Officer Sally Peterson
- Federated Indians of Graton Rancheria - Chairperson Greg Sarris
- Middletown Rancheria - Chairperson Jose Simon
- Kashia Band of Pomo Indians of the Stewarts Point Rancheria Tribal Historic Preservation Officer Anthony Macias
- Cortina Rancheria - Kletsel Dehe Band of Wintun Indians - Chairperson Charlie Wright
- Dry Creek Rancheria of Pomo Indians - Chairperson Chris Wright

Chapter 8. The Preferred Alternative

8.1 Rationale for Alternative Preference

The Preferred Alternative for the project is Alternative 3 as described in section 5.3.4 (page 29). This alternative meets the purpose and need of the project by providing flood protection and sediment reduction downstream of Matanzas Creek Dam in the most efficient manner. This alternative is the locally preferred alternative and the PR&G-recommended alternative. Project features were designed to utilize existing features as much as possible to reduce new disturbance and associated construction costs. The Preferred Alternative would meet current NRCS and California DSOD regulations and engineering standards associated with a high-hazard dam and ensure the useful life of the structure for at least 50 years. The storage capacity would be increased to route up to the 100-year 24-hour storm event without use of the auxiliary spillway.

The Watershed Plan area associated with the Preferred Alternative is 49,445 acres and is defined as the HUC 12 Upper Santa Rosa Creek (180101100702) and Lower Santa Rose Creek (180101100703) Subwatersheds. The watershed area contains the municipality of the City of Santa Rosa and surrounding rural area. The Preferred Alternative watershed area is shown on project Map B-1 in Appendix B; benefitted areas are shown on Map B-2.

8.2 Measures to be Installed

The Preferred Alternative would bring the dam into compliance with NRCS and California DSOD standards by raising the auxiliary spillway crest, raising the dam crest, and installing upstream and downstream earthen embankment stabilization buttresses (see Map C-9 in Appendix C). The Preferred Alternative includes the following measures:

1. Raise the dam crest to 435.0 feet (raise of 7.4 feet). Suitable material would be imported from an existing permitted or commercial source.
2. Raise the auxiliary spillway crest to 424.0 feet (raise of 11.4 feet) while maintaining a 200-foot width. Construct a roller-compacted concrete spillway crest/apron and concrete cutoff wall near the crest.
3. Regrade the spillway to an average -5.8 percent grade and maintain a 200-foot width.
4. Remove approximately 104 acre-feet of accumulated sediment from within the impoundment area to establish 50 years of future sediment capacity. Excavated sediment would be exported to existing permitted or commercial sites.
5. Install upstream and downstream embankment stability buttresses to address seismic and liquefaction issues and bring the embankment in compliance with NRSC and California DSOD seismic criteria. Suitable material would be imported from an existing permitted or commercial source.
6. Extend the primary spillway conduit by 175 feet upstream and 181 feet downstream and construct a new inlet and stilling basin on the primary spillway conduit as required due to accommodate installation of embankment stability buttresses.

The Preferred Alternative would disturb approximately 48.2 acres. The project site would be accessed by an existing road off of Bennett Valley Road. Project activities would take up to 24 months to complete. In-stream project activities would likely take place between June 15 and October 15.

This alternative would increase the flood storage capacity to 2,322 acre-feet, which is sufficient for the dam to route the 100-year 24-hour storm event through the principal spillway without activating the auxiliary spillway. The 100-year inundation area behind the dam would be 87.2 acres, which is an increase of 16.3 acres from the existing (see Map C-7 in Appendix C). The inundation area would drain within 4 days after the 100-year 24-hour event.

The Preferred Alternative would not modify the dam's high hazard potential classification; however, it would reduce the risk of catastrophic failure. The service life of the dam would be extended for a minimum of 50 additional years.

Project Conservation Measures

The project conservation measures listed in Appendix A.1 are also incorporated into the Preferred Alternative.

8.3 Mitigation

Proactive measures to avoid or prevent adverse impacts that could otherwise result from project implementation were identified as project conservation measures and are detailed in Appendix A.1. Mitigation for impacts to riparian habitat, waters of the U.S., and wetlands may be required for implementation of the Preferred Alternative upon consultation with regulatory agencies.

8.4 Permits and Compliance

The following federal, state, and local permits and compliance actions would be required for implementation of the Preferred Alternative.

8.4.1 Federal

- USACE: A Clean Water Act Section 404 permit for fill within jurisdictional waters and wetlands would be required for rehabilitation of the dam.

8.4.2 State

- California DSOD: Approval would be required for the final design report, construction drawings, and specifications by the California State Engineer.
- California Water Boards: Coverage under the Construction General Permit Order 2009-0009-DWQ for discharges associated with construction activity that disturb over 1 acre would be required in compliance with Clean Water Act Section 402. A SWPPP would be prepared and a Notice of Intent (NOI) would be filed.
- CEQA – Compliance with the California Environmental Quality Act will be required
- CDFW LSAA – A Lake and Streambed Alteration Agreement (LSAA) from the California Department of Fish and Wildlife will be required.
- RWQCB 401 Certification – A Section 401 Water Quality Certification from the North Coast Regional Water Quality Control Board will be required.

8.4.3 Local

- Sonoma County: Any necessary county permits and necessary easements (flood, permanent, O&M, etc.) would be acquired prior to construction. The Land Rights maps are included as Map C-19 in Appendix C.

8.5 Installation and Financing

Sonoma Water would acquire all necessary authorizations and permits prior to initiation of project construction. Construction schedules would be based on funding and suitable weather conditions.

The NRCS would provide 65 percent of the total construction rehabilitation cost for the Preferred Alternative with funding from the PL-566 program. Sonoma Water would be responsible for providing the remaining non-federally funded 35 percent of the construction cost of the project. NRCS would provide 100 percent of design engineering, and both the NRCS and Sonoma Water would bear project administration costs that each incurs for the project.

Costs for operation and maintenance of the Preferred Alternative would be budgeted by Sonoma Water to meet periodic maintenance needs.

8.6 Operation, Maintenance, and Replacement

Operation of the dam includes the administration, management, and performance of non-maintenance actions needed to keep the dam structure safe and functioning as designed. Maintenance includes repairing damage as needed to prevent failure and may be routine or as needed; damage may be caused by normal deterioration, droughts, flooding, or vandalism. Maintenance would generally consist of the following items:

- The dam and appurtenances would be inspected annually and after critical events.
- A periodic engineer inspection would be conducted annually
- Deep-rooted vegetation (trees and shrubs) would be removed from the embankment and abutments annually.
- Erosional channels would be repaired annually through grading, seeding, or riprap placement.

Inspection of the project measures is necessary to verify that the structure is safe and functioning properly. Sonoma Water and California DSOD would be responsible for inspecting the dam on an annual basis, as well as after major events such as floods or earthquakes. Inspection reports would be supplied to the NRCS following each inspection. Inspections and the associated reports would assess the following items:

- The adequacy of operation and maintenance activities,
- Needed operation and maintenance work,
- Unsafe conditions, including changes in the use of the floodplain below the dams,
- Specify ways of relieving unsafe work or performing other needed work, and
- Set action dates for performing corrective actions.

Sonoma Water would continue to be responsible for the operation, maintenance, rehabilitation, and future modifications to the dam. A specific operation and maintenance plan would be prepared by the NRCS and Sonoma Water for each measure in accordance with the NRCS National Operation and Maintenance Manual 180-NOMM, Part 500 (NRCS 2003). The plan and agreement would be entered into before a project agreement is signed and would be in place for the extended life of the project. The agreement would provide for inspections, reports, and procedures for performing the maintenance items. In addition to specific sponsor responsibilities

for the project measures, the agreement must include specific provisions for retention, use, and disposal of property acquired or improved with PL-566 assistance.

8.7 Economic Tables

The installation (including technical assistance and construction) cost estimate for the Preferred Alternative is detailed in Table 8-1. No installation activities would occur on or impact federal lands.

Table 8-1. Estimated Installation Cost; Central Sonoma Watershed, California (dollars[1])

Works of Improvement	Unit	Non-federal Land	Total Non-federal Land PL 83-566 Funds	Total Non-federal Land Other Funds	Total
Floodwater-retarding dam rehabilitation	Dam	1	$21,509,000	$10,516,000	$32,025,000

Prepared: January 2023

[1.] Price base: 2022; Costs rounded up to the nearest thousand

Table 8-2 identifies the estimated installation costs to be charged to the PL 83-566 fund and the costs taken by Sonoma Water ("other funds"). There are no relocation payments or water right costs for the Preferred Alternative.

Table 8-2. Estimated Cost Distribution; Central Sonoma Watershed, California (dollars[1])

Works of Improvement: Floodwater-retarding dam rehabilitation	Installation Cost – PL 83-566 Funds	Installation Cost – Other Funds	Installation Cost – Total
Construction Costs	$18,109,000	$9,751,000	$27,860,000
Engineering Costs	$2,985,000	$0	$2,985,000
Real Property Rights	$0	$350,000	$350,000
Administration/Permit Costs	$415,000	$415,000	$830,000
Total	$21,509,000	$10,516,000	$32,025,000

Prepared: January 2023

[1] Price base: 2022. Costs rounded up to the nearest thousand; numbers may not appear to sum correctly due to rounding.

Table 8-3 shows the installation costs allocated by purpose; the entirety of the project purpose is dam rehabilitation.

Table 8-3. Cost Allocation and Cost Sharing Summary Water Resource Project Measures for Dam Rehabilitation; Central Sonoma Watershed, California (dollars[1])

Dam Rehabilitation Items	Cost Share - PL 83-566 Funds	Cost Share - Other Funds	Total
Construction	$18,109,000	$9,751,000	$27,860,000
Engineering	$2,985,000	$0	$2,985,000
Administration	$0	$350,000	$350,000
Real Property	$415,000	$415,000	$830,000
Total	$21,509,000	$10,516,000	$32,025,000

Prepared: January 2023

[1] Price base: 2022; Costs rounded up to the nearest thousand; numbers may not appear to sum correctly due to rounding.

8.8 Structural Tables

Table 8-4 summarizes the proposed dam with planned storage capacity.

Table 8-4. Structural Data – Dam with Planned Storage Capacity; Central Sonoma Watershed, California

Design Parameter	Unit	Matanzas Creek Dam
Hazard Class of structure	-	High Hazard (NRCS), Extremely High Hazard (CADSOD)
Consequence of Seismic Failure[1]	-	Low Consequence
Maximum Design Earthquake (MDE) PGA[2]	g	0.93 (1,000-year return period)[3]
Operating Basis Earthquake (OBE) PGA[2]	g	0.71 (500-year return period)[3]
Maximum Credible Earthquake (MCE) (84th Percentile) PGA[2]	g	1.06 (~1,500-year return period)
Uncontrolled drainage area	sq-mi	0
Controlled drainage area	sq-mi	11.45
Total drainage area	sq-mi	11.45
Runoff curve No. (1-day) (AMC II)	-	71.4
Time of concentration (Tc)	hours	2.4
Elevation top dam (NAVD 88)	feet	435
Elevation crest auxiliary spillway (NAVD 88)	feet	424
Elevation crest high stage inlet	feet	377.63
Elevation crest low stage inlet (NAVD 88)	feet	354.5
Auxiliary spillway type	-	earthen
Auxiliary spillway bottom width	feet	200
Auxiliary spillway exit slope	percent	5.8
Maximum height of dam	feet	103
Volume of fill	cu-yd	394,000
Total capacity at crest of auxiliary spillway	acre-feet	2,322
Sediment submerged	acre-feet	0
Sediment aerated	acre-feet	240
Beneficial use	-	NA
Floodwater retarding	acre-feet	2,233
Between high and low stage	acre-feet	240
Surface area	acres	8.3
Sediment pool	acres	10.8
Beneficial use pool	acres	NA
Floodwater retarding pool at crest of auxiliary spillway	acres	88.3
Principal spillway design		
Rainfall volume (1-day)	inches	10.47

Design Parameter	Unit	Matanzas Creek Dam
Rainfall volume (10-day)	inches	24.92
Runoff volume (10-day)	inches	15.90
Capacity of low stage (max.)	cfs	37.5
Capacity of high stage (max.)	cfs	1,315
Dimensions of conduit	feet	5.25 x 5.25
Type of conduit	-	R/C Box Culvert
Frequency operation-auxiliary spillway	percent chance	< 1.0
Auxiliary spillway hydrograph		
Rainfall volume	inches	14.11
Runoff volume	inches	10.28
Storm duration	hours	24
Velocity of flow (Ve)	ft/s	4.55
Max. reservoir water surface elev.	feet	424.8
Freeboard hydrograph		
Rainfall volume	inches	24.45
Runoff volume	hours	20.31
Storm duration	hours	24
Max. reservoir water surface elev.	feet	432.6
Capacity equivalents		
Sediment volume	inches	0.003
Floodwater retarding volume	inches	0.025
Beneficial volume (identify use)	inches	NA

Prepared: January 2023

[1] Consequence of seismic failure per TR-60 based on inundation risk associated with normal pool reservoir level.

[2] Site-adjusted Peak Ground Acceleration (PGA). Values developed from Probabilistic Seismic Hazard Analysis and Deterministic Seismic Hazard Analysis performed for project.

[3] Low Consequence of Seismic Failure considered for MDE per TR-60 Figure 4-1, assuming that the reservoir is operated with the low-level outlet maintained open. High Hazard Potential considered for OBE per TR-60 Figure 4-2. The deterministic MCE evaluated as required per CA DSOD standards.

Table 8-5 shows the anticipated average annual costs of the Preferred Alternative. It also summarizes the total annual cost based on the annualized cost of installation, amortized over 52 years, and the average annual cost for operations and maintenance.

Table 8-5. Estimated Average Annual Costs; Central Sonoma Watershed, California (dollars[1])

Works of Improvement	Project Outlays Amortization of Installation Cost[2]	Net O&M	Other Direct Costs	Total
Floodwater-retarding dam rehabilitation	$1,129,000	-$123,000	$0	$1,006,000

Prepared: January 2023
[1] 2022 price level, 2023 base year, amortized using a 2.5 percent discount rate over a 52-year period
[2] Costs for technical assistance to install measures are included

Table 8-6 summarizes the estimated average annual benefits and costs of the Preferred Alternative; the proposed measures are combined into a single analysis unit, as the individual measures function together as a single system and depend on each other.

Table 8-6. Comparison of Annual Benefits and Costs; Central Sonoma Watershed, California (dollars[1])

Annual Benefits - Total Average Annual Damages Avoided	$22,000
Annual costs	$1,006,000
Average Annual Construction Costs	$1,129,000
Average Annual O&M Costs	-$123,000
Average Annual Net Benefits	-$984,000
Benefit-Cost Ratio	0.02:1

Prepared: January 2023
[1] Values rounded to the nearest thousand, 2022 price level, 2023 base year, amortized using a 2.5 percent discount rate over a 52-year period. Numbers may not appear to sum correctly due to rounding.

Chapter 9. References

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Chapter 10. List of Preparers

The draft Supplemental Plan-EA was reviewed by state NRCS resource specialists, the project Sponsor, and the NRCS's National Water Management Center (NWMC).

Table 10-1. Supplemental Plan-EA Preparers

Name	Affiliation	Title (Years of Experience)	Education	Other
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Denise de Joseph	NRCS CA – STO – WFPO & ACEP-WRE Programs	Cultural Resources Specialist (24)	M.S. Archeological Science	SOI Qualified - Archeology
Christopher Null	NRCS CA – STO – Ecological Science Division	State Archeologist (20+)	M.A. Archaeology	SOI Qualified - Archeology
Max Silver	NRCS CA – STO – Engineering Division	State Geologist (5)	Ph.D Geology	
Steve Hill	NRCS CA – STO – Engineering Division	Natural Resource Manager (22)	M.S. Agronomy	
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Clifton Dorrance	AECOM	Project Engineer (14)	B.S. Agricultural Engineering	Texas, California P.E.
Hayden Coombs	Jones and DeMille Engineering	Project Engineer (4)	B.S. Civil Engineering M.S. Civil Engineering	Utah P.E.
Jason Weiss	AECOM	Economist (25)	B.S. Industrial Engineering M.S. Resources Economics and Policy	
Ricky Anderson	Jones and DeMille Engineering	Hydrology/Hydraulics Engineer (8)	B.S. Civil Engineering M.S. Civil Engineering	Utah P.E., CFM
Alice Chen	AECOM	Economist (2.5)	B.S. Economics, Environmental Studies M.S. Environmental Science and Policy	
Seth Gentzler	AECOM	Civil Engineer (28)	B.S. Civil Engineering	P.E.

Name	Affiliation	Title (Years of Experience)	Education	Other
			M.S. Environmental Engineering	
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Lance Finnefrock	AECOM	Geotechnical Engineer (14)	B.S. Civil & Environmental Engineering M.S. Civil (Geotechnical) Engineering	P.E., G.E.
Ben Aldridge	AECOM	Geotechnical Engineer (9)	B.S. Civil Engineering M.S. Civil Engineering	P.E.
Fariborz Vossoughi	AECOM	Structural Engineer (15)	B.S. Civil Engineering M.S. Structural Engineering PhD Structural Engineering	PhD, P.E.
Julian Jaramillo	AECOM	Structural Engineer (9)	B.S. Civil Engineering M.S. Structural and Earthquake Engineering	P.E.
Kathleen Kubal	AECOM	Archeologist (17)	B.S. Anthropology M.S. Cultural Resource Management	R.P.A.
Jon Stead	AECOM	Biologist (26)	B.S. Ecology M.S. Ecology	
Chandra Miller	AECOM	Architectural Historian (15)	B.A. History M.A. Public History	
Dave Cook	Sonoma Water	Principal Environmental Specialist (27)	M.S.	
Jessica Martini-Lamb	Sonoma Water	Environmental Resources Division Manager (26)	B.S.	
Aaron Fulton	Sonoma Water	Principal Engineer (16)	M.S.	California P.E.
Carlos Diaz	Sonoma Water	Deputy Director of Engineering (19)	M.S.	California P.E.

Chapter 11. Distribution List

A notice of availability for the Draft Supplemental Plan-EA was distributed to the following government agencies/staff and organizations.

11.1 Federal Agencies

Federal Emergency Management Agency (FEMA)

National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS)

U.S. Army Corps of Engineers (USACE)

U.S. Environmental Protection Agency (EPA)

U.S. Fish & Wildlife Service (USFWS)

11.2 Tribal Entities

Cloverdale Rancheria of Pomo Indians

Cortina Rancheria - Kletsel Dehe Band of Wintun Indians

Dry Creek Rancheria of Pomo Indians

Federated Indians of Graton Rancheria

Kashia Band of Pomo Indians of the Stewarts Point Rancheria

Koi Nation of Northern California

Lytton Rancheria

Middletown Rancheria

Mishewal-Wappo Tribe of Alexander Valley

11.3 State Entities

State Assemblymember – District 2 and District 12

State Senator – District 2

U.S. Representative – Fifth Congressional District

U.S. Senators

State of California - Office of the Governor

California Division of Safety of Dams

California Department of Fish and Wildlife, Bay Delta Region

California Department of Water Resources

California Environmental Protection Agency

North Coast Regional Water Quality Control Board

11.4 Local Government

City of Santa Rosa

Sonoma County

11.5 Other Organizations

Laguna De Santa Rosa Foundation

11.6 Private Parties

The names and addresses of private parties who received notices of the Draft Supplemental Plan-EA are not listed in this chapter for privacy.

Chapter 12. Acronyms, Abbreviations, and Short Forms

APE	Area of potential effect
BMP	Best Management Practice
CDFW	California Department of Fish and Wildlife
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Ac
CFR	Code of Federal Regulations
cfs	cubic feet per second
CRHR	California Register of Historical Resources
DPS	Distinct Population Segment
DSOD	Division of Safety of Dams
EA	Environmental Assessment
EAP	Emergency Action Plan
EPA	U.S. Environmental Protection Agency
FBH	Freeboard Hydrograph
FEMA	Federal Emergency Management Agency
FONSI	Finding of No Significant Impact
FWOFI	Future-Without-Federal-Investment
HUC	Hydrologic Unit Code
IPaC	Information for Planning and Consultation
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NWMC	National Water Management Center
NWPM	National Watershed Program Manual
O&M	Operations and Maintenance
OEHHA	Office of Environmental Health Hazard Assessment

OHP	California Office of Historic Preservation
PL-566	Public Law 83-566
Plan-EA	Plan-Environmental Assessment
PMF	Probable Maximum Flood
PR&G	Principles, Requirements, and Guidelines for Water and Land Related Resources Implementation Studies and Federal Water Resource Investments
PSH	Principal Spillway Hydrograph
RED	Regional Economic Development
ROD	Record of Decision
Sonoma Water	Sonoma County Water Agency
SWPPP	Stormwater Pollution Prevention Plan
THPO	Tribal Historic Preservation Officer
TMDL	Total Maximum Daily Load
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service

Appendices

Appendix A — Project Actions, Alternatives, Comments, and Responses

Appendix B — Project Map

Appendix C — Support Maps

Appendix D — Investigation and Analysis Report

Appendix E — Other Supporting Information

Appendix A. Project Actions, Alternatives, Comments, and Responses

A.1. Project Conservation Measures

A.2. Summary and Comparison of Alternative Plans

A.3. Public Participation Plan

A.4. Scoping Report

A.5. NHPA Section 106 Consultation Documents

A.6. Agency Coordination Letters

A.7. Draft Plan EA Comments - To be included in the final environmental assessment

Appendix A.1. Project Conservation Measures

Table A-1. Project Conservation Measures

Resource Area	Project Conservation Measure
Air Quality 1	All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times per day.
Air Quality 2	All haul trucks transporting soil, sand, or other loose material off-site shall be covered.
Air Quality 3	All visible mud or dirt trackout onto adjacent public roads shall be removed using wet power vacuum street sweepers at least once per day. The use of dry power sweeping is prohibited.
Air Quality 4	All vehicle speeds on unpaved roads shall be limited to 15 mph.
Air Quality 5	All roadways, driveways, and sidewalks to be paved shall be completed as soon as possible. Building pads shall be laid as soon as possible after grading unless seeding or soil binders are used.
Air Quality 6	All excavation, grading, and/or demolition activities shall be suspended when average wind speeds exceed 20 mph.
Air Quality 7	All trucks and equipment, including their tires, shall be washed off prior to leaving the site.
Air Quality 8	Unpaved roads providing access to sites located 100 feet or further from a paved road shall be treated with a 6- to 12-inch layer of compacted layer of wood chips, mulch, or gravel.
Air Quality 9	Publicly visible signs shall be posted with the telephone number and name of the person to contact at the lead agency regarding dust complaints. This person shall respond and take corrective action within 48 hours. The Air District's General Air Pollution Complaints number shall also be visible to ensure compliance with applicable regulations.
Cultural 1	For post-review discoveries, the Unanticipated Discoveries procedures outlined in Appendix E.2 shall be followed. If any human remains are discovered under any circumstance, the Unanticipated Discoveries procedures shall be followed.
Dewatering 1	Dewatering operations include but are not limited to the removal of groundwater through well and sump developments, the removal of perched water, and the removal of stored surface water (considered separate from collected storm waters). Construction contractors will install a system of wells to dewater the granular soils to within a few feet of the contact. Removal of the remaining water resting on the fine-grained soils and bedrock will be performed by installing sumps and routing the water via trenches to the closest well or sump. Finer soils may require the use of active groundwater control measures such as vacuum wellpoint and eductor systems, which induce a vacuum in the borehole that enhances groundwater flow towards the well. Depending on the turbidity of dewatering flows, it may be necessary to treat via a settling basin or sand filters to meet regulatory discharge requirements. All pump intakes will be covered with 0.125-inch mesh to prevent entrainment of fish or amphibians. Pump intakes will be periodically checked for impingement of fish or amphibians. Preconstruction biological surveys will be conducted and an aquatic species rescue and relocation plan will be developed. After the creek diversion system is in place, if authorized in the California Department of Fish and Wildlife (CDFW) 1600 agreement issued for the project, qualified biologists will rescue native aquatic species from the ponded water within the work area and relocate them to a safe location.
Listed Species 1	Minimization measures from the Programmatic Formal Consultation on the NRCS's Conservation Practices in Four Bay Area Counties would be applied (see Appendix D.8).
Noise 1	Operation of equipment at the site would only occur during daylight hours.
Noise 2	A project-specific noise analysis would be conducted pursuant to CEQA Guidelines and appropriate mitigation measures would be identified at that time.

Resource Area	Project Conservation Measure
Noxious Weeds 1	Equipment will be washed to remove any soil and debris that may contribute to the spread of noxious weeds.
Noxious Weeds 2	Any seed mix used in implementation of the project must be certified weed free.
Reclamation 1	As practicable, the embankment and other disturbed areas will be seeded or planted with appropriate species per NRCS Practice Standard "Critical Area Planting" (342).
Vegetation 1	Vegetation removal will be limited as much as practicable.
Vegetation 2	Environmental fencing or other protective measures will be installed around the vernal pools adjacent to the proposed auxiliary spillway that are occupied by Lobb's aquatic buttercup to protect the pools from disturbance during construction activities.
Vegetation 3	Trees to be removed will be evaluated for protection and permitted in accordance with Sonoma County Code Section 26-88-010(m), Section 26-67, and Chapter 26D processes as necessary.
Water Quality 1	Equipment servicing and refueling areas will be located at least 300 feet away from any stream channels. To ensure that accidental spills do not enter waters, the storage of petroleum-based fuels and the refueling of construction machinery will not occur outside of approved designated staging areas. The project will comply with state and federal water quality standards and toxic effluent standards to minimize any potential adverse impacts from discharges to waters of the U.S.
Water Quality 2	A stormwater pollution prevention plan (SWPPP) will be prepared by the construction contractor prior to initiation of ground disturbance. The SWPPP will detail the best management practices and site-specific control features to prevent sediment and other pollutants from discharging off the site during construction. BMPs may include silt fence, fiber wattles, and earthen berms.
Wildlife 1	Where practicable, vegetation will be removed outside the nesting bird season (February 15 – August 15) to avoid impacts to nesting birds. If vegetation removal activities must occur between February 15 and August 15, pre-construction surveys for nesting birds within 7 days prior by a qualified biologist will be required. Appropriate spatial and temporal buffers will be applied if nesting birds are located.
Wildlife 2	Pre-construction surveys for roosting bats and sign of bat activity will be conducted prior to tree removal by a qualified biologist. In coordination with a bat expert, appropriate spatial and temporal buffers will be incorporated to the project design and construction schedule if potential roosts are located, or if roost or potential roost removal is required.
Wildlife 3	In-channel work will be restricted to occur only between June 15 and October 15. Dewatering, aquatic species capture and relocation, and construction activities within any wetted and/or flowing creek channel will only occur within this window. Planting activities outside the active channel may occur beyond October 15 if necessary to improve plant establishment during the onset of winter precipitation.
Wildlife 4	Preconstruction surveys will occur within 7 days of initial ground disturbance, within 7 days of initial dewatering, and within 7 days of re-initiation of ground-disturbing work if there is more than a 14-day pause in ground-disturbing work. During the preconstruction survey(s), biologists will survey for special-status species and nesting birds that may be impacted by implementation of the project.
Wildlife 5	To prevent inadvertent entrapment of terrestrial wildlife during construction, excavated holes or trenches more than 1 foot deep with walls steeper than 30 degrees will be covered at the close of each working day by plywood or similar materials. Alternatively, one or more escape ramps constructed of earth fill or wooden planks will be installed. Before such holes or trenches are filled, they will be thoroughly inspected for trapped animals. Any animals discovered in the holes or trenches will be allowed to leave on their own volition, and work around the hole or trench will cease until the animal has left.

Resource Area	Project Conservation Measure
Wildlife 6	Prior to construction, a qualified biologist with experience in the ecology and identification of the special-status species that may occur in the project area will conduct a Worker Environmental Awareness Training (WEAT) for all construction personnel, including contractors and subcontractors. The WEAT will include, at a minimum: • a brief description of special-status species that may occur in the project area, including species identification and habitat requirements; • an explanation of the species' status and protection; • communication and work stoppage procedures in case a special-status species is observed within the project area; and • a list of measures being taken to reduce effects to the species during project implementation. Brochures conveying this information with color photographs of the species will be prepared for distribution to construction personnel working in the project area.

Appendix A.2. Summary and Comparison of Alternative Plans.

Table A-2. Summary and comparison of alternative plans table

Item or Concern	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Measures to address: Flood damage	No change; continued risk of dam breach, flood storage capacity for 25-year 24-hour storm event	Reduced risk of dam breach, flood storage capacity for 25-year 24-hour storm event	Reduced risk of dam breach, flood storage capacity for the 50-year 24-hour storm event	Reduced risk of dam breach, flood storage capacity for the 100-year 24-hour storm event
Installation Cost[1]	NRCS: $0 Sponsor: $0 Total: $0	NRCS: $29,737,000 Sponsor: $13,969,000 Total: $43,706,000	NRCS: $20,122,000 Sponsor: $9,525,000 Total: $29,647,000	NRCS: $21,509,000 Sponsor: $10,516,000 Total: $32,025,000
Average Annual Cost[1]	Installation: $0 O, M, & R[2]: $214,000 Total: $214,000	Installation: $1,541,000 O, M, & R[2]: -$130,000 Total[3]: $1,411,000	Installation: $1,045,000 O, M, & R[2]: -$124,000 Total[3]: $921,000	Installation: $1,129,000 O, M, & R[2]: -$123,000 Total[3]: $1,006,000
Annual Benefits[1]	---	$14,000	$19,000	$22,000
Annual Costs[3]	---	$1,411,000	$921,000	$1,006,000
Annual Net Benefits[3]	---	-$1,397,000	-$902,000	-$984,000
Air quality	No effect	Temporary localized impacts	Temporary localized impacts	Temporary localized impacts
Cultural resources	No effect	No adverse effect, no significant impact	No adverse effect, no significant impact	No adverse effect, no significant impact
Endangered and threatened species	No effect to listed species or critical habitat	May affect but not likely to adversely affect California red-legged frog; no effect to critical habitat	May affect but not likely to adversely affect California red-legged frog; no effect to critical habitat	May affect but not likely to adversely affect California red-legged frog; no effect to critical habitat
Fish and wildlife	No effect	Temporary disturbance of up to 6.9 acres of habitat for various species; temporary disturbance to individual animals for up to 2 years	Temporary disturbance of up to 48.2 acres of habitat for various species; temporary disturbance to individual animals for up to 2 years	Temporary disturbance of up to 48.2 acres of habitat for various species; temporary disturbance to individual animals for up to 2 years
Floodplain management	No change	No changes to floodplain management	No changes to floodplain management	No changes to floodplain management
Invasive species	No effect	Disturbance of up to 48.2 acres may temporarily increase risk of spread	Disturbance of up to 48.2 acres may temporarily increase risk of spread	Disturbance of up to 48.2 acres may temporarily increase risk of spread

Item or Concern	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Land use	No change	Increased in maximum inundation area of 6.1 acres	Increased in maximum inundation area of 10.9 acres	Increased in maximum inundation area of 16.3 acres
Noise levels	No change	Temporary increase in daytime noise levels for up to 2 years	Temporary increase in daytime noise levels for up to 2 years	Temporary increase in daytime noise levels for up to 2 years
Prime and unique farmlands	No change	No conversion of classified farmlands	No conversion of classified farmlands	No conversion of classified farmlands
Public health and safety	No change; continued risk of dam breach, flood storage capacity for 25-year 24-hour storm event	Reduced risk to public safety from reduced risk of dam breach flooding; flood storage capacity for 25-year 24-hour storm event	Reduced risk to public safety from reduced risk of dam breach flooding; flood storage capacity for the 50-year 24-hour storm event	Reduced risk to public safety from reduced risk of dam breach flooding; flood storage capacity for the 100-year 24-hour storm event
Riparian areas	No effect	Temporary loss of 6.6 acres and permanent loss of 0.3 acres of riparian vegetation	Temporary loss of 6.6 acres and permanent loss of 0.3 acres of riparian vegetation	Temporary loss of 6.6 acres and permanent loss of 0.3 acres of riparian vegetation
Socioeconomic factors	No change	No change	No change	No change
Soil resources	No effect	Disturbance of up to 48.2 acres of soil	Disturbance of up to 48.2 acres of soil	Disturbance of up to 48.2 acres of soil
Vegetation	No effect	Temporary removal of up to 42.2 acres of vegetation; permanent loss of 6.0 acres on auxiliary spillway	Temporary removal of up to 48.2 acres of vegetation	Temporary removal of up to 48.2 acres of vegetation
Water quality	No change; continued sediment capture of 3.8 acre-feet per year for approximately 22.6 years	Temporary increase in turbidity due to disturbance of 48.2 acres; continued sediment capture of 3.8 acre-feet per year for approximately 50 years	Temporary increase in turbidity due to disturbance of 48.2 acres; continued sediment capture of 3.8 acre-feet per year for approximately 50 years	Temporary increase in turbidity due to disturbance of 48.2 acres; continued sediment capture of 3.8 acre-feet per year for approximately 50 years
Waters of the U.S.	No effect	Permanent loss of 1,534 feet (0.2 acres) of jurisdictional waters	Permanent loss of 1,534 feet (0.2 acres) of jurisdictional waters	Permanent loss of 1,534 feet (0.2 acres) of jurisdictional waters

Item or Concern	No Action Alternative	Alternative 1	Alternative 2	Alternative 3
Wetlands	No effect	Permanent loss of approximately 27,052 square feet (0.62 acres) of wetland; temporary loss of approximately 16,142 square feet (0.37 acres) of wetland	Permanent loss of approximately 27,052 square feet (0.62 acres) of wetland; temporary loss of approximately 16,142 square feet (0.37 acres) of wetland	Permanent loss of approximately 27,052 square feet (0.62 acres) of wetland; temporary loss of approximately 16,142 square feet (0.37 acres) of wetland

Notes:

[1] Values rounded to the nearest thousand, 2022 price level, 2023 base year, amortized using a 2.5 percent discount rate over a 52-year period. Regional Economic Development (RED) account concerns were not identified during the scoping process. Therefore, the RED account information is not included.

[2] "O, M, & R" stands for Operation, Maintenance, and Replacement.

[3] Values rounded to the nearest hundred, 2022 price level, 2023 base year, amortized using a 2.5 percent discount rate over a 52-year period.

Appendix A.3. Public Participation Plan

Appendix A.4. Scoping Report

Appendix A.5. NHPA Section 106 Consultation Documents

Appendix A.6. Agency Coordination Letters

Appendix A.7. Draft Plan EA Comments - To be included in the final environmental assessment

Appendix B. Project Map

Map B-1. Project Map

Map B-2. Benefited Areas

Appendix C. Support Maps

Appendix D. Investigation and Analysis Report

D.1. Technical Memoranda

D.2. PR&G Report

D.3. USFWS IPaC Species List

D.4. Summary of Existing Environmental Conditions

D.5. Botanical Assessment

D.6. Aquatic Resources Delineation Report

D.7. Cultural Resource Survey Reports

D.8. Endangered Species Act Section 7 Consultation Documents

D.9. Air Quality Analysis Results

Appendix D.1. Technical Memoranda

The technical memoranda prepared for this watershed plan are summarized in the following sections.

D.1.1 Existing Conditions

A summary of the existing conditions of the dam, spillway, and outlet works is provided in TM001. The report includes general information on the dam, review of available records, and a summary of the topographic survey, dam inspection, geotechnical investigation, geologic features, and sediment survey. The dam inspection included a video assessment of the outlet conduit, dam drains, and concrete riser. Still photos from the inspections are included in the report. The full videos are available in the project files of the NRCS, the Sonoma Water, and AECOM.

D.1.2 Geologic Investigation Report

The Geologic Investigation Report (TM002) summarizes preliminary subsurface investigations that were performed to obtain geologic data and information to evaluate static and seismic stability of the dam, investigate the mapped Matanzas Creek Fault, evaluate stability of the mapped landslide at the left abutment, and to evaluate erodibility of the existing earthen auxiliary spillway.

D.1.3 Soil Mechanics Report

The purpose of the Soil Mechanics Report (TM003) is to present and analyze the results of the geotechnical laboratory testing program, document material characterization and geotechnical engineering analysis results, and provide geotechnical recommendations for required dam improvements and/or further study. The document summarizes the site-specific probabilistic seismic hazard analysis, deterministic seismic hazard analysis, seepage, filter compatibility, slope stability, and seismic stability analyses of the existing dam embankment. In addition, a slope stability analysis was completed of the mapped landslide on the left abutment.

D.1.4 Hazard Classification

TM004 provides the dam breach analysis and hydrologic hazard analysis that were conducted to determine the NRCS and California DSOD hazard classifications of Matanzas Creek Dam. Peak breach flows and breach hydrographs were determine using guidelines found in TR-210-60 (NRCS 2019). The three failure modes included in the dam breach analysis were hydrologic failure, static failure, and seismic failure, which correspond to a reservoir pool elevation at the peak reservoir level during the Freeboard Hydrograph, auxiliary spillway crest, and principal spillway crest, respectively. The reservoir elevation at the time of breach, the reservoir storage at the time of breach, and the peak breach flows for each of the failure modes are summarized in Table D-1.

Table D-1. Matanzas Creek Dam Peak Breach Flows

Failure Mode (TR-210-60)	Reservoir Elevation[1] at Time of Breach (feet)	Reservoir Storage at Time of Breach (acre-feet)	Peak Breach Flow (cfs)
Hydrologic	422.77	2,215	173,546
Static	412.63	1,445	122,692
Seismic	377.63	88.9	20,247

[1] NAVD88 vertical datum

The dam breach hydrographs were hydraulically modeled using the U.S. Army Corps of Engineers River Analysis System (HEC-RAS version 5.0.7). In general, the breach flows pass through Santa Rosa and eventually drain towards the Laguna de Santa Rosa floodplain.

The population at risk (PAR) for each failure model was determined using county parcel and structure data, the hydraulic modeling results, and the "PAR Computation Worksheet" spreadsheet. The failure and risk indexes were calculated using the "Evaluation of Potential Rehabilitation Projects" spreadsheet. Both mentioned spreadsheets were developed and provided by the NRCS. Table D-2 summarizes the results of the dam breach analysis.

Table D-2. Failure Index, Risk Index, and PAR

Scenario	Load Factor	Response Factor	Failure Index	Fatality Rate	PAR	Risk Index
Static	1	92	92	0.007	16,938	10,908
Hydrologic	--	--	116	0.007	28,680	23,288
Seismic	1.0	25	25	0.007	184	32
		Total	**233**		**Total**	**34,228**

Using a fatality rate of 0.007, the potential loss of life for a hydrologic breach is 200 persons. Therefore, it is recommended that Matanzas Creek Dam retain its NRCS High Hazard classification and its California DSOD Extremely High Hazard classification. TM004 also includes dam breach inundation maps.

D.1.5 Existing Hydrology Analysis

A hydrologic analysis (TM005) of Matanzas Creek Dam includes an evaluation of the existing dam and any needed improvements needed to bring the dam into compliance with NRCS and California DSOD guidelines. NRCS TR-210-60 established minimum requirements for earth dams, which includes an evaluation of the principal spillway hydrograph (PSH), auxiliary spillway hydrograph (ASH), and freeboard hydrograph (FBH; NRCS 2019). California DSOD's *Inspection and Reevaluation Protocols* outlines minimum hydrologic requirements (California DSOD 2018).

The hydrologic analysis included a delineation of the dam's watershed, development of the ARCII Curve Number (CN), and determination of appropriate lag time and transform methods. Precipitation data were determined by Hydrometeorological Report No. 58/59 (NOAA 1999) and acquire from NOAA Atlas 14 precipitation data (NOAA 2017). A calibration of the hydrologic parameters was completed using Santa Rosa Creek and Matanzas Creek stream gage data and reservoir level data for a February 2016 storm event. The calibration resulted in a CN of 71.4 and

a lag time of 1.8 hours. The existing stage-storage-discharge relationships for the dam were also evaluated and updated for the analysis.

Based on the results of the analysis, Matanzas Creek Dam meets all NRCS and California DSOD hydrologic requirements with two exceptions: first, the dam cannot route the PSH without activating the earthen auxiliary spillway hydrograph; and second, the dam does not have sufficient sediment storage capacity for another 50-year design life.

D.1.6 Spillway Stability and Integrity Analysis

A SITES stability and integrity analysis was conducted per TR-210-60 guidelines to evaluate the erodibility of the current spillway. Auxiliary spillway surface conditions and material characteristics were approximated based on findings summarized in TM002. TR-210-60 requires the use of the 6-hour ASH auxiliary spillway discharge for the stability analysis. This storm event, however, does not engage Matanzas Creek Dam's auxiliary spillway; therefore, the dam passes the spillway stability criterion.

For the integrity analysis, TR-210-60 requires evaluation of the spillway's ability to resist erosion during the 6-hour and 24-hour FBH. The auxiliary spillway passes the integrity analysis for the 6-hour FBH but fails the analysis (spillway breaches) for the 24-hour FBH.

Geologic data for the auxiliary spillway was limited for this analysis. Therefore, a range of parameters were considered to complete a sensitivity analysis. Based on favorable geologic parameters, the spillway would pass the 24-hour FBH integrity analysis. However, without additional geologic investigations being completed to confirm the favorable parameters, the unfavorable parameters were used to conclude that the existing auxiliary spillway cannot pass TR-210-60 integrity requirements.

For more information on this analysis, see TM006.

D.1.7 Alternative Development and Hydraulic Design

Alternatives considered for Matanzas Creek Dam include the No Action, decommissioning of the dam, non-structural, and structural rehabilitation alternatives. This section focuses on the development of structural alternatives.

A total of 17 structural rehabilitation alternatives were considered to bring Matanzas Creek Dam into compliance with federal and state requirements and to provide flood protection to downstream infrastructure. Several of the structural alternatives were dismissed because they either 1) did not bring the dam into compliance with NRCS and California DSOD requirements, or 2) there was another more cost-effective rehabilitation alternative versus the one being dismissed. After several review meetings with the NRCS and Sponsor, three alternatives where selected for consideration in the Plan-EA.

Alternative 1 involves converting the earthen auxiliary spillway to a structural auxiliary spillway. The structural spillway would consist of a labyrinth weir being constructed near the existing auxiliary spillway crest and constructing a concrete spillway channel to a stilling basin near the downstream valley floor. This alternative does not require the crest of the dam to be raised. The structural auxiliary spillway crest would be raised to 417.88 feet, which is the highest possible raise without needing to raise the crest of the dam. At this crest elevation, the dam would be able to route the 25-year 24-hour storm event without activating the auxiliary spillway, which matches the existing dam's capability.

This alternative resolves the PSH deficiency because the PSH can be routed through a structural auxiliary spillway per TR-210-60 guidelines (NRCS 2019). The structural spillway also resolves the integrity concern of the earthen spillway.

The conceptual design for Alternative 2 consists of raising the crests of both the dam and the earthen auxiliary spillway. The minimum auxiliary spillway crest elevation of 420 feet (a total raise of approximately 7.4 feet) is required to route the PSH through the principal spillway without activating the earthen auxiliary spillway. The auxiliary spillway crest would be able to route the 50-year 24-hour storm event without activating the auxiliary spillway; this would require a dam crest raise to elevation 431 feet (a total raise of approximately 3.4 feet) to meet all NRCS and California DSOD requirements. The dam crest raise would be completed by importing additional fill material on the upstream slope of the embankment.

In addition to the auxiliary spillway crest raise, the earthen spillway would need to be regraded with a more consistent slope and spillway width to meet spillway stability and integrity requirements. Near the crest of the auxiliary spillway, armoring of the spillway with roller compacted concrete and construction of a cutoff wall would be required to meet spillway integrity requirements.

Alternative 3 is very similar to the design concept of Alternative 2. The difference is the earthen auxiliary spillway crest and dam crest will be raised to 424 feet (a total raise of approximately 11.4 feet) and 435 feet (a total raise of 7.4 feet), respectively. This additional raise of the crest is to increase the dam's flood storage and routing capabilities to the 100-year 24-hour storm event. This means the 100-year event could be routed solely through the principal spillway, which minimizes the peak flow and flooding downstream of the dam. In contrast, a 100-year storm event for Alternative 2 would route floodwaters through the principal spillway and engage the auxiliary spillway. Although Alternative 3 produces the highest reservoir water surface elevation for the 100-year event, it satisfies the requirement of NRCS Circular 390-21-1 and does not induce flooding upstream infrastructure during the 100-year event.

For more information regarding the development of each considered alternative for Matanzas Creek Dam, see TM007.

D.1.8 Conceptual Drawings

The structural rehabilitation alternatives were evaluated to approximately a 30 percent design level. Design drawings were generated to help communicate the geospatial locations and conceptual design details of the project elements and aid in cost estimating. TM007 contains the set of 30 percent design drawings for Alternatives 1, 2, and 3.

D.1.9 Probable Cost

The probable cost of each project element was estimated by considering 30 percent design quantities, past and present unit costs, and engineering experience. TM007 contains detailed quantities, unit cost, and total project element costs. A summary of the cost for Alternatives 1, 2, and 3 is shown in Table D-3.

Table D-3. Alternative Probable Cost Summary

Structural Rehabilitation Alternative	Construction Cost	Engineering Cost	Administration/Permitting Cost	Real Property & Easements Costs	Total Probable Cost
Alternative 1	$38,727,000	$4,149,000	$830,000	$0	$43,706,000

Structural Rehabilitation Alternative	Construction Cost	Engineering Cost	Administration/Permitting Cost	Real Property & Easements Costs	Total Probable Cost
Alternative 2	$26,029,000	$2,788,000	$830,000	$0	$29,647,000
Alternative 3	$27,860,000	$2,985,000	$830,000	$350,000	$32,025,000

D.1.10 Frequency Flood Routing

Hydrologic and hydraulic modeling was completed for the routing of frequency-based floods to determine the flood impacts upstream and downstream of the dam for all alternatives considered. The recurrence-interval floods to be included in the flood routing are the 10-year, 25-year, 50-year, 100-year, 200-year, and 500-year 24-hour storm events.

The hydrologic parameters for Matanzas Creek Dam's watershed were determined in TM005. Parameters for downstream and adjacent watersheds were completed for the broader Central Sonoma Watershed project (ESA 2022).

Routing of the frequency-based floods was completed using the U.S. Army Corps of Engineers River Analysis System (HEC-RAS version 6.2). The HEC-RAS model for the broader Central Sonoma watershed was also provided by ESA. The received model was a 1-dimensional and 2-dimensional model.

Depth rasters and inundation boundaries from the hydraulic modeling results were exported to create inundation maps. The depth rasters were then intersected with available parcel data, building footprints, and other GIS data to assign flood depths to various types of infrastructure downstream of the dam.

For more information on the frequency flood routing, see TM008.

D.1.11 Economic Analysis

Economic feasibility was determined by comparing the average annual benefits to the average annual costs. An economic analysis was performed to quantify the benefits and costs of each action alternative. The No Action Alternative was considered to be the baseline condition, which assumes the existing maintenance activities continue but no major changes are made to the dam. Benefits and costs over the period of analysis were annualized to allow for a direct comparison of average annual benefits to average annual costs. The benefits and costs were evaluated using a 2022 price level and were evaluated over a 52-year period of analysis (24 months of construction and 50-year evaluation period) using a 2.5 percent discount rate. The analysis uses inundation models for six flood recurrence intervals, which are the 10-percent (10-year), 4-percent (25-year), 2-percent (50-year), 1-percent (100-year), 0.5-percent (200-year), and 0.2-percent (500-year) annual-probability flood events, to estimate future damages from flooding within the study area. Average annual benefits were compared to the average annual costs to generate a benefit-cost ratio for each project alternative.

The benefit categories evaluated were: 1) residential and nonresidential structure, automobile damages avoided; 2) reduction in debris removal costs; 3) infrastructure (roads, bridges, etc.) damages avoided; 4) recreation; 5) agriculture; and 6) construction and operations and operation and maintenance costs avoided. The average annual structure-related damages for each action alternative were compared with that of the No Action Alternative. The differences were counted as the structure-related benefits (damages avoided).

Average annual costs associated with the action alternatives include costs for construction, real property, easements, and operations and maintenance.

Table D-4 summarizes the benefit-cost ratio for Alternatives 1, 2, and 3.

Table D-4. Benefit-Cost Analysis Summary

Category	Alternative 1	Alternative 2	Alternative 3
Costs			
Average Annual Construction Costs	$1,541,000	$1,045,000	$1,129,000
Average Annual O&M Costs	-$130,000	-$124,000	-$123,000
Total Average Annual Costs	**$1,411,000**	**$921,000**	**$1,006,000**
Benefits			
Total Average Annual Damages Avoided	$14,000	$19,000	$22,000
Total Average Annual Benefits	**$14,000**	**$19,000**	**$22,000**
Evaluation			
Average Annual Net Benefits	**-$1,397,000**	**-$902,000**	**-$984,000**
Benefit-Cost Ratio (BCR)	**0.01:1**	**0.02:1**	**0.02:1**

Note: 2022 price level, 52-year period of analysis, and 2.5% discount rate. All $ values rounded to the nearest thousand.

For additional detail on the economic analysis, see TM009.

D.1.12 Statement of Limitations

This document represents Jones & DeMille Engineering's professional judgment based on the information available at the time of its completion and as appropriate for the project scope of work. Services performed in developing the content of this document have been conducted in a manner consistent with that level and skill ordinarily exercised by members of the engineering profession currently practicing under similar conditions. No warranty, express or implied, is made.

D.1.13 References

California Division of Safety of Dams. 2018. Division of Safety of Dams Inspection and Reevaluation Protocols. Available at: https://water.ca.gov/-/media/DWR-Website/Web-Pages/Programs/All-Programs/Division-of-Safety-of-Dams/Files/Publications/DSOD-Inspection-and-Reevaluation-Protocols_a_y19.pdf (accessed 12-13-2022).

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Natural Resources Conservation Service (NRCS). 2019. Technical Release 210-60: Earth Dams and Reservoirs. Conservation Engineering Division. March 2019.

Appendix D.2. PR&G Report

Appendix D.3. USFWS IPaC Species List

Appendix D.4. Summary of Existing Environmental Conditions

Appendix D.5. Botanical Assessment

Appendix D.6. Aquatic Resources Delineation Report

Appendix D.7. Cultural Resource Survey Reports

Appendix D.8. Endangered Species Act Section 7 Consultation Documents

Appendix D.9. Air Quality Analysis Results

Appendix E. Other Supporting Information

Appendix E.1. Agricultural Crop Types

Table E-1. Crop Types within the Watershed Area

Category	Acres
Annual Cropland	169
Intensively Managed Hayfield	85
Irrigated Pasture	197
Nursery or Ornamental Horticultural Area	6
Orchard or Grove	98
Perennial Agriculture	11
Vineyard	2,218
Vineyard Replant	1
Total:	**2,784**

Table E-2. Crop Types within the Dam Breach Inundation Areas - Hydrologic Failure

Category	Acres
Annual Cropland	98
Intensively Managed Hayfield	45
Irrigated Pasture	58
Nursery or Ornamental Horticultural Area	1
Orchard or Grove	18
Perennial Agriculture	1
Vineyard	67
Total:	**289**

Appendix E.2. Unanticipated Discoveries Procedures

A. In the event that previously unidentified cultural resources are identified during project implementation, the project Sponsor and/or contractor will take the following steps:

1. Construction will be immediately halted in the area of the discovery, and measures taken to protect the resource until such time that an NRCS Cultural Resources Specialist (CRS) or qualified professional inspects the work site.
2. The project Sponsor or contractor will notify the NRCS by contacting NRCS State Archaeologist Christopher Null at Christopher.Null@usda.gov, or 530-792-5621.
3. The NRCS shall inspect the discovery in a timely manner and will follow Section 106 regulations at 36 CFR § 800.13 and procedures set forth in the NRCS National Cultural Resources Handbook, as appropriate."