Corte Madera Creek Flood Risk Management Project

Environmental Impact Statement/ Environmental Impact Report

U.S. Army Corps of Engineers
San Francisco District

Marin County Flood Control and
Water Conservation District

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Draft Environmental Impact Statement/Environmental Impact Report

NEPA Lead Agency: U.S. Army Corps of Engineers

CEQA Lead Agency: Marin County Flood Control and Water Conservation District

Title: Corte Madera Creek Flood Risk Management Project

Designation: Draft Environmental Impact Statement/Environmental Impact Report

Location: Marin County, CA

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The official comment period on the draft EIS is from October 13, 2018 to November 27, 2018. The Notice of Availability of the Final EIS will be published in the *Federal Registrar* in spring, 2019. After release of this Final EIS, USACE will document its decision on the proposed project in a record of decision that is expected to be issued in spring 2019.

EXECUTIVE SUMMARY

The United States Army Corps of Engineers developed this integrated Draft General Reevaluation Report (GRR) and joint Environmental Impact Statement/ Environmental Impact Report (EIS/EIR) to evaluate the Federal interest in implementing a flood risk management project on Corte Madera Creek in Marin County, California. This report presents a description of existing and expected future conditions of resources related to these project purposes, formulation and evaluation of plans considered, analysis of the environmental effects of the Tentatively Selected Plan, project costs, and implementation issues. It integrates the following elements:

- Requirements of the United States Army Corps of Engineers (USACE) feasibility study planning process;
- An Environmental Impact Statement (EIS) prepared in compliance with the National Environmental Policy Act (NEPA); and
- An Environmental Impact Report (EIR) prepared in compliance with the California Environmental Quality Act (CEQA).

Study / Project Area

The Corte Madera Creek watershed, also known as the Ross Valley watershed, is located in central eastern Marin County, California (Figure 1-1). The watershed contains 42 linear miles of stream channels, covers approximately 28 square miles, including areas of unincorporated Marin County and the towns of Corte Madera, Ross, San Anselmo, and Fairfax, and discharges into the San Francisco Bay 9 miles north of the Golden Gate Bridge. The lower ridges and valley areas of the watershed, including areas adjacent to Corte Madera Creek, are highly developed suburban residential and commercial areas.

The study area is divided into units, consisting of Units 3 and 4 and the concrete-lined portion of Unit 2, along approximately 1.4 miles of Corte Madera Creek (Figure 1-2). Unit 4 of Corte Madera extends approximately 0.4 mile downstream from Sir Francis Drake Boulevard and continues approximately 600 feet downstream of the Lagunitas Road Bridge before terminating at the Denil fish ladder. Unit 3 begins at the Denil fish ladder and the upstream end of the concrete channel and continues for approximately 0.67 mile to the College Avenue Bridge. The upper portion of Unit 2 consists of a concrete channel that extends approximately 0.33 mile downstream to 450 feet downstream of Stadium Avenue.

Purpose and Need

The purpose of the project is to manage flood risk from Corte Madera Creek associated with Unit 4 and to address any potential induced flooding as a result in Units 2 and 3. Studies identified the abrupt transition between Units 3 and 4 created by the existing Denil fish ladder, the narrow channel condition on the east and west banks, and the Lagunitas Road Bridge as constrictions to flood flow. The need for the proposed actions is to reduce/remove existing water flow impediments and constrictions within Unit 4, thus providing a greater level of flood protection in the watershed. The project would address channel modifications to Unit 4, from the upstream end of the existing Unit 3 concrete channel to Sir Francis Drake Boulevard at the border of Ross and San Anselmo, and any induced flooding downstream in Units 2 and 3 resulting from these modifications.

Alternatives Considered in Detail

The USACE has developed, in conjunction with the District, five action alternatives (A, B, F, G, and J), and a no action alternative. Other than the no action alternative, all alternatives are intended to increase current channel capacity to convey flood flows through flood control study units (Units) 2, 3, and 4. In addition, all action alternatives were developed in consideration of improving fish passage for threatened and endangered fish species in Corte Madera Creek. Alternative F is the environmentally superior alternative. Alternative J is the Tentatively Selected Plan and the preferred alternative.

Alternative A: Top of Bank Floodwall

Alternative A would construct top-of-bank floodwalls along the length of the creek for the length of the Project area (Figures 3-1a to 3-1f). Setback floodwalls (floodwalls located away from channel) would be constructed around the Kent Middle School athletic fields. These floodwalls would tie into high ground so that floodwaters would not outflank and flow behind the walls. This alternative would require full purchase of 30 parcels. Purchase of residential parcels would require relocation of residents and the land would be purchased at fair market value. Permanent easements would total 13.62 acres and temporary easements would affect 3.14 acres. Permanent easements may be required for operations and maintenance roads, flowage (to flood or submerge), utility, and channel improvement, and temporary easements would be for access or staging during construction. The need for real estate purchase results from the location of floodwalls on property and the requirement for clearance around floodwalls.

Alternative B: Top-of-bank Floodwall/Partial Sylvan Lane Setback/College of Marin Widening

Alternative B would utilize a combination of top-of-bank and setback floodwalls (Figures 3-2a to 3-2f). For College of Marin Widening, 2,740 feet of concrete channel would be removed around the College of Marin and Kent Middle School, and replaced with features that replicate a natural tidal creek. Box culverts would be installed under College Avenue. This alternative would require purchase of 18 parcels. Permanent easements would total 13.54 acres and temporary easements would affect 3.07 acres.

Alternative F: Bypass/Allen Park Riparian Corridor /College of Marin Widening

Alternative F would utilize a combination of top-of-bank and setback floodwalls, an underground bypass, Allen Park Riparian Corridor, and College of Marin Widening (Figures 3-3a to 3-3f). Alternative F would include an underground bypass culvert along Sir Francis Drake Boulevard to convey flow from the upstream portion of the Project area downstream to the Allen Park Riparian Corridor downstream from the Denil fish ladder. The underground bypass would alleviate the need to construct any floodwalls in the natural channel upstream of Lagunitas Road Bridge. Downstream of the Allen Park Riparian Corridor, the channel would be identical to Alternative B, including removal of 2,740 feet of concrete channel to restore natural features, construction of floodwalls, and construction of box culverts at College Avenue Bridge. Alternative F would also include replacement and improvement of the bicycle-pedestrian path adjacent to the creek. This alternative would not require purchase of any parcels. Permanent easements would total 12.18 acres and temporary easements would affect 3.17 acres.

Alternative G: Floodwall/Allen Park Riparian Corridor/College of Marin Widening

Alternative G would utilize a combination of floodwalls, Allen Park Riparian Corridor, and College of Marin Widening (Figures 3-4a to 3-5f). This alternative is identical to Alternative F downstream of the fish ladder, but would construct floodwalls instead of a bypass upstream of Lagunitas Road Bridge. Top-of-bank floodwalls would be constructed similar to Alternative A. Construction would be identical to Alternative F downstream of the fish ladder. Alternative G would also include replacement and improvement of the bicycle-pedestrian path. This alternative would result in purchase of 18 parcels. Permanent easements would total 14.44 acres and temporary easements would affect 2.98 acres.

Alternative J: Bypass/Allen Park Riparian Corridor/Floodwall

Alternative J would utilize a combination of an underground bypass, Allen Park Riparian Corridor, and floodwalls (Figures 3-5a to 3-5f). Alternative J would be identical to Alternative F in Unit 4 and include an underground bypass culvert along Sir Francis Drake Boulevard to the Allen Park Riparian Corridor. Maximum floodwall height around Allen Park Corridor would be 2 feet. Downstream of the Allen Park Riparian Corridor, floodwalls would be constructed near the Granton Park neighborhood and adjacent to College Avenue. Alternative J would not include box culverts at College Avenue. This alternative would not require purchase of any parcels. Permanent easements would total 3.44 acres and temporary easements would affect 3.87 acres.

Alternative I: No Action

The No Action/No Project Alternative represents the expected future condition if none of the action alternatives are approved and there is no change from the current channel configuration. For the no action alternative, the current conditions and flood capacity would remain unchanged. The capacity ranges from 3,300 cubic feet per second (cfs) at the upstream end to greater than 6,900 cfs downstream (USACE, 2010). Under these existing conditions, flood flows in excess of these capacities would continue to pass outside the channel onto a developed residential/urban floodplain. The Denil fish ladder would not be removed and fish passage would not be improved through Corte Madera Creek. Over time, the fish ladder would likely continue to degrade. Moreover, the transition point between the natural Unit 4 and concrete lined Unit 3 stream reaches would remain a pinch point (constricted section) or a flood flow breakout zone.

Summary of Environmental Impacts

The significant and unavoidable environmental impacts of the Project and mitigation measures to reduce those impacts are summarized in Table ES-1. Chapter 4 of the EIS/EIR discusses all effects in detail, including those that would be less than significant and would not require mitigation.

Water Quality

The water quality analysis in this EIS/EIR evaluates the effects of the proposed Project on: violation of water quality standards, waste discharge requirements, or substantial degradation of water quality; increase of polluted runoff; or impacts resulting from construction of storm water drainage facilities. Corte Madera Creek experiences a variety of water quality problems related to nonpoint-source pollution from urban runoff including 4.1 miles of storm sewers, septic systems, road and bank erosion; specific concerns include pesticides, bacteria, particulates (sediment), and nutrients (Town of Ross 2009; CCA 2002, in USACE 2010). The SFRWQCB provides information on sediment, pathogens, and diazinon as pollutants of concern. High water temperatures have been attributed to urbanization of the watershed, specifically the reduction of shaded stream surface area, although less so within Unit 4 due to loss of riparian vegetation and increased channel width (Friends 2008a, in USACE 2010). Water temperature is the water quality parameter that would be impacted by Alternatives A and B.

Alternatives A, B, and G would convert up to 1.34 acres of riparian woodland to low herbaceous vegetation and open channel. The loss of existing shade would be permanent. Stream segments with reduced shade would likely result in increased water temperature, algae, and other aquatic plants.

Alternative A would not remove any portion of the concrete-lining of the channel except for a small amount that could occur with removal of the fish ladder. Compared to other action alternatives, Alternative A would likely have the greatest impact to water temperature because of the loss of shade, primarily in Unit 4, and none of the benefits from increased groundwater infiltration from removal of the concrete channel. The impact to water temperature in Unit 4 and farther downstream to the SMN Bridge would be significant. Downstream of the SMN Bridge, water temperature would be dominated by tidal water temperature.

Alternative B would remove the concrete lining of the channel for College of Marin Widening in portions of Unit 3. These changes would increase groundwater discharge into the channel by removing the concrete lining which impedes groundwater discharge into the creek. During the dry season, groundwater normally has cooler temperatures than surface water that could cool stream temperatures. However, since the mean-lower-low water of tide extends to the SMN Bridge (Table 4.1-5), this cooling effect could be overshadowed by the tidal water temperature. Similar to Alternative A, Alternative B could result in a significant impact to water temperature in Unit 4 and farther downstream to the SMN Bridge.

All action alternatives would include the placement of floodwalls within a 1 percent annual exceedance probability special flood hazard area. These floodwalls would prevent or reduce creek flood flows into the floodplain but may impede flood flows of the existing interior drainage systems, resulting in the need for additional facilities to relieve flooding within the floodwalls. The current level of design for the action alternatives is not sufficient to predict accurately requirements for such facilities. Construction could cause significant impacts to biological resources, water quality, traffic, noise, air quality, and other resources. Until the design of the project progresses further, neither the extent of impacts nor the ability to avoid or mitigate them can be known. The construction of new storm water drainage facilities or expansion of existing facilities could cause significant environmental effects.

Biological Resources

The biological resources analysis in this EIS/EIR evaluates the effects of the proposed Project to special status species and associated habitat, to riparian and other sensitive habitat, to federally protected wetlands, to wildlife movement, and conflicts with local ordinances and conservation plans. Corte Madera Creek is designated critical habitat for Central California Coast steelhead and Central California Coast coho salmon and essential fish habitat for Central California Coast coho salmon. Steelhead are present in the creek; however, coho are considered extirpated from the creek. Although habitat exists for other sensitive aquatic species, there is low to no potential for presence for most of these sensitive species that were historically present. There is low potential for sensitive bats, raptors, and migratory birds nesting or foraging in the Project area; however, avoidance and minimization measures are included to protect these species during construction.

Sensitive riparian woodland is present within Unit 4 along Corte Madera Creek and brackish salt marsh is present at the downstream end of the Project area. Alternatives A, B, and G would convert up to 1.34 acres of riparian woodland to low growing herbaceous vegetation and open channel, whereas, Alternatives F and J would create approximately 1.35 acres of riparian woodland habitat. Alternatives B, F, and G were projected to increase tidal marsh habitat by up to 1.2 acres.

Alternatives A, B, and G would reduce shade, forage, organic debris, and cover, and likely increase water temperature in Unit 4 within Corte Madera Creek. The loss of shade in Unit 4 would likely increase water temperature downstream in Unit 3. Creation of Allen Park Riparian Corridor in Alternative G would partially mitigate some of these impacts. Removal of the Denial fish ladder and construction of a new transition would correct fish passage issues from the existing fish ladder. Lack of cover, forage, and habitat diversity in Units 2 and 3 within the Project area would persist in Alternative A, whereas, Alternatives B, F, G and J would improve habitat to varying degrees.

Alternatives A, B, and G were found to have significant impacts to special status species and critical habitat, riparian woodland, and salmonid migration.

Aesthetics

The visual resources analysis in this EIS/EIR evaluates the effects of the proposed Project in terms of loss of scenic views, alterations to the visual character of the area, and the introduction of substantial new sources of light and glare. The surrounding ridge-tops and upper slopes of the watershed are generally wooded and undeveloped whereas the valley floor where the Project is located is densely developed. The communities surrounding the Project area have maintained a small town feel that blends with the landscape. The Project is situated around Corte Madera Creek on the valley floor and the project features would not extend more than 12 feet above ground surface. Impacts to aesthetics would only affect local receptors as the current combination of fairly dense trees, buildings, and terrain limit visibility to short distances.

Alternatives A, B, and G would result in construction of top-of-bank floodwalls ranging in maximum height from 7 to 11 feet per alternative that would restrict views of Corte Madera Creek in Unit 4. The construction of the floodwall would require removal of 1.34 acres of riparian woodland bordering the creek further impacting views. The alteration and loss of views of the creek and adjacent aesthetically pleasing vegetation was considered significant and unavoidable for Alternatives A, B, and G.

Noise and Vibration

The noise and vibration analysis in this EIS/EIR evaluates the effects of the proposed Project in terms of potential increases in temporary and permanent noise and vibration levels. The majority of ambient noise in the study area is associated with transportation-related sources. Traffic along Sir Francis Drake Boulevard is readily noticeable along Corte Madera Creek. Construction noise from other projects represents a temporary, yet pervasive type of noise source in the study area.

Construction would contribute to short-term significant impacts to noise. The Project is located in an urban area, thus many sensitive receptors, including residents, schools, hospitals, and parks, would be within 1,000 feet of construction activities.

Construction noise would exceed the regulations set by Marin County and the Town of Ross. Mitigation would be implemented in the form of erecting noise barriers, installing mufflers on equipment, and restricting work hours.

For construction of the underground bypass along Sir Francis Drake Boulevard in Alternatives F and J, there is potential for night work to occur during culvert installation to avoid full closure of the road. The need to conduct night work would be determined during preconstruction engineering and design.

Even with mitigation, construction would have a significant, unavoidable impact on noise for all action alternatives.

Land Use

The land use assessment addresses the potential for the proposed Project to conflict with local plans or conservation plans, divide an established community, or result in permanent conversion of an existing land use. The Project lies within highly developed suburban residential and commercial areas. Land uses adjacent to Corte Madera Creek include residential housing, parking facilities, a bicycle-pedestrian pathway, multiple parks, public services, commercial establishments, and schools. Implementation of Alternatives A, B, and G would require purchases of residential parcels resulting in relocation of the residents. Permanent easements for all action alternatives would also impact local residents, businesses, and public uses. Parcels of commercial properties would be purchased. Although the affected owners would be monetarily compensated at fair market values, these impacts would still be considered significant and unavoidable. No feasible mitigation was identified. Impacts to changes in land use from Alternatives F and J were considered less than significant.

Traffic, Transportation, and Circulation

The transportation analysis in this EIS/EIR evaluates the effects of the proposed Project in terms of changes to bicycle, pedestrian, and roadway traffic. A bicycle-pedestrian pathway runs adjacent to the creek from the downstream limit to Lagunitas Road Bridge. Sir Francis Drake Boulevard, a main thoroughfare in the Project area, would serve as the main haul route for the Project.

The Unit 4 bypass would be constructed beneath Sir Francis Drake Boulevard for Alternatives F and J and would cause extensive traffic interference, contributing to traffic impacts. Bypass construction would involve road excavation, which would require closure or reduced lanes on part or all of Sir Francis Drake Boulevard. Detours would be established, potentially on Red Hill Avenue, Laurel Grove Avenue, or Wolfe Grade. Partial and full road closure would cause traffic delays and congestion, resulting in substantial level of service reduction. A Traffic Control Plan would be implemented to reduce impacts, but would not eliminate traffic impacts.

Traffic impacts could potentially be minimized by including night construction or using three smaller box culverts. By installing the box culverts at night, full closure of Sir Francis Drake Boulevard would only occur at night, minimizing impacts to traffic. Temporary shoring, excavation, backfilling, and utility relocation would still occur during the daytime construction hours, 8 am to 5 pm. Constructing three smaller box culverts would reduce the trench size needed, thereby reducing the amount of road closed. Using a three box culvert system could eliminate the need for any full road closure and night work. This design element would be determined during pre-construction engineering design.

For all design and construction methods, partial closure would be necessary, at a minimum, and significant traffic impacts would persist for Alternatives F and J. Mitigation that requires coordination with the public during construction would be implemented to minimize delays and maximize safety during bypass installation. However, construction on Sir Francis Drake Boulevard could still cause congestion or reduced level of service for all action alternatives. For Alternatives F and J, impacts to traffic would remain significant and unavoidable.

Socioeconomics

The socioeconomics analysis in this EIS/EIR evaluates the effects of the proposed Project in terms of potential induced growth and displacement of homes or people. Building flood control structures would not directly contribute to substantial population growth in the study area. Indirectly, it is feasible that greater flood protection might draw interest in real estate throughout the previously affected region, but not significantly.

Alternatives A, B, and G would require the purchase of real estate. Some homeowners may be displaced by land purchase; however, they would be compensated by receiving fair market value for their homes and relocation assistance. Alternatives A, B, and G would require the purchase of 17, 15, and 16 residential parcels, respectively.

Alternatives F and J would not require the purchase of any real estate. However, during construction of the bypass under Sir Francis Drake Boulevard, utilities could be temporarily interrupted for some residents. If so, residents would be temporarily relocated to nearby hotels while utilities are offline.

TABLE ES-1 SIGNIFICANT AND UNAVOIDABLE IMPACTS						
Impact	Mitigation	Alternative				
		A	B	F	G	J
WQ-1: Violate any water quality standards or waste discharge requirements or otherwise substantially degrade water quality.	No Feasible Mitigation	•	•			
WQ-3: Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.	Not Yet Determined	•	•	•	•	•
AES-1: Substantially degrade the existing visual character or quality of the study area and its surroundings.	No Feasible Mitigation	•	•		•	
AES-2: Have a substantial adverse effect on a scenic vista.	No Feasible Mitigation	•	•		•	
BIO-1: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the NMFS, USFWS, and CDFW.	No Feasible Mitigation	•	•		•	
BIO-2: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the NMFS, USFWS, and CDFW.	No Feasible Mitigation	•	•		•	
BIO-4: Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.	No Feasible Mitigation	•	•		•	
LND-4: Result in permanent conversion of existing land uses	No Feasible Mitigation	•	•		•	
NOI-1: Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.	**Mitigation NOI-1:** Erect sound barriers around work sites	•	•	•	•	•
NOI-2: A substantial temporary or periodic increase in ambient noise levels in the project vicinity, above levels existing without the project.	**Mitigation NOI-1:** Erect sound barriers around work sites	•	•	•	•	•
TRF-1: The project conflicts with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.	**Mitigation TRF-1:** Coordinate with the public during construction			•		•
TRF-2: The project conflicts with an applicable congestion management program, including but not limited to level of service (LOS) standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways.	**Mitigation TRF-1:** Coordinate with the public during construction			•		•
SOC-2: Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere.	No Feasible Mitigation	•	•		•	
SOC-3: Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.	No Feasible Mitigation	•	•		•	

Areas of Controversy

The public scoping period extended from December 23, 2015, to March 1, 2016. On January 28, 2016, a scoping meeting was held in the Town of Ross. Oral comments were received at the scoping meeting, and additional written comments were received at and following the meeting. The main areas of controversy included:

1. Community perception of floodwalls on private property
2. Traffic Impacts along Sir Francis Drake Boulevard
3. Potential vegetation removal for floodwalls per the USACE guidance - ETL 1110-2-583, *Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures*, April 2014.
4. Single Purpose Authorization of the Congressional authorization around considering only single purpose, flood reduction measure and not the other ecological and environmental benefits of the project such as the Riparian Corridor.
5. Increased flood risk downstream of project sites.
6. Adequate passage and habitat for enhanced fish species

Unresolved Issues

Refinements to the Tentatively Selected Plan's construction cost:

The TSP's construction cost estimate needs refinement to better represent utility relocation and the potential for flood wall pumps stations to prevent the accumulation of water during a flood event. The relocation of the sanitary sewer line, which intersects with the fish ladder and Allen Park Riparian Corridor, have not been factored into the current cost estimate. However, the relocation would be required for each action alternative and is not expected to affect the section of the proposed alternative (i.e., the TSP). Similarly, pump stations are also not in the cost estimate and the project team has not performed an interior drainage analyses to determine if there is a need.

Floodwall Heights of the Tentatively Selected Plan:

USACE has not completed a Risk and Uncertainty Analysis to determine the exact heights of floodwalls, and thus the heights could change after the analysis is complete. Furthermore, Unit 4 does not include floodwalls in the Lagunitas Bridge area as it has a bypass culvert structure. Depending on the final design of the culverts and the Risk and Uncertainty Analysis, some vegetation removal within the creek channel may be needed within Unit 4 to achieve the desired level of assurance (e.g. 4 percent APE) without the presence of a floodwall.

Construction of the Underground Bypass

Construction methodology of the bypass under Sir Francis Drake Boulevard has not yet been determined. Sir Francis Drake Boulevard is a main thoroughfare so several approaches are being considered to address traffic impacts. The underground bypass may be constructed of three parallel box culverts, which would reduce the trench size needed, reducing the amount of road requiring closure. Alternatively, the box culverts could be installed at night, limiting full road closure to nighttime construction hours, 8 pm to midnight. Temporary shoring, excavation, backfilling, and utility relocation would still occur during the daytime construction hours, 8 am to 5 pm. Although night work would reduce traffic impacts, it would cause additional noise impacts during sensitive times. Construction methodology of the underground bypass would be determined during PED.

Geotechnical Risks for Bypass Construction

Several borings from a geotechnical investigation along the left bank encountered shallow bedrock. The use of a temporary shoring system will need to be evaluated as sheet piles may not be sufficient to excavate to the depths currently anticipated for the bypass. Additional geotechnical investigations will be needed to better understand the subsurface soil and rock characteristics along the bypass alignment. This could have significant cost impacts during Project construction.

Vegetation Variance along Floodwalls

The riparian habitat impact analysis is conservative and addresses the loss to riparian habitat assuming a 15-foot buffer without a variance. ETL 1110-2-583 provides USACE design policy for vegetation near levees, dams, and floodwalls. Vegetation policy guidance letters (October 2017) indicate that vegetation variances may be granted in cases where the flood safety risks of the vegetation do not outweigh the benefits of allowing non-policy compliant vegetation. A risk analysis will be performed for Corte Madera Creek prior to PED and results of those findings will be included in the final design to assess compliance with ETL 1110-2-583. This will determine to what extent riparian vegetation could be restored at Frederick Allen Park Riparian Corridor within 15 feet of floodwalls.

Sir Francis Drake Boulevard Rehabilitation Project and Bypass Construction

Kittle Creek is an intermittent stream that drains under Sir Francis Drake Boulevard near the Lagunitas Road Bridge. The Sir Francis Drake Boulevard Rehabilitation Project will alter the drainage of Kittle Creek and likely construct a culvert beneath the road. Because a culvert and bypass would be constructed beneath Sir Francis Drake Boulevard, coordination during Project design would be required. Many cumulative impacts could be avoided to resources evaluated in this EIS/EIR if the Sir Francis Drake Boulevard rehabilitation project and the bypass were designed and constructed together.

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Acronyms and Abbreviations

%	percent
°F	degrees Fahrenheit
AB	Assembly Bill
AEP	annual exceedance probability
Allen Park	Frederick S. Allen Park
AMM	avoidance and minimization measure
ARB	California Air Resources Board
B	beneficial
BAAQMD	Bay Area Air Quality Management District
BMP	best management practice
CAA	Clean Air Act
CAAQS	California Ambient Air Quality Standards
CalEEMod	California Emissions Model
Caltrans	California Department of Transportation
CCAA	California Clean Air Act
CCR	California Code of Regulations
CDFW	California Department of Fish and Wildlife
CDPH	California Department of Public Health
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CFR	Code of Federal Regulations
cfs	cubic feet per second
CGS	California Geological Survey
CH_4	methane
CMCFCP	Corte Madera Creek Flood Control Project
CNDDB	California Natural Diversity Database
CNEL	Community Noise Equivalent Level
CNPS	California Native Plant Society
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalents
CWA	Clean Water Act
dBA	A-weighted decibel
District	Marin County Flood Control and Water Conservation District
DTSC	Department of Toxic Substances Control
DWR	Department of Water Resources
EFH	essential fish habitat
EIS/EIR	Environmental Impact Statement/Environmental Impact Report
ER	USACE Engineer Regulation
ESA	Endangered Species Act
ESU	evolutionarily significant unit
ETL	USACE Engineer Technical Letter
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FRM	flood risk management
FTA	Federal Transit Administration

FWCA	Fish and Wildlife Coordination Act
GC	Government Code
GHG	greenhouse gases
GRR	General Reevaluation Report
HFC	hydrofluorocarbons
HTRW	hazardous, toxic, and radioactive waste
in/sec	inches per second
IPCC	Intergovernmental Panel on Climate Change
KFPD	Kentfield Fire Protection District
lb/day	pound per day
L_{dn}	Day-Night Average Sound Level
L_{eq}	equivalent noise level
L_{max}	maximum instantaneous noise level
L_{min}	minimum instantaneous noise level
LOS	level of service
LPP	Locally Preferred Plan
LTS	less than significant
LTS/W	less than significant with mitigation
m	meter
mL	milliliter
MLLW	mean-lower-low -water
MMT	million metric tons
MMWD	Marin Municipal Water District
MSA	Magnuson-Stevens Fisheries Conservation and Management Act
msl	mean sea level
MT	metric ton
N_2O	nitrous oxide
N/A	not applicable
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NED	National Economic Development
NEPA	National Environmental Policy Act
NEHRPA	National Earthquake Hazards Reduction Program Act
NI	no impact
NMFS	National Marine Fisheries Services
NPDES	National Pollutant Discharge Elimination System
NO_2	nitrogen dioxide
NOI	Notice of Intent
NOP	Notice of Preparation
NO_x	nitrogen oxides
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
O_3	ozone
OPR	California Governor’s Office of Planning and Research
OSHA	Occupational Safety and Health Administration
Pb	lead
PED	preconstruction engineering and design
PDT	project delivery team

PFC	perfluorocarbons
PG&E	Pacific Gas and Electric
PM	particulate matter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PM_{10}	particulate matter less than 10 microns in diameter
ppb	parts per billion
ppm	parts per million
PRC	Public Resources Code
Project	Corte Madera Creek Flood Risk Management Project
RCRA	Resource Conservation and Recovery Act
ROG	reactive organic gases
RVFD	Ross Valley Fire Department
RVSD	Ross Valley Sanitary District
RWQCB	Regional Water Quality Control Board
S	significant
SB	Senate Bill
SDWA	Safe Drinking Water Act
SF_6	sulfur hexafluoride
SFA	Sustainable Fisheries Act
SFBAAB	San Francisco Bay Area Air Basin
SFRWQCB	San Francisco Regional Water Quality Control Board
SIP	Supplemental Information Paper
SMN	Science, Math, Nursing
SO_2	sulfur dioxide
SPF	standard project flood
SSC	Species of Special Concern
SWPPP	Storm Water Pollution Prevention Plan
SWRCB	State Water Resource Control Board
TMDL	total maximum daily load
TSP	Tentatively Selected Plan
UCMP	University of California Museum of Paleontology
Units	flood control study units
USACE	United States Army Corps of Engineers
USC	United States Code
USEPA	U.S. Environmental Protection Agency
USGS	United States Geological Survey
WDR	Waste Discharge Requirements
WRDA	Water Resources Development Act
$\mu g/m^3$	micrograms per cubic meter

1 INTRODUCTION

The U.S. Army Corps of Engineers (USACE) is conducting a flood risk management (FRM) study for Corte Madera Creek in Marin County, California in coordination with the Marin County Flood Control and Water Conservation District (District), the local, non-federal partner. This document serves as an integrated General Reevaluation Report (GRR) and joint Environmental Impact Statement/Environmental Impact Report (EIS/EIR) for the Corte Madera Creek Flood Risk Management Project formerly known as the Corte Madera Creek Flood Control Project. In this document, the former flood control project is referred to as the CMCFCP, while the Corte Madera Creek Flood Risk Management Project, for which this integrated document was developed, is referred to as the Project.

Corte Madera Creek, in Marin County, California has flooded numerous times in the past 70 years, and certain flood events have resulted in loss of human life and significant property and infrastructure damage. In response to a 1962 authorization from Congress, the USACE and the District began work on the CMCFCP. In subsequent years, the USACE completed improvements for three flood control units (Units) associated with the CMCFCP (i.e., Units 1, 2 and 3); however, construction of Unit 4 was never completed.

The Project evaluated in this GRR and EIS/EIR involves the evaluation, design, and construction of flood control improvements to Unit 4 in Corte Madera Creek, including any modifications to Units 2 and 3 related to proposed Unit 4 improvements. In addition, all flood management strategies and/or modifications would be developed in consideration of improving fish passage for threatened and endangered fish species that migrate in Corte Madera Creek.

This chapter provides basic background information for the Project and describes the GRR's study area, background, and the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) requirements. A list of relevant reports and studies is provided for background reference.

1.1 NEPA and CEQA Requirements

Under NEPA (42 United States Code [USC] § 4321 *et seq*.) and associated regulations (40 Code of Federal Regulations [CFR] 1500-1508, USACE Engineer Regulation [ER] 200-2-2), the USACE is required to evaluate a proposed action, including feasible and reasonable alternatives, when proposing to carry out, approve, or fund a major federal action that may have a significant effect on the quality of the human environment. The USACE has determined that proposed flood control improvements to Unit 4 of Corte Madera Creek, including any modifications to Units 2 and 3 related to proposed Unit 4 improvements, would constitute a major federal action that requires compliance with NEPA.

The EIR was prepared in accordance with CEQA (California Public Resources Code [PRC] § 21000 *et seq.*), the CEQA Guidelines (California Code of Regulations [CCR], Title 14, § 15000 *et seq*.), and the Marin County Environmental Impact Review Guidelines. For projects subject to CEQA, public agencies are charged with the duty to substantially lessen or avoid significant environmental effects where feasible (PRC § 21004, CEQA Guidelines 14 CCR § 15002[a] [3] and 15021[a] [2]).

1.1.1 Lead Agencies

The USACE is the federal lead agency under NEPA. The lead federal agency is generally the agency with the larger federal control over the proposed action.

The District is the lead agency under CEQA for this Project. The lead agency is a public agency that has the principal responsibility for carrying out or approving a project under CEQA. In general, a local government agency with jurisdiction over general land uses is the preferred public agency serving as lead agency.

According to CEQA Guidelines, a lead agency under CEQA may work with a federal agency to prepare a joint document that will meet the requirements of both NEPA and CEQA. Analogous to CEQA, NEPA regulations encourage federal agencies to cooperate with local agencies “to the fullest extent possible to reduce duplication between NEPA and comparable State and local requirements,” including the preparation of a joint document, which is affirmed in 40 CFR Section 1506.2. Moreover, a joint document cannot be prepared solely by a state or local agency; the federal lead agency under NEPA must be involved in the preparation of the joint document as described in 40 CFR § 1506.2 and CEQA Guidelines (14 CCR § 15222).

The USACE, San Francisco District, as NEPA lead agency, and the District, as the CEQA lead agency, have prepared this joint project-level integrated General Reevaluation Report (GRR) and EIS/EIR to address the potential impacts of the Project and alternatives in Marin County, California.

1.1.2 NEPA and CEQA Principles and Terminology

The NEPA applies to proposals for legislation and/or other major federal actions according to Regulation 42 USC § 4332(2) (c). These federal actions include actions with a potential for environmental impacts. Such actions may include adoption and approval of official policy, formal plans, programs, and specific federal projects, as stated in regulation 40 CFR § 1508.18.

The CEQA applies to any discretionary projects proposed to be carried out or approved by public agencies including, but not limited to the issuance of conditional use permits as stated in PRC § 21080. CEQA regulation 14 CCR § 15378 broadly defines a “project” to include “the whole of an action, which has a potential for resulting in either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment.”

NEPA and CEQA use the term “significance;” however, the context for which “significance” is used is different between NEPA and CEQA. The NEPA requires that an EIS be prepared when the proposed federal action as a whole has the potential to “significantly affect the quality of the human environment.” The NEPA determination of significance is based on context and intensity. The magnitude of the impact is evaluated and described in the appropriate environmental document.

The CEQA requires the identification of each “significant effect on the environment” resulting from the action and ways to mitigate each significant effect. Each and every significant effect on the environment must be disclosed in the EIR and mitigated if feasible. In addition, the CEQA Guidelines list a number of mandatory findings of significance. The manner in which the differences between the two processes are addressed must therefore take into account that NEPA does not compel mandatory findings of significance, and that some impacts determined to be significant under CEQA may not necessarily be determined significant under NEPA.

This integrated GRR and EIS/EIR has combined the requirements of both NEPA and CEQA, as well as USACE policy.

1.2 Study Information

This section describes the GRR study background, study and Project authority, purpose and scope, and study/Project area. The GRR and EIS/EIR includes identifying alternatives and/or actions for the Project, evaluating the potential environmental impacts of such improvements, and identifying the National Economic Development (NED) plan, as explained further in Chapter 2. After identifying the NED plan, a

Tentatively Selected Plan (TSP) is identified that is either the NED plan or a Locally Preferred Plan (LPP), equivalent to the proposed Project under NEPA and CEQA. This GRR and EIS/EIR document integrates the following elements:

- Requirements of the USACE feasibility study planning process (documented in the GRR);
- An EIS prepared in compliance with NEPA; and
- An EIR prepared in compliance with CEQA.

1.2.1 Study Background

In response to numerous flood events in the Corte Madera Creek watershed, including a flood in 1942 which caused major damage to surrounding communities, Congress directed the USACE to evaluate possible solutions to flooding in the vicinity of Corte Madera Creek under Section 11 of the Flood Control Act of 1944. The USACE completed a preliminary examination report in 1946. Following another major flood event in 1951, the California Legislature created the District through the Marin County Flood Control and Water Conservation District Act of 1953, which consisted of all the territory lying within the exterior boundaries of Marin County.

Three additional flood events occurred in 1955, 1958, and 1960, with the December 1955 flood documented as the most severe event for which measurements were obtained prior to any improvements to the creek (FEMA 2009a, in USACE 2010). Following a study of the Corte Madera Creek watershed by the USACE, Congress authorized the Corte Madera Creek Flood Control Project (CMCFCP) with the Flood Control Act of 1962:

> *"The following works of improvement for the benefit of navigation and the control of destructive floodwaters and other purposes are hereby adopted and authorized to be prosecuted under the direction of the Secretary of the Army and the supervision of the Chief of Engineers in accordance with the plans in the respective reports hereinafter designated and subject to the conditions set forth therein: Provided that the necessary plans, specifications, and preliminary work may be prosecuted on any project authorized in this title with funds from appropriations hereafter made for flood control so as to be ready for rapid inaugurations of a construction program:*
>
> ***San Francisco Bay Area***
>
> *… The project for Corte Madera Creek, Marin County, California, is hereby authorized substantially in accordance with the recommendations of the Secretary of the Army and the Chief of Engineers in House Document Numbered 545, Eighty-seventh Congress, at an estimated cost of $5,534,000: Provided that local interests shall contribute in cash 3 per centum of the Federal construction of the Rose [sic] Valley Unit with a contribution presently estimated at $158,000."*

The CMCFCP was originally conceived to consist of six units with a concrete-lined channel extending approximately 6.5 miles from the San Francisco Bay upstream into Fairfax. It was designed to carry all the flow from a standard project flood (SPF) (approximately 7,500 cubic feet per second (cfs) or a 0.4 percent annual exceedance probability [AEP] event). The USACE completed Design Memorandum No. 1 for improvements to Unit 1 of Corte Madera Creek in 1966 following two additional major flood events in 1962 and 1963. In addition, Congress amended the CMCFCP under the Flood Control Act of 1966 (PL 89-789, Section 204) to reduce the local cash contribution from 3 to 1.5 percent. In 1967, the Marin County Board of Supervisors adopted Resolution 92-61, which formally requested the upper limit of the CMCFCP be set at Sir Francis Drake Boulevard Bridge. This action was followed shortly by the USACE's completion of Design Memorandum No. 2 for Units 2, 3, and 4 in 1967.

Following the completion of flood control improvements to Unit 1 (1968) and Unit 2 (1969), the area experienced another flood event in 1969. The Unit 1 and Unit 2 improvements consisted of an earthen trapezoidal channel, extending 3 miles from the San Francisco Bay to Kentfield. The upper 1,700 feet of Unit 2 were designed and constructed as a rectangular concrete-lined channel. Unit 3, which was completed in 1971, extended the concrete-lined channel 3,500 feet upstream, terminating 600 feet downstream of Lagunitas Road Bridge in the Town of Ross.

Construction of Unit 4 as a concrete-lined channel was originally scheduled to begin in 1972, but further implementation of the CMCFCP beyond Units 1, 2, and 3 was delayed by litigation. Construction was then further delayed due to environmental concerns of property owners whose residences and businesses were directly adjacent to the creek. At the request of former Congressman John Burton, the USACE, in conjunction with a citizen's advisory committee, restudied Unit 4 to develop an alternative to the concrete-lined channel that would be less damaging to the natural environment and include an extensive public participation process. This alternative consensus plan, referred to as the Royston Plan, was completed in 1977, and was evaluated in a Design Memorandum that was completed in 1980, although the balance of the authorized CMCFCP (Units 4, 5, and 6) was halted pending support from local interests and residents.

In 1982, a storm event resulted in up to 5 feet depth of out of bank water that caused considerable damage in San Anselmo, Ross, Kentfield, and Larkspur, and the third largest flood of record occurred the following year in 1983. Following another major flood event in 1986, Congress authorized the USACE under the Water Resources Development Act (WRDA) of 1986 (PL 99-862, Section 823) to proceed with CMCFCP improvements to Unit 4 (in accordance with the Royston Plan) and eliminate channel modifications upstream of Sir Francis Drake Boulevard (Unit 5 and Unit 6) from further consideration. Consistent with the adopted Marin County Resolution 92-61, WRDA 1986 states:

> *"The project for flood control on Corte Madera Creek, Marin County, California, authorized by section 201 of the Flood Control Act of 1962 is modified to authorize and direct the Secretary to construct the project for Unit 4, from the vicinity of Lagunitas Road Bridge to Sir Francis Drake Boulevard, substantially in accordance with the plan dated February 1977 on file in the office of San Francisco District Engineer. The plan is further modified to authorize and direct the Secretary to construct such flood-proofing measures as may be necessary to individual properties and other necessary structural measures in the vicinity of Lagunitas Road Bridge to insure the proper functioning of the completed portions of the authorized project. The project is further modified to eliminate any channel modifications upstream of Sir Francis Drake Boulevard."*

Following the WRDA 1986 authorization, the USACE developed a draft EIS and several Design Memorandums that addressed community concerns about floodwall heights and alignments in Unit 4. Additional public comments on the documents resulted in further modifications to the proposed flood control improvements in Unit 4, which were documented in the final supplemental environmental impact statement (FSEIS) published in November 1987. At the District's request, a supplemental information paper titled Supplemental Information Paper I (SIP I) was developed and released to the public in 1988 in response to the public comment on the FSEIS. The SIP I identified the public concerns about the completion of Unit 4, as well as concerns about channel flow capacity and the effects of sedimentation in Units 2 and 3.

Based on the public concerns raised in SIP I, the USACE Waterways Experiment Station, now known as the USACE Engineer Research and Development Center, conducted an extensive sedimentation study in 1989. It determined the flow capacity in the existing concrete-lined channel to be significantly less than the 100-year level of protection. As a result of this study, the USACE and the District developed a report titled SIP II, which discussed alternatives for restoring flow capacity in Units 2 and 3.

In 1992, the CMCFCP was reclassified from active to deferred status pending endorsement of a new consensus plan by the local sponsor. Fully acknowledging the previous studies undertaken by the USACE, the Marin County Board of Supervisors determined that the various alternatives for both correction and completion of the CMCFCP at a 100-year level of protection were environmentally unacceptable to the community. After several more years of discussion and consideration of alternatives, the District reached agreement on a project that, while providing less than a 100-year level of protection, would minimize impacts on the creek and surrounding lands. It called for a project that would provide up to 5,400 cfs flow capacity while retaining the then-historic Lagunitas Road Bridge and limiting the size of the sediment basin in Ross to the natural channel width.

On March 5, 1996, the Marin County Board of Supervisors adopted Resolution 96-26, which recognized the need to complete Unit 4, and redesign Units 2 and 3, under criteria established by the Zone Nine Advisory Board. The criteria included minimizing the use of concrete, retaining adjacent recreational facilities such as the creekside multi-use pathway, using native plants, enhancing riparian and fish spawning habitat, and maximizing the channel capacity while retaining the Lagunitas Road Bridge as is. The resolution also served as an official request that the USACE proceed with the Project at an overall lower level of design protection, which would meet the environmental concerns of the community.

Following another major flood event in 1997, the USACE approved the Project Study Plan for Corte Madera Creek and reactivated the project in 1998. In 2005, following a flood event that damaged the fish ladder and demonstrated that flow restrictions at the Lagunitas Road Bridge existed, the District initiated a reevaluation of flow restrictions and necessary FRM measures within the creek. By 2009, the USACE had initiated a GRR for the Project, and the Town of Ross undertook a separate project to replace the Lagunitas Road Bridge.

In 2010, the USACE prepared a baseline report for the Corte Madera Creek Flood Control Study, hereby incorporated by reference, to provide initial elements for a project EIS/EIR and identify initial project measures and alternatives, and to provide an inventory of existing resources in the environmental setting within the study area.

In 2013, the USACE held a SMART Planning charrette for a new GRR for the Project. SMART planning is the USACE's feasibility study process and stands for specific, measurable, attainable, risk informed, and timely planning. The charrette resulted in a re-scoping of the study to focus on completing Unit 4 and to be fully coordinated with the non-federal FRM improvements of the ongoing Ross Valley Flood Protection and Watershed Program.

In March 2015, funding for the general reevaluation study was received, and additional work was conducted, including evaluating the future without project conditions, hydrology and hydraulics modeling, developing screening criteria, formulating measures and alternative plans, and screening alternatives to a focused array of alternatives.

Table 1-1 provides a comprehensive summary of the CMCFCP and Project timeline.

TABLE 1-1 CORTE MADERA CREEK FLOOD CONTROL PROJECT TIMELINE

Year	Action/Event
1944	Congress authorized the evaluation of possible solutions to flooding along Corte Madera Creek under the Flood Control Act of 1944
1946	The USACE completed preliminary evaluation of flood risks along Corte Madera Creek.
1951	Flood Event
1953	The District formed by California State Legislature.
1955	Flood Event

TABLE 1-1 CORTE MADERA CREEK FLOOD CONTROL PROJECT TIMELINE

Year	Action/Event
1958	Flood Event
1960	Flood Event
1962	Congress authorized the design and construction of the Corte Madera Creek Flood Control Project (improvements to Units 1, 2, 3, 4, 5, and 6 of Corte Madera Creek).
	Flood Event
1963	Flood Event
1966	The USACE completed Design Memorandum No. 1 for Improvements to Corte Madera Creek between Bon Air Road and San Francisco Bay. In addition, Congress amended the CMCFCP under the Flood Control Act of 1966 to reduce local cash contribution.
1967	Marin County Board of Supervisors adopted Resolution 92-61, requesting the upper limits of the project be set at Sir Francis Drake Boulevard. In addition, the USACE completed Design Memorandum No. 2 for improvements to Corte Madera Creek between Sir Francis Drake Boulevard and Bon Air Road.
	Flood Event
1968	Completion of Unit 1 flood control improvements.
1969	Completion of Unit 2 flood control improvements.
	Flood Event
1971	Completion of Unit 3 flood control improvements.
1972	Public concern halted initiation of construction of Unit 4 flood control improvements.
1974	State Court of Appeals settlement in favor of Town of Ross to halt construction of Unit 4 as originally designed.
1977	Completion of alternative consensus plan (Royston Plan) for Unit 4 improvements.
1980	The USACE completed a Design Memorandum that evaluated the Royston Plan.
1982	Flood Event
1983	Flood Event
1984	Improvements to Units 4, 5, and 6 reclassified as inactive due to lack of public support.
1986	Congress authorized improvements to Unit 4 (per Royston Plan) and removed Units 5 and 6 from the project under Water Resources Development Act of 1986.
	Flood Event
1987	FSEIS completed for Unit 4 improvements per Royston Plan.
1988	Supplemental Information Paper I developed in response to public comment on FSEIS.
1989	Sedimentation and flow-capacity study conducted by USACE Waterways Experiment Station. In addition, Supplemental Information Paper II was developed.
1992	Unit 4 improvements reclassified as deferred.
1996	Marin County Board of Supervisors adopted Resolution 96-26, which resulted in an official request by the Board that the USACE proceed with the project at a level of design protection that would meet the environmental concerns of the community.
1997	Flood Event
1998	The USACE approved a Project Study Plan and reactivated project.
2005	Flood Event
2006	In 2006, the District created the Ross Valley Flood Control and Watershed Program in response to extensive flooding in the watershed.
2010	USACE prepared the baseline report for the Corte Madera Creek Flood Control Study.
2013	USACE held SMART Planning Charrette for a general reevaluation study
2014	Feasibility Cost Sharing Agreement signed between USACE and the District with 50% non-federal cost share
2015	Federal funds received, and study resumed

CMCFCP = Corte Madera Creek Flood Control Project
USACE = United States Army Corps of Engineers

1.2.2 Study Authority and Project Authorizations

Congress authorized the evaluation of possible solutions to flooding along Corte Madera Creek under Section 11 of the Flood Control Act of 1944. The CMCFCP was authorized by Congress in the Flood Control Act of 1962 (Public Law [PL] 87-874, Section 203), and amended by Section 204, FCA 1966, [PL 89-789], and Section 823, WRDA 1986 [PL 99-862] in response to numerous flooding events in the Corte Madera Creek watershed in Marin County, California. The CMCFCP extends from San Francisco Bay upstream to the intersection of Corte Madera Creek and Sir Francis Drake Boulevard in the Town of Ross, California. The USACE, San Francisco District and the non-federal sponsor, the District, began the project in 1962, and completed three flood control study units by 1971 (Units 1, 2, and 3).

1.2.3 Study Purpose and Scope

There is a high risk of economic flood damage, including damage to critical infrastructure, in the Town of Ross, unincorporated community of Kentfield, and other surrounding unincorporated lands. There is also risk to human life and safety in these communities and commercial areas. The Project is being formulated to reduce the risk of flooding to commercial, residential, and public infrastructure along the creek, consistent with protecting the nation’s environment, pursuant to national environmental statutes, with applicable executive orders and other federal planning requirements.

The USACE 1999 guidance for the general reevaluation study approved preparation of the GRR. The purpose of the GRR, a feasibility-level investigation, is to determine if there is a continued federal interest in providing FRM improvements along Corte Madera Creek. The scope for the GRR is to formulate effective, efficient, and environmentally acceptable plans with a focus on completing Unit 4 in accordance with the existing Project authorization.

1.2.4 Study / Project Area

The Corte Madera Creek watershed, also known as the Ross Valley watershed, is located in central eastern Marin County, California (Figure 1-1). The watershed contains 42 linear miles of stream channels, and covers approximately 28 square miles, including areas of unincorporated Marin County and the towns of Corte Madera, Ross, San Anselmo, and Fairfax. The lower ridges and valley areas of the watershed, including areas adjacent to Corte Madera Creek, are highly developed suburban residential and commercial areas.

The two major upstream branches of Corte Madera Creek are Fairfax Creek and San Anselmo Creek. Beginning at their confluence, the stream is known as San Anselmo Creek until it reaches Ross Creek, where it is renamed Corte Madera Creek. The tidal portion of the creek extends several miles upstream from San Francisco Bay to the vicinity of the Kentfield Hospital Bridge.

The general reevaluation study area consists of Units 3 and 4 and the concrete-lined portion of Unit 2, along approximately 1.4 miles of Corte Madera Creek (Figure 1-2). Corte Madera Creek drains an area of approximately 28 square miles in Marin County, California and discharges into the San Francisco Bay 9 miles north of the Golden Gate Bridge. Unit 4 of Corte Madera extends approximately 0.4 mile downstream from Sir Francis Drake Boulevard and continues approximately 600 feet downstream of the Lagunitas Road Bridge before terminating at the Denil fish ladder. Unit 3 begins at the Denil fish ladder and the upstream end of the concrete channel and continues for approximately 0.67 mile to the College Avenue Bridge. The upper 1,900 feet of Unit 3 contains 28 small concrete pools placed in the center of the stream spaced about 64 feet apart. These pools were to serve as resting pools for salmonids; however, most of the pools fail to reduce flow velocity and provide inadequate cover. The upper portion of Unit 2 consists of a concrete channel that extends approximately 0.33 mile downstream to 450 feet downstream of Stadium Avenue. The lower portion of Unit 2 is an earthen channel that then extends another 0.67 mile to the Bon Air Road Bridge, and 0.33 mile along the Tamalpais Creek tributary from its confluence. Unit 1 is an earthen channel that extends approximately 2 miles from Bon Air Bridge to the San Francisco Bay. Although Unit 1, 2, and 3 channel modifications were completed in 1971, public concerns led to a delay in the planned actions for Unit 4.

1.3 NEPA Purpose and Need / CEQA Objectives

Under NEPA, an environmental document must briefly specify the underlying purpose and need to which the lead agency is responding in proposing the action and the alternatives (40 CFR § 1502.130). Under CEQA Guidelines (14 CCR § 15124[b]), an environmental document is required to include a statement of objectives that outlines the underlying purpose of the project and that will help the lead agency to determine a reasonable range of alternatives.

The purpose of the Project is to manage flood risk from Corte Madera Creek associated with Unit 4, as currently authorized. Studies identified the abrupt transition between Units 3 and 4 created by the existing Denil fish ladder, the narrow channel condition on the east and west bank, and the Lagunitas Road Bridge as constrictions to flood flow. The Town of Ross replaced the Lagunitas Road Bridge in 2010 with a higher bridge profile of greater flow capacity, approximately 5,400 cfs. The need for the proposed actions is to reduce/remove existing water flow impediments and constrictions within Unit 4, thus providing a greater level of flood protection in the watershed. The Project would address channel modifications to Unit 4, from the upstream end of the existing Unit 3 concrete channel to Sir Francis Drake Boulevard at the border of Ross and San Anselmo, and any induced flooding downstream in Units 2 and 3 resulting from these modifications.

The Project is being formulated to reduce the risk of flooding commercial, residential, and public infrastructure along the creek. This plan formulation is consistent with protecting the nation’s environment, pursuant to national environmental statutes, with applicable executive orders and with other federal planning requirements. Recent flood events within Corte Madera Creek are primarily due to the relatively small capacity of the creek channel within Unit 4 and backwater effects created by the fish ladder located at the transition into the existing Unit 3 channel.

The CEQA objectives are:

- Reduce the likelihood and consequences of flooding on human life and safety;
- Reduce the risk of flood damages, including critical infrastructure within the area;
- Develop and implement environmentally sustainable FRM features consistent with natural geomorphic processes and ecological functions of the study area;
- Improve fish habitat conditions for salmonids;
- Use environmentally sustainable designs and construction methodologies, which would minimize environmental impacts from future operation and maintenance actions in the study area. Additional studies conducted by the USACE focused on evaluating the design performance of Units 3 and 4.
- Address the abrupt transition between Units 3 and 4 created by the existing Denil fish ladder, the narrow channel condition on the east and west bank, and the Lagunitas Road Bridge as constrictions to flood flow.
- Ensure that Project is consistent and compatible with the District’s Ross Valley Flood Protection and Watershed Program, the purpose of which is to manage flood risk in the Ross Valley watershed.

1.4 Intended Uses of this Document

The purpose of this report is two-fold: (1) to present the findings from the GRR, and (2) to fulfill the federal (NEPA) and state (CEQA) requirements for environmental review of alternative actions. This document is an integrated document, inclusive of both the GRR and NEPA/CEQA environmental review aspects of the chapters.

1.5 Document Organization

This integrated GRR/EIS/EIR is organized into the following chapter headings described below.

Chapter 2. Plan Formulation

This chapter presents the iterative planning process used by USACE and the District to formulate and select the final array of alternatives. It describes the problems, opportunities, and constraints, and screening criteria to develop alternatives that meet the Project objectives. This chapter identifies and describes the final array of alternatives and the NED plan. Per compliance with NEPA and CEQA and in accordance with federal and USACE regulations, this chapter describes the planning process that includes preliminary and intermediate measures and alternatives that were considered, including those eliminated from further analysis.

Chapter 3. Description of Alternatives

This chapter describes the final array of alternatives (five action alternatives and no action alternative) and discusses the construction and engineering aspects, as required by NEPA and CEQA. It includes avoidance and minimization measures (AMM) that would be included to protect the environment. This chapter also briefly describes the TSP, further explained in Chapter 6.

Chapter 4. Affected Environment, Environmental Consequences, and Cumulative Effects

This chapter discusses the resources considered in detail and those omitted from further evaluation. Pursuant to NEPA, impacts were addressed in proportion to their significance (40 CFR § 1502[b]). Pursuant to CEQA, impacts that are less than significant were only briefly described (14 CCR § 15128). This chapter includes a discussion of the analysis for each resource category, including: regulatory setting, affected environment and any specific methods used to identify the affected environment, environmental consequences and specific methods used to evaluate environmental consequences, significance determinations, AMMs that are part of Project alternatives, direct and indirect impacts, and mitigation measures. This section also discusses the cumulative impacts of the alternatives along with past, present, and future reasonably foreseeable projects.

Chapter 5. Other Required Analysis

The NEPA and CEQA require certain analyses that may not fall into a specific resource category. This chapter includes: energy requirements and conservation potential; irreversible and irretrievable commitment of resources; significant and unavoidable adverse environmental effects; local short-term uses and maintenance or enhancement of long-term productivity; growth-inducing impacts; and uncertain, unique, or unknown risks.

Chapter 6. Tentatively Selected Plan

This chapter explains the components of the TSP, considered the NEPA preferred alternative (40 CFR § 1502.14[e]). It describes the plans, environmental mitigation, operations and maintenance, various cost details, environmental requirements, operating procedures, commitments, and risks and uncertainty.

Chapter 7. Environmentally Superior Alternative

This chapter identifies the NEPA environmentally preferable alternative (40 CFR § 1505.2[b]) and CEQA environmentally superior alternative (14 CCR 15126.6[e] [2]).

Chapter 8. Stakeholder Coordination and Outreach

This chapter discusses public meetings, stakeholder (public and agency) coordination and outreach, and other relevant information.

Chapter 9. Regulatory Oversight and Environmental Compliance

This chapter discusses how the Project complies with various state, federal, and local environmental laws.

Chapter 10. List of Preparers

This chapter lists the preparers, which include contributing authors and reviewers.

Chapter 11. References

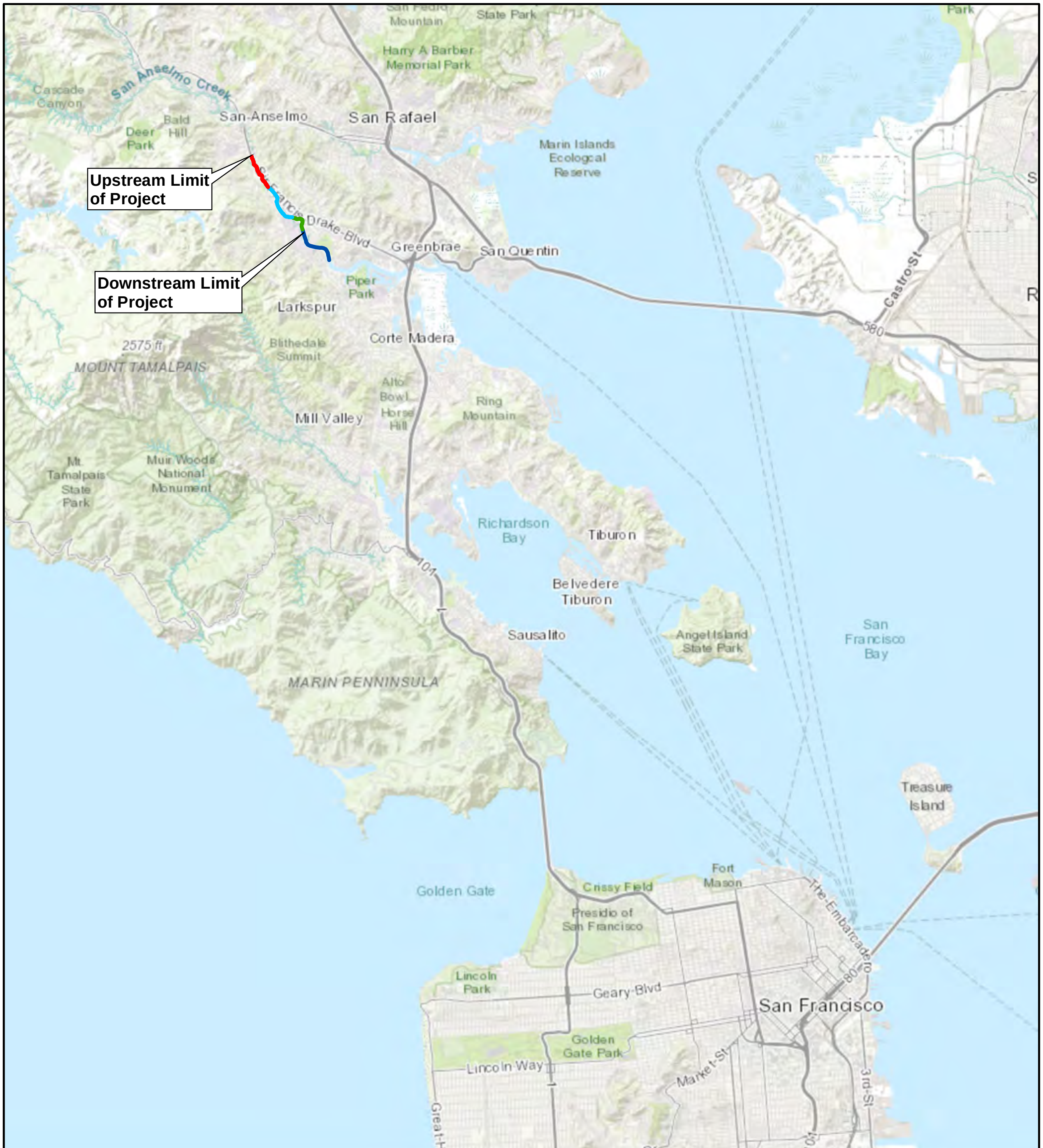
This chapter lists the references used during report preparation.

Chapter 12. Index

This chapter provides definitions for some key terms used in this document and an alphabetized list of selected words with reference to the page(s) on which each term is discussed within this integrated document.

Appendices

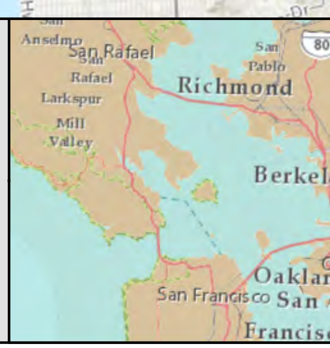
The appendices contain supporting documents as shown in the Table of Contents.



Corte Madera Creek - Flood Control Study Units

- UNIT 4 Natural Channel
- UNIT 3 Concrete-Lined Channel
- UNIT 2 Concrete-Lined Channel
- UNIT 2 Natural Channel

Miles: 0 1 2

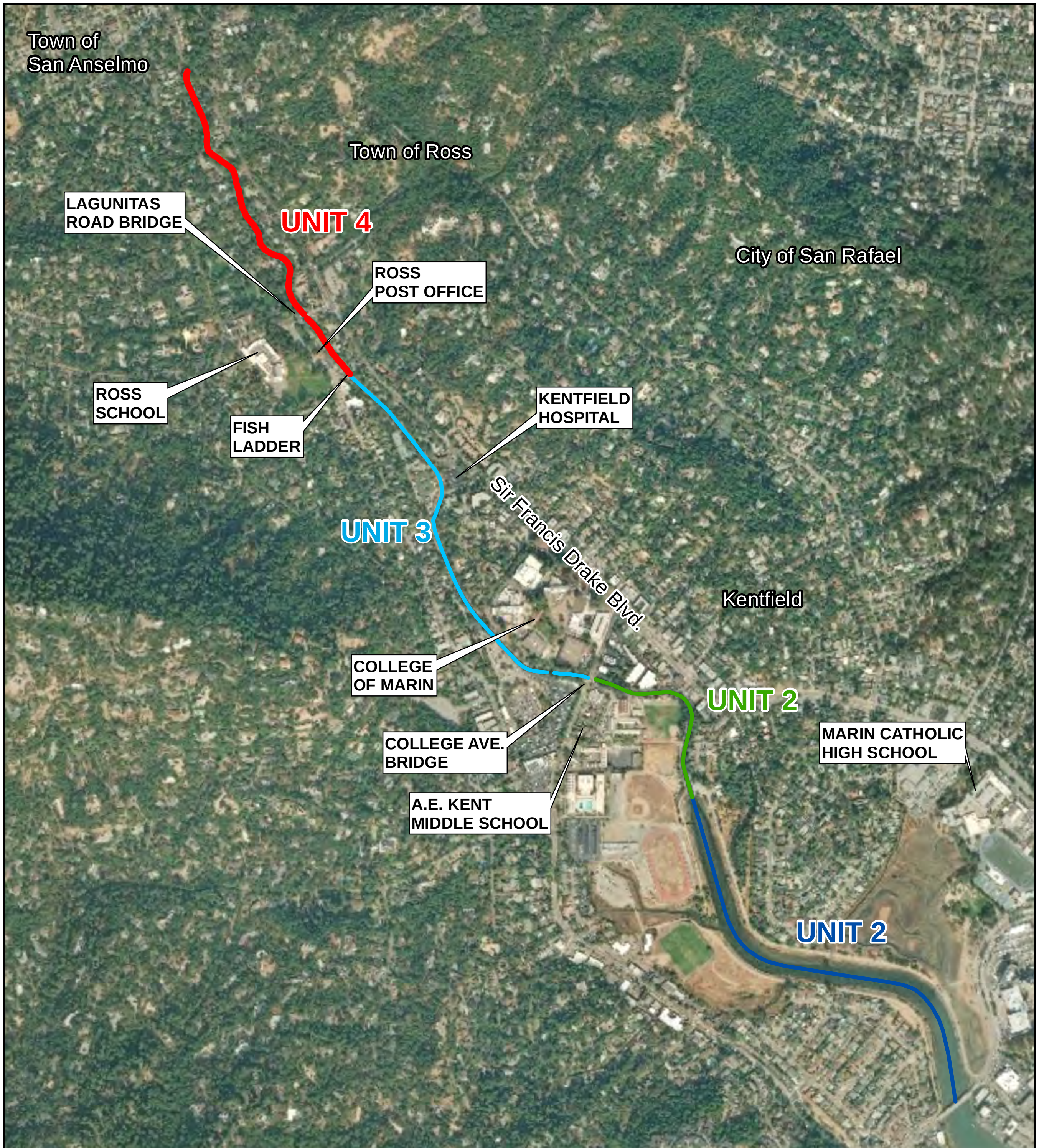


Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Figure 1-1
Regional Location Map

Date: 10/4/2018 Datum: NAD83

Burleson Consulting, Inc.



Corte Madera Creek - Flood Control Study Units

- UNIT 4 Natural Channel
- UNIT 3 Concrete-Lined Channel
- UNIT 2 Concrete-Lined Channel
- UNIT 2 Natural Channel

N

Miles
0 0.1 0.2

Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Figure 1-2 Study Area

Date: 10/4/2018 Datum: NAD83

Burleson Consulting, Inc.

2 PLAN FORMULATION

Plan formulation takes into consideration the study area's problems and opportunities; study goals, objectives and constraints; and the four Principle and Guideline criteria from United States Army Corps of Engineers (USACE) Engineering Regulation 1105-2-100; 2000 (completeness, effectiveness, efficiency, and acceptability) which guide USACE planning and evaluation for federal water resources projects. The process considers the problems and opportunities with respect to both the existing condition and the future without-project condition (no action alternative).

Before describing specific outcomes of the Corte Madera Creek Flood Risk Management Project (Project) plan formulation process, it is necessary to understand the planning terminology used by the project delivery team (PDT) as well as the general plan formulation strategy. A "management measure" (or "measure") is a feature or an activity (or collection of features and activities) that addresses one or more planning objectives. Measures are the building blocks for alternatives that address all of the planning objectives.

After the full set of measures was screened to remove those that were too costly, technically infeasible, or environmentally unacceptable, the PDT combined the remaining measures into alternatives that address the planning objectives. These alternatives make up the final array of alternatives on which the PDT performed analyses to evaluate costs, benefits, and impacts. In addition, all action alternatives were developed in consideration of improving fish passage for threatened and endangered fish species in Corte Madera Creek.

The benefit, cost, and impact analyses on the final array culminated in the identification of the National Economic Development (NED) plan, which reasonably maximize net economic benefits compared to the other alternatives and defines the level of maximum federal cost sharing. The PDT should identify the NED plan but does not need to recommend it. For example, the study partners can request that the USACE recommend a Locally Preferred Plan (LPP), which is a policy-compliant plan other than the NED. The NED plan would be the Federal plan unless an LPP is requested by the non-Federal sponsor, which will require Assistant Secretary of the Army (Civil Works) approval or a categorical exemption to the NED plan from USACE headquarters, if applicable. A categorical exemption generally applies if the LPP is of lesser scope and costs relative to the NED plan and if there are not smaller scale, less costly plans that maximize net economic benefits. The Tentatively Selected Plan (TSP) would likely be either the NED plan or LPP.

2.1 Future Without Project Conditions

The future without-project (FWOP) condition used in the USACE planning process is equivalent to the National Environmental Policy Act (NEPA) no action alternative for this study. It is the benchmark for assessing the benefits and impacts of the array of options (and, eventually, alternatives) under the USACE planning and NEPA process. The USACE FWOP condition assumes that no project would be implemented in the future. The period of analysis begins with the year that project outputs are first expected (Year 0, which is 2025 for this study) and spans 50 years (to Year 50, or 2075 for this study).

2.2 Problems and Opportunities

2.2.1 Problems

The first step in USACE's six-step planning process involves identification of problems and opportunities in the study area. Problems are defined as undesirable conditions to be changed through the implementation of an alternative plan. The identified problems and opportunities have guided the study's inventory and forecast of conditions and the development of the study planning objectives.

Problems that have been identified are included below. Unless otherwise noted, responsibility for addressing the following problems is considered to be within the mission and authorization of both the USACE and local interests.

- There is a risk to human life and safety in the Town of Ross, and surrounding unincorporated lands of Kentfield due to flooding from Corte Madera Creek.
- There is a risk of economic flood damage to urban infrastructure in the Town of Ross, and surrounding unincorporated lands of Kentfield from Corte Madera Creek.
- The existing concrete channels and fish ladder have adversely modified geomorphic processes, ecological functions, and water quality associated with these ecosystems, which is habitat for federally listed species, including the federally threatened steelhead trout and federally endangered coho salmon.

2.2.2 Opportunities

For the purpose of this planning effort, opportunities are those positive conditions that can be achieved by an alternative plan, and are discussed below.

- There is an opportunity to coordinate with the Ross Valley Watershed Flood Protection and Watershed Program, to reduce the residual flood risk throughout the watershed.
- There is an opportunity to provide environmentally sustainable FRM features commensurate with protecting aquatic habitat, riparian habitat, and water quality in the study area; including facilitating fish passage.
- There is an opportunity to minimize future operation and maintenance requirements by creating a more naturally functioning riverine system, which may also reduce environmental mitigation requirements and costs.
- There is an opportunity to update the Operations, Maintenance, Repair, Replacement, and Rehabilitation manual for the entire project, including flood control study units (Units) 1, 2, and 3.
- There is an opportunity to increase recreational opportunities in conjunction with FRM features and existing land uses.

2.3 Planning Objectives and Constraints

The federal objective of water and related land resources planning is to contribute to NED. In addition, it must be consistent with protecting the nation's environment, pursuant to national and state environmental statutes, with applicable executive orders and with other federal and state planning requirements. Contributions to the NED are increases in the net value of the national output of goods and services, expressed in monetary units. They are the direct net economic benefits that accrue in the planning area and in the rest of the nation. The national objective is a general statement and is not specific enough for direct use in plan formulation. The water and land resource problems and opportunities identified in this study are refined and stated as specific planning objectives to provide focus for the formulation of alternatives. These planning objectives reflect the problems and opportunities and represent desired positive changes to the without project condition. All objectives will be evaluated based on USACE period of analysis, which is defined as 50 years, starting at base year of project completion. The base year for the project is currently forecast to be 2025.

2.3.1 Planning Objectives

The USACE project planning objectives are statements of the study purpose. Planning objectives are more specific than the USACE national objectives and respond to problems and opportunities in the Project area. Each objective is developed to address one or more of the identified problems and opportunities; however, not all of the problems and opportunities will become planning objectives. These planning objectives guide the formulation of alternatives, and are provided below.

- To reduce the risk of flood damages, including critical infrastructure, in the Towns of Ross and unincorporated community of Kentfield.
- To reduce the likelihood and consequences of flooding on human life and safety in the Town of Ross and unincorporated community of Kentfield.

2.3.2 Planning Constraints

Unlike planning objectives that represent desired positive changes, planning constraints represent restrictions that should not be violated as a result of project implementation. Planning constraints identified in this study are provided below.

Universal Constraint

The project design, construction, and operations and maintenance must comply with applicable federal and state laws (applicable to the non-Federal partner), regulations, and policies such as the federal NEPA, Endangered Species Act (ESA), Coastal Zone Management Act, Fish and Wildlife Coordination Act (FWCA), Clean Water Act (CWA), Clean Air Act (CAA), National Historic Preservation Act, California Environmental Quality Act (CEQA), California Endangered Species Act (CESA), and Porter-Cologne Act.

Study-Specific Constraints

Corte Madera Creek is critical to the long–term sustainability of the federally threatened steelhead trout and federally endangered coho salmon. This project cannot jeopardize the continued existence of these federally listed species.

Based on the preliminary authority analysis, all project features are limited to Unit 4, including any downstream or upstream modifications required to fully implement completion of Unit 4.

2.3.3 Planning Considerations

2.3.3.1 Local Planning Goals

The Marin County Flood Control and Water Conservation District (District) has the following goals for the project:

- To develop and implement environmentally sustainable FRM features to support natural geomorphic processes, ecological functions and to protect water quality within the study area.
- To include environmentally sustainable designs and construction methodologies in the development of the FRM features, which would minimize environmental impacts and reduce financial costs from future operations and maintenance actions in the Project area.
- To reduce frequency and severity of flooding in the Ross Valley watershed.
- To work collaboratively with the Ross Valley watershed community to develop a project that balances integrated benefits and local interests in Ross and Kentfield.

2.3.3.2 Other Considerations

The following considerations were considered in the development of the alternatives. The General Reevaluation Report (GRR)/ Environmental Impact Statement/Environmental Impact Report (EIS/EIR) describes how these features may be impacted and mitigations that can lessen expected impacts.

Land Acquisition. The majority of real estate adjacent to Corte Madera Creek is developed by commercial and residential buildings leaving a minimal amount of undeveloped real estate. This real estate is likely expensive compared to other areas.

Natural Geomorphic Processes and Ecological Functions: It is important that an alternative provides decreased sedimentation, improved water quality, and incidental habitat benefits in conjunction with other FRM features.

Bridges. Several pedestrian and vehicular bridge crossings are located in Units 2, 3, and 4. Considerations of all bridge crossings were included in this study, along with possible culverts in some bridge abutments to increase flow capacity near bridge constrictions.

Trees. Resource agencies and the public have expressed concerns regarding the maintenance of existing mature trees. Natural cover for fish and habitat for other species is desired and these trees have aesthetic value to the community.

Utility Lines at Fish Ladder and Other Locations. Modification of the fish ladder would need to account for existing utilities near the transition of Units 3 and 4. Utility lines are situated near potential sites for channel widening, floodwalls/levees, and the underground bypass.

Historic Post Office. The project should avoid impacts to the historic post office adjacent to Lagunitas Road in Unit 4.

Bicycle-Pedestrian Pathway. Maintaining the existing bike path adjacent to the creek has considerable community support and it should be incorporated into this study.

Public Acceptability. The public desires a flood risk reduction project that accommodates environmentally friendly designs while minimizing structural modifications inside and adjacent to Corte Madera Creek.

2.4 Planning Strategy

The planning strategy, also referred to as the plan formulation, is the process of assembling alternative plans that meet planning objectives and avoid planning constraints. Alternative plans are a set of one or more management measures functioning together to address one or more planning objectives. A management measure is a feature or activity that can be implemented at a specific geographic site to address one or more planning objectives.

2.5 Summary of Management Measures

The PDT looked at various ways to address flooding in Unit 4, as well as any resulting induced flooding in the concrete sections of Units 2 and 3, caused by proposed measures in Unit 4. No measures were proposed in the earthen channel in Units 1 and 2. Measures include combinations of structural measures such as containing the flow within the channel and constructing a bypass channel as well as nonstructural measures such as flood proofing, raising structures, relocations, and warning and evacuation plans.

The following 6 non-structural and 14 structural measures were combined to develop alternative plans to address flood risk in the study area:

Non-Structural Measures

- Flood proof structures
- Emergency warning system
- Flood insurance
- Reduce authorized capacity
- Floodplain management
- Real estate relocation and acquisition

Structural Measures

- Widen channel at select areas where constriction exists
- Modify and armor channel in selected areas
- Deepen channel
- Remove concrete channel and recontour to natural grade
- Floodwalls along the channel banks
- Setback floodwalls in certain areas where breakout is present
- Setback levees (Units 2 and 3 only)
- Obstruction removal
- Remove fish ladder, replace with smooth transition
- Bench excavation and retaining wall setback (leave concrete retaining wall)
- Bench excavation along select areas of the channel bank with retaining wall and setback floodwall
- Raise bridges
- Sediment removal
- Bypass culverts

Measures were screened based on the set of criteria described below. The criteria were derived for the specific planning study using planning objectives, constraints, and opportunities of the study area. Expertise of the PDT members was used to determine the screening ratings. The criteria for each measure was rated using a high/medium/low metric (described below for each criteria).

Effectiveness. Effectiveness is the extent to which a measure achieves the planning objectives. Measures that clearly make little or no contribution to the planning objectives should be dropped from consideration.

- Metric 1: Flood damage reduction – whether an alternative reduces flood damages in the study area from overbank flows from Corte Madera Creek.
- Metric 2: Human life and safety – whether an alternative reduces the risk of fluvial flooding on human life and safety in Kentfield, Town of Ross, and other unincorporated areas of Marin County.

Efficiency. Efficiency of a measure is the cost effectiveness and economic optimization of the measure expressed in net economic benefits. Economic benefits realized from FRM measures and alternatives are measured in monetary units as contributions to NED. Measures that provided little benefit relative to cost should be dropped from consideration.

- Metric 1: Qualitative assessment of potential for net benefits (no actual costs were estimated, only scale of expense).

- Metric 2: Quantitative assessment of incremental economic benefits and cost (i.e., whether the project features are potentially economically justified on an incremental basis).

Acceptability. Acceptability is evaluated by the ability to implement a measure. In other words, acceptability means a measure is technically, environmentally, economically, and socially feasible. The measures developed for all of the alternative plans are generally considered satisfactory methods of addressing flooding problems. While some measures are more preferable than others to the public, all should be acceptable. Measures that are clearly not feasible should be dropped from consideration.

A full description of the measures and screening metrics, including effectiveness, efficiency, and acceptability, is provided in Appendix Q.

2.6 Summary of Initial Array of Alternatives

Initial measures were combined into an array of alternative plans utilizing the following formulation strategies: no action, authorized Royston Plan (Royston 1977, in USACE 2010), conveyance, bypass, non-structural, and various potential hybrids of these strategies. Each alternative was evaluated based on how effectively it meets the study objectives and the PDT's best professional judgment of project costs. Table 2-1 summarizes the initial array of alternatives screening effort.

TABLE 2-1 CORTE MADERA CREEK FLOOD RISK MANAGEMENT PROJECT – INITIAL ARRAY OF ALTERNATIVES

ID	Description	Retained/Dropped	Reasons for Elimination
1	No Action	Retained	
2	Top of bank floodwalls along Units 2, 3, & 4.	Dropped	Unacceptable adverse impact to ESA listed species.
3	Top of bank floodwall/setback floodwall combination along Units 2, 3, & 4.	Retained	
4	Top of bank floodwalls in Unit 4 and retaining wall/floodwall combinations in Units 2 & 3.	Retained	
5	Top of bank floodwall/setback floodwall combination in Unit 4 and retaining, top-of-bank/setback floodwall, and bike path excavation in Units 2 & 3.	Dropped	Similar to Alternative 4 which better met planning objectives.
6	Widening in Units 2-4.	Dropped	Hydraulic modeling did not reveal significant improvement, unacceptable adverse impact to ESA-listed species.
7	Combination of deepening and widening in Units 2-4.	Dropped	Similar to Alternative 6 which better met planning objectives.
8	Combination of top-of-bank/setback floodwalls and widening with flood proofing only in Unit 4 (1977 Royston Plan).	Dropped	Did not meet planning objective to reduce flood damages.
9	Modified Royston – Combination of top of bank/setback floodwalls, widening, and flood proofing in Unit 4 and measures in Units 2 and 3 to address induced flooding.	Dropped	Similar to Alternative 3 and 4 which better met planning objectives.
10	Top of bank floodwalls in Units 2-4 with an additional setback levee at the downstream end of the concrete channel in Unit 2.	Dropped	Determined to be a scaling of Alternatives 3 and 4 rather than a distinct alternative.

TABLE 2-1 CORTE MADERA CREEK FLOOD RISK MANAGEMENT PROJECT – INITIAL ARRAY OF ALTERNATIVES			
ID	**Description**	**Retained/Dropped**	**Reasons for Elimination**
11	Bypass channel in Unit 4 from upstream of Lagunitas Road Bridge down either Sylvan Lane or Sir Francis Drake Boulevard and reentering the creek at the start of the concrete channel. Combination of floodwalls, setback floodwalls, and bench excavation.	Retained	
12	Widening of the channel by removing portions of the concrete channel to create floodplains and riparian corridor in Frederick S. Allen Park (Allen Park), installing flood walls adjacent to the banks, and stabilizing creek slopes. Combination of top-of-bank/setback floodwalls and retaining walls. Allen Park would be graded to function as floodplain with overflow channels.	Retained	
13	Non-structural Alternative: elimination of the hydraulic jump at fish ladder for a smooth transition between Units 3 and 4, remove the fish ladder (passage barrier) and flood proof, raise or relocate structures in the highest risk areas.	Retained	

Following the initial alternative evaluation and screening, the initial alternatives were further refined to a focused array of alternatives. To do this, the PDT went through the following process:

Units were subdivided into separate reaches. These reaches were created because measures function independently in each reach. For instance, widening in Unit 4 downstream of Lagunitas Road Bridge would work as a system with top-of-bank floodwalls, widening, or setback floodwalls in Unit 4 above Lagunitas Road Bridge. Thus, the alternatives were refined and evaluated individually to further narrow the array of alternatives before performing the technical hydraulic and economic analyses. The use of reaches was instrumental in alternative development; however, the reaches are not used to describe the alternatives in the environmental analysis.

The following reaches were delineated and are presented in Figure 2-1:

Reach 1 = Upstream Unit 4 - Sir Francis Drake Boulevard Bridge in Town of Ross to Lagunitas Road Bridge

Reach 2 = Downstream Unit 4 - Lagunitas Road Bridge to existing Denil Fish Ladder

Reach 3 = Units 2 and 3 Concrete Channel - Fish Ladder to Downstream End of Concrete Channel

Within the focused array of alternatives, the PDT identified sub-alternatives associated with each reach. The sub-alternatives were evaluated and screened based on parametric real estate cost and a qualitative assessment of environmental impacts. The metrics used to screen the sub-alternatives included:

<u>Estimated Real Estate Costs:</u> Based on a preliminary assessment of modeled real estate costs, the PDT determined that sub-alternatives with significantly higher real estate acquisition requirements would not be as efficient as alternatives with lesser real estate acquisition requirements (all alternatives are assumed to have the same benefits and level of performance to contain a 25-year flood event or with a

4 percent annual exceedance probability). The sub-alternatives with the highest real estate costs were dropped.

Environmental Impact Metric: During coordination and outreach to the resource agencies, the PDT received input on alternatives from the San Francisco Regional Water Quality Control Board (SFRWQCB), the United States Environmental Protection Agency (USEPA), and the National Marine Fisheries Service (NMFS). Each of these agencies included comments that effectively state their opposition to any net loss of existing riparian vegetation or the further simplification of geomorphic processes in the existing natural channel in Unit 4. Because Corte Madera Creek is designated critical habitat for California Central Coast steelhead and coho salmon and essential fish habitat (EFH) for salmonids, measures that would likely cause significant adverse impacts to habitat or water quality (e.g. increased water temperatures) were not acceptable. The sub-alternatives with relatively high environmental impacts and high mitigation costs were also eliminated from further analysis.

Table 2-2 presents the remaining sub-alternatives after the initial screening process.

TABLE 2-2 SUB-ALTERNATIVES CONSIDERED FOR CORTE MADERA CREEK FLOOD RISK MANAGEMENT PROJECT

Sub-alternative	Description
1A	Top of bank floodwalls in Reach 1.
1B	Combination top-of-bank floodwalls along Sir Francis Drake Boulevard and partial setback floodwalls along Sylvan Lane in Reach 1.
1C	Combination top-of-bank floodwall along Sir Francis Drake Boulevard and full setback floodwalls along Sylvan Lane in Reach 1.
1D	Bypass tunnel/culvert from mid-Reach 1 to the top of Reach 3 at the fish ladder. The goal of this sub-alternative is for the culvert to replace the need for floodwalls in Reaches 1 and 2.
2A	Top-of-bank floodwalls in Reach 2.
3A	Top of bank floodwalls and select setback barriers around the Kentfield Middle School ball fields in Reach 3.
3B	Top of bank floodwalls, lowered bike path and select setback barriers around College of Marin parking lots in Reach 3.
3C	Concrete channel removal and creation of Allen Park Riparian Corridor in the portion of Reach 3 on Town of Ross property between the fish ladder and the Kentfield Hospital.
4	Nonstructural - Raise/flood proof structures in the study area having greatest risk of damages after removal of fish ladder and replace with smooth transition and modifications to fish resting pools to address impacts to listed species.

These sub-alternatives were combined into an array of alternatives based on the following formulation strategies:

Alternative A: Top of Bank Floodwall – Sub-alternatives 1A+2A+3A

Alternative B: Top-of-bank Floodwall/Partial Sylvan Lane Setback/College of Marin Widening – Sub-alternatives 1B+2A+3B

Alternative C: Top-of-bank Floodwall/Full Sylvan Lane Setback/College of Marin Widening – Sub-alternatives 1C+2A+3B

Alternative D: Bypass/College of Marin Widening – Sub-alternatives 1D+3B

Alternative E: 1D+1B+2A+3A

Alternative F:	Bypass/Allen Park Riparian Corridor /College of Marin Widening– Sub-alternatives 1D+3C+3B
Alternative G:	Floodwall/Allen Park Riparian Corridor/College of Marin Widening – Sub-alternatives 1A+2A+3C+3B
Alternative H:	Nonstructural Alternative – Sub-alternative 4
Alternative I:	No Action
Alternative J:	Bypass/Allen Park Riparian Corridor/Floodwall– Sub-alternatives 1D+3C

Table 2-3 summarizes the focused array of alternatives and a qualitative assessment of potential environmental impacts for each. Potential stakeholder concerns are also noted. Based on considerations listed in Table 2-3, the PDT identified the final array of alternatives, described in detail in Section 2.7, which include Alternatives A, B, F, G, I, and J.

TABLE 2-3 COMPARISON OF ALTERNATIVES FOR CORTE MADERA CREEK FLOOD RISK MANAGEMENT PROJECT							
Alt	Sub-Alternatives	Name	Features	Environmental Impacts		Key Stakeholder Issues	Screening
				Riparian	Aquatic		
A	1A+2A+3A	Top of Bank Floodwall	Reach 1: Top-of-bank floodwalls Reach 2: Top-of-bank floodwalls Reach 3: Top-of-bank floodwalls and setback floodwalls at Kentfield Middle School	Temporary impacts to entire riparian corridor and permanent vegetation free zone of 15-foot width along both sides of floodwalls on both banks (USACE ETL 1110-2-583 2014).	Temporary impacts during construction and permanent impacts where 15 feet vegetation free zone extends to Corte Madera Creek	Opposed by many private property owners and Resource Agencies	**Retained** – useful baseline for comparison to other alternatives
B	1B+2A+3B	Top of Bank Floodwall/ Partial Sylvan Lane Setback/ College of Marin Widening	Reach 1: Combination top-of-bank floodwalls along Sir Francis Drake Boulevard and partial setback floodwalls along Sylvan Lane Reach 2: Top-of-bank floodwalls Reach 3: Top-of-bank floodwalls, lowered bike path, and select setback barriers at College of Marin	Temporary impacts to entire riparian corridor and permanent vegetation free zone of 15-foot width along both sides of top-of-bank floodwalls in Reach 1	Temporary impacts during construction and permanent impacts where 15 feet vegetation free zone extends to Corte Madera Creek	Opposed by many private property owners in reach 1	**Retained** – relatively less impact on Unit 4 (natural channel) and ESA listed species and riparian vegetation

TABLE 2-3 COMPARISON OF ALTERNATIVES FOR CORTE MADERA CREEK FLOOD RISK MANAGEMENT PROJECT							
Alt	Sub-Alternatives	Name	Features	Environmental Impacts		Key Stakeholder Issues	Screening
				Riparian	Aquatic		
C	1C+2A+3B	Top-of-bank Floodwall/Full Sylvan Lane Setback/College of Marin Widening	Reach 1: Combination top-of-bank floodwalls along Sir Francis Drake Boulevard and full setback floodwalls along Sylvan Lane Reach 2: Top of bank floodwalls and select widening Reach 3: Top of bank floodwalls, lowered bike path, and select setback barriers at College of Marin	Temporary impacts to entire riparian corridor and permanent vegetation free zone of 15-foot width along top-of-bank floodwalls on left bank only in Reach 1	Temporary impacts during construction and permanent impacts where 15 feet vegetation free zone extends to Corte Madera Creek	Opposed by many private property owners	**Out** - cost prohibitive (higher real estate and mitigation cost compared to Alt. B)
D	1D+3B	Bypass/College of Marin Widening	Reaches 1 and 2: Bypass Reach 3: Top of bank floodwalls, lowered bike path, and select setback barriers at College of Marin	Temporary impacts during construction of bypass outlets.	Temporary impacts during construction and permanent impacts where 15 feet vegetation free zone extends to Corte Madera Creek	Bypass is preferred by many private property owners and Resource Agencies Temporary construction impacts to traffic on Sir Francis Drake Boulevard and vicinity	**Out** –similar to Alternative F (preferred), less effective at meeting planning objectives compared to Alt. F

TABLE 2-3 COMPARISON OF ALTERNATIVES FOR CORTE MADERA CREEK FLOOD RISK MANAGEMENT PROJECT							
Alt	Sub-Alternatives	Name	Features	Environmental Impacts		Key Stakeholder Issues	Screening
				Riparian	Aquatic		
E	1D+1B+2A +3A	Partial Sylvan Lane Setback/Bypass/ Top-of-bank Floodwall	Reaches 1 and 2: Hybrid partial Sylvan Lane setback floodwalls and Bypass (shorter walls than Alternative B) Reach 3: Top of bank floodwalls and select setback barriers	Temporary impacts to entire riparian corridor and permanent removal of 15 width along both sides of the top of bank floodwalls in Reach 1.	Temporary impacts during construction and permanent impacts where 15-foot vegetation free zone extends to Corte Madera Creek	Floodwalls opposed by many private property owners Temporary construction impacts to traffic on Sir Francis Drake Boulevard and vicinity	**Out** – cost prohibitive, less effective at meeting planning objectives compared to Alt F.
F	1D+3C+3B	Bypass/ Allen Park Riparian Corridor/College of Marin Widening	Reaches 1 and 2: Bypass Reach 3: Allen Park Riparian Corridor - removal of about 600 feet of concrete channel in Unit 3 from fish ladder to Kentfield Hospital Pedestrian Bridge with substantial widening and lowering of floodplain on Town of Ross Property. Top of bank floodwalls and select setback barriers by College of Marin.	Temporary impacts but additional riparian vegetation in the long term from Allen Park Riparian Corridor. Permanent removal at bypass outlets.	Temporary impacts during construction and permanent impacts where 15 feet vegetation free zone extends to Corte Madera Creek	Bypass is preferred by some private property owners and Resource Agencies Temporary construction impacts to traffic on Sir Francis Drake Boulevard and vicinity Allen Park Riparian Corridor preferred by Resource Agencies and Town of Ross	**Retained** – cost efficient (self-mitigating and relatively low real estate cost) and eliminates the need for floodwalls in Unit 4

TABLE 2-3 COMPARISON OF ALTERNATIVES FOR CORTE MADERA CREEK FLOOD RISK MANAGEMENT PROJECT							
Alt	Sub-Alternatives	Name	Features	Environmental Impacts		Key Stakeholder Issues	Screening
				Riparian	Aquatic		
G	1A+2A+3C +3B	Top-of-bank Floodwall/ Allen Park Riparian Corridor /College of Marin Widening	Reach 1 and 2: Top of bank floodwalls. Reach 3: Allen Park Riparian Corridor - removal of about 600 feet of concrete channel in Unit 3 from fish ladder to Kentfield Hospital Pedestrian Bridge with substantial widening and lowering of floodplain on Town of Ross Property. Top of bank floodwalls and select setback barriers by College of Marin.	Temporary impacts to entire riparian corridor and permanent removal of 15 width along both sides of the top of bank floodwalls in Reach 1 . Mitigation potentially provided by Allen Park Riparian Corridor.	Temporary impacts during construction and permanent impacts where 15 feet vegetation free zone extends to Corte Madera Creek	Floodwalls opposed by many private property owners Allen Park Riparian Corridor preferred by Resource Agencies and Town of Ross	**Retained** – PDT wanted to compare differences with Alt. F (with no floodwalls in Unit 4 due to bypass)
H	Nonstructural Alternative		Raise/flood proof structures in the study area with greatest damages after removal of fish ladder and replacement with smooth transition and modifications to fish resting pools to address impacts to listed species	Minimal	Minimal	Would leave many homes, businesses, and structures, in floodplain, likely opposed by community	**Out-** —cost prohibitive, partial protection of contents only, not effective as a standalone alternative. Nonstructural features may be included as component of other alternatives .

TABLE 2-3 COMPARISON OF ALTERNATIVES FOR CORTE MADERA CREEK FLOOD RISK MANAGEMENT PROJECT							
Alt	Sub-Alternatives	Name	Features	Environmental Impacts		Key Stakeholder Issues	Screening
				Riparian	Aquatic		
I	No Action					No flood risk benefits. Opposed by many people in community	**Retained**
J	1D+3C	Bypass/Allen Park Riparian Corridor/ Floodwall	Reaches 1 and 2: Bypass Reach 3: Allen Park Riparian Corridor - removal of about 600 feet of concrete channel in Unit 3 from fish ladder to Kentfield Hospital Pedestrian Bridge with substantial widening and lowering of floodplain on Town of Ross Property.	Temporary impacts but additional riparian vegetation in the long term from Allen Park Riparian Corridor. Permanent removal at bypass outlets.	Temporary impacts during construction and permanent impacts where 15 feet vegetation free zone extends to Corte Madera Creek	Bypass is preferred by some private property owners and Resource Agencies Temporary construction impacts to traffic on Sir Francis Drake Boulevard and vicinity Allen Park Riparian Corridor preferred by Resource Agencies and Town of Ross	**Retained**– cost efficient (self-mitigating and relatively low real estate cost) and eliminates the need for floodwalls in Unit 4

Abbreviations:
ESA = Endangered Species Act
ETL = USACE Engineer Technical Letter
USACE = United States Army Corps of Engineers

2.7 Plan Selection

As described in USACE Engineering Regulation 1105-2-100, plan selection entails identifying a single alternative plan or Tentatively Selected Plan (TSP) that will be selected for recommendation from among alternatives considered in detail. The recommended plan must be shown to be preferable to taking no action or implementing any of the other alternatives considered during the planning process. Plan selection includes identifying both the NED plan and the TSP.

2.7.1 The National Economic Development Plan

The NED plan is identified through the net benefits analysis, which estimates in monetary terms the economic benefits and costs of proposed plans, and identifies plans that maximize the differences between benefits and costs. The NED plan is the alternative plan that reasonably maximizes net economic benefits consistent with protecting the nation's environment.

The Tentatively Selected Plan

The TSP can be one of two options - either the NED plan or a LPP requested by the non-Federal sponsor. Projects may obtain an exemption from the NED plan if requested by the non-federal sponsor and approved by Assistant Secretary of the Army (Civil Works). In some instances, a non-federal sponsor may not be able to afford or otherwise support the NED plan. When the LPP is clearly of less scope and cost, there are not smaller scale plans that realize greater net benefits, and the LPP meets the Administration's policies for high-priority outputs, an exception to the NED plan is usually granted.

The net benefit analysis of the final array of alternatives is shown in Table 2-4. Of the final array of alternatives, only Alternative J yielded positive net benefits (as indicated with a benefit-to-cost ratio greater than unity). Table 2-4 provides a summary of the estimated costs and economic analysis for each of the alternatives in the final array. Supporting information is presented in Appendix F Economic Considerations, Appendix H Real Estate Cost, and Appendix J Cost Engineering.

As a final step in plan selection, an economic optimization analysis was performed to evaluate different sized (or scales) of Alternative J to determine where net economic benefits were reasonably maximized. Three different scales were evaluated based on level of flood protection– 10 percent annual exceedance probability (AEP), 4 percent AEP (included in the final array), and 2 percent AEP level design. The bypass would be designed with 1 to 3 box culverts to accommodate an array of high flows providing different levels of flood protection. The 10 percent AEP alternative would provide the least protection with only one box culvert and floodwalls, the 4 percent AEP scale would provide increased protection with two box culverts and floodwalls (same height as 10 percent AEP), and the 2 percent AEP scale would provide increased protection with three box culverts and higher floodwalls. While larger scales of Alternative J provide increased flood protection and economic benefits, they also incur greater implementation costs. As such, an optimization analysis concluded that Alternative J with a 4 percent AEP reasonably maximized net economic benefits.

Both the 10 percent AEP and 2 percent AEP plans produce fewer net benefits than the 4 percent AEP plan. Alternative J 4 percent AEP is in alignment with the District's Ross Valley Flood Protection and Watershed Program's overall flood risk reduction strategy for the Ross Valley Watershed. Thus, Alternative J 4 percent AEP plan is both the TSP and NED plan. Although the 10 percent and 2 percent AEP plans have positive benefit-to-cost ratios, indicating federal interest, they will not be evaluated in this EIS/EIR. Table 2-6 summarizes the rational for eliminating these plans from further evaluation.

TABLE 2-4 BENEFIT-COST ANALYSIS OF FINAL ARRAY OF ALTERNATIVES

Economic Factor	Alternative A	Alternative B	Alternative F	Alternative G	Alternative J
Construction Cost	$57,000,000	$59,600,000	$72,800,000	$60,800,000	$26,882,000
Real Estate	$92,393,000	$75,794,000	$22,318,000	$75,238,000	$19,232,000
Mitigation	$1,789,000	$0*	$0*	$0*	$0*
Total First Cost	$151,183,000	$135,394,000	$95,118,000	$136,038,000	$46,114,000
Construction Period	25 months	26 months	28 months	28 months	28 months
Interest During Construction (XX months construction, 2.75%)	$4,354,000	$4,058,000	$3,075,000	$4,398,000	$1,491,000
Total Investment	**$155,537,000**	**$139,452,000**	**$98,193,000**	**$140,436,000**	**$47,605,000**
Avg. Ann. Cost (2.75%, 50 yr. project life)	$5,761,000	$5,165,000	$3,637,000	$5,202,000	$1,763,000
Operations, Maintenance, Repair, Replacement, and Rehabilitation	$400,000	$400,000	$400,000	$400,000	$265,000
Total Avg. Annual Cost	$6,161,000	$5,565,000	$4,037,000	$5,602,000	$2,028,000
Equivalent Avg. Annual Benefits	$3,544,000	$3,276,000	$2,934,000	$3,220,000	$2,559.000
Benefit/Cost Ratio	0.60	0.62	0.73	0.57	1.26
Net Benefits	-$2,617,000	-$2,289,000	-$1,103,000	-$2,382,000	$531,000

* The construction of Alternatives B, F, and G include College of Marin widening. The construction of Alternatives F, G, and J include Allen Park Floodplain Riparian Corridor. College of Marin widening and Allen Park Floodplain Riparian Corridor provide both conveyance and environmental benefits (i.e. incidental environmental outputs), such that there are no additional mitigation costs (e.g. offsite real estate) to construct these alternatives.

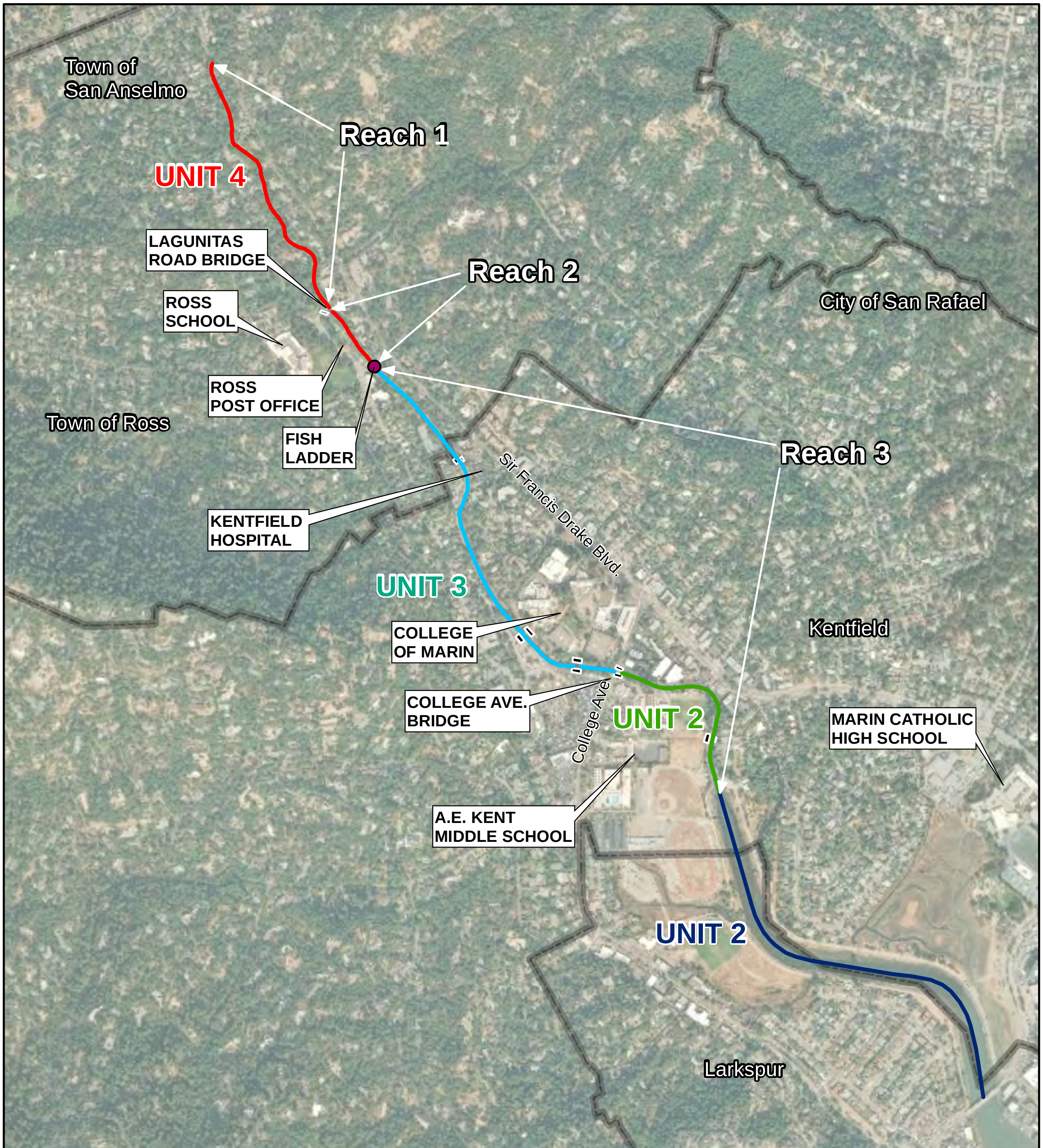
TABLE 2-5 ECONOMIC OPTIMIZATION OF ALTERNATIVE J

	Alternative J – 4,370 cfs 10% AEP (10yr)	Alternative J – 5,430 cfs 4% AEP (25yr) – NED Plan	Alternative J – 6,180 cfs 2% AEP (50yr)
Description of plan Flood Risk Management components	**Single bypass**, Allen Park Riparian Corridor floodwalls (**height same as 4% AEP**)	**Double bypass**, Allen Park Riparian Corridor and floodwalls	**Triple bypass**, Allen Park Riparian Corridor and floodwalls (**height 1.5 feet higher than 4% AEP**)
Construction*	$19,485,000	$26,882,000	$36,474,000
Real Estate	$18,159,000	$19,232,000	$20,305,000
Total Costs	$37,271,000	$46,114,000	$56,779,000
Construction Period	28 months	28 months	32 months
Interest During Construction (28 months construction, 2.75%)	$1,205,000	$1,491,000	$2,072,000
Total Investment	$38,476,000	$47,605,000	$58,851,000
Average Annual Cost (2.75%, 50-yr project)	$1,425,000	$1,763,000	$2,179,000
Operation and Maintenance	$250,000	$265,000	$400,000
Total Average Annual Cost	$1,675,000	$2,028,000	$2,579,000
Equiv. Average Annual Benefits	$1,867,000	$2,559,000	$3,045,000
Benefit/Cost Ratio	1.11	1.26	1.18
Net Benefits	$192,000	$531,000	$466,000

*Includes Construction Management and Preconstruction Engineering and Design (PED) costs
AEP = annual exceedance probability
cfs = cubic feet per second

TABLE 2-6 REASONS FOR ELIMINATION FOR ALTERNATIVE J 10 PERCENT AND 2 PERCENT AEP

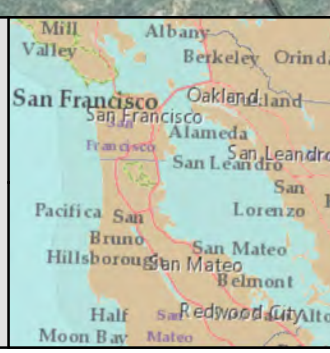
Name	Features	Screening
Alternative J 10% AEP	Single bypass, Allen Park Riparian Corridor floodwalls (heights same as 4% AEP)	OUT – High residual risk, lacks support from National Flood Service as a meaningful FRM solution, does not meet planning objective (high residual flood risk), lowest net benefits compared to the 4% and 2% AEP plans.
Alternative J 2% AEP	Triple bypass, Allen Park Riparian Corridor and floodwalls (height 1.5 feet higher than 4% AEP)	OUT – Traffic impacts to Sir Francis Drake Boulevard which cannot be mitigated, potential disruption to emergency service (multiple fire and police stations) which rely on SFD during emergency response. Limiting construction of triple bypass within current footprint of Sir Francis Drake Boulevard is questionable, floodwall heights ranging in height from 3.5-7.5 feet have potential aesthetic impacts. Provided less net economic benefits than Alternative J 4% AEP.



Corte Madera Creek - Flood Control Units

- UNIT 4 Natural Channel
- UNIT 3 Concrete-Lined Channel
- UNIT 2 Concrete-Lined Channel
- UNIT 2 Natural Channel
- County Boundary

0 0.1 0.2 Miles



Corte Madera Creek Flood Risk Management Project

Marin County, CA

Figure 2-1
Reach Delineation

Date: 10/4/2018 Datum: NAD83

Burleson Consulting, Inc.

3 DESCRIPTION OF ALTERNATIVES

3.1 Introduction

The United States Army Corps of Engineers (USACE) has developed, in conjunction with the Marin County Flood Control and Water Conservation District (District), five action alternatives, and a no action alternative. Other than the no action alternative, all alternatives are intended to improve current channel capacity to convey flood flows through flood control study units (Units) 2, 3, and 4. In addition, all action alternatives were developed in consideration of improving fish passage for threatened and endangered fish species in Corte Madera Creek. Figures 3-1a through 3-5a present overviews of Alternatives A, B, F, G and J. Close up plans with associated cross sections are included in each action alternative description in Sections 3.3, 3.4, 3.5, 3.6, and 3.7.

As noted previously, the Project alternatives were assembled by evaluating improvements for three units totaling 7,490 linear feet or about 1.4 miles (Figures 3-1a – 3-5a). Locations along Corte Madera Creek are identified by "stations" for modeling and design purposes. The project stationing is consistent with the original project stationing used during construction of Units 1 through 3. One station (1+00) indicates 100 feet; for example, Station 375+85 refers to a location, 37,585 feet upstream from the starting station that is an arbitrary point in San Francisco Bay. The Corte Madera Creek Flood Risk Management Project (Project) study area as defined in the Baseline Report, extends upstream to the Sir Francis Drake Bridge in Town of Ross. The upstream extent of alternative actions is at the confluence of Corte Madera and Ross creeks. Stations associated with each unit are summarized below.

- Unit 4 (Station 400+00 to 369+70; 3,030 feet): Upstream project limit to the downstream end of Denil fish ladder
- Unit 3 (Station 369+70 to 335+00; 3,470 feet): Fish ladder to College Avenue
- Unit 2 (Station 335+00 to 318+10; 1,690 feet): College Avenue to the end of concrete channel

The project alternatives are based on a preliminary level of design (Appendix I), which the project delivery team (PDT) used to complete hydraulic models (HEC-RAS) to estimate floodwall heights. Further refinements to design elements, (e.g. floodwall heights and footprints), may change during preconstruction engineering and design (PED) for the selected alternative. Alternatives would also be subject to refinement taking into account public and agency comments received on the draft EIS/EIR.

3.2 No-Action Alternative (Future Without Project Condition)

The NEPA no action alternative and CEQA no project alternative include the same assumptions, and are therefore evaluated together for each resource area as the no action alternative. The no action alternative is the NEPA benchmark for assessing environmental effects, including the cumulative impacts, of the proposed Project. The No Action/No Project Alternative represents the expected future condition if none of the action alternatives are approved and there is no change from the current channel configuration. However, CEQA Guidelines 14 CCR §15126.6 (e)(1) state that "The 'no project' alternative analysis is not the baseline for determining whether the proposed Project's environmental impacts may be significant, unless it is identical to the existing environmental setting analysis which does establish the baseline." Currently, the existing environmental setting is the same as the no action alternative, whereas the projected end of the useful life of the Project (year 2075) is considered to be the future without project condition. The primary change is the expected sea level rise from climate change. The no project alternative, then, describes the circumstances that would occur if the project does not proceed (CEQA Guidelines 14 CCR §15126.6 [e] [3] [B]) and, like the no action alternative, assumes the continuation of existing plans, policies, and operations into the future. Additionally, impacts are analyzed "projecting what would reasonably be expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services" (CEQA Guidelines 14 CCR §15126.6 [e][3][C]).

For the no action alternative, the current conditions with no flood control improvements would be retained at Units 2, 3, and 4, and flood capacity would remain unchanged. The capacity ranges from 3,300 cubic feet per second (cfs) in Unit 4 to greater than 6,900 cfs in Unit 1 (USACE, 2010). Table 3-1 presents the flow capacity for various units of the Project. Under these existing conditions, flood flows in excess of these capacities would continue to pass outside the channel onto a developed residential/urban floodplain. The Denil fish ladder, currently a hindrance to fish passage, would not be removed and fish passage would not be improved through Corte Madera Creek. Over time, the fish ladder would likely continue to degrade. Moreover, the transition point between the natural Unit 4 and concrete lined Unit 3 stream reaches would remain a pinch point (constricted section) or a flood flow breakout zone.

TABLE 3-1 FLOW CAPACITY

Unit	Flow Capacity (cfs)
4	3,300
3	3,400
2 Upper	4,000
2 Lower	>4,900
1	>6,900

3.3 Common Features to All Action Alternatives

Common features to all alternatives are described below. Features are identified as located on the right or left bank of the creek, facing downstream. The right bank refers to the west or south side of the channel and the left bank refers to the east or north side of the channel.

3.3.1 Fish Ladder Removal and New Transition

The Denil fish ladder, from Station 370+00 to 369+70 in Unit 4 downstream from the Lagunitas Road Bridge, would be removed and replaced with a smooth transition for every action alternative. The Denil fish ladder was intended to be a temporary structure at the upstream end of the Corte Madera Creek Flood Control Project (CMCFCP) in Unit 3 until it could be extended into Unit 4; however, a lawsuit prevented the construction of the CMCFCP in Unit 4. The Denil fish ladder has been identified as an impediment to fish passage and would be replaced with a combination of natural bed material and biotechnical bank stabilization or stone protection treatments to eliminate the hydraulic jump and create a smooth transition that would also improve fish passage.

As a result of removing the fish ladder, channel modifications would be necessary to accommodate the change in flow dynamics. This would also create the need to modify and lower the channel floor elevations to allow for a smooth transition and geomorphological sustainable channel bed. The channel bed modification would extend from the fish ladder to approximately 110 feet upstream of Lagunitas Road Bridge. A portion of the natural channel in Unit 4, extending a length of approximately 115 feet, within the reach between Lagunitas Road Bridge and the fish ladder, would be widened to increase hydraulic conveyance capacity. The concrete streambed downstream of the existing fish ladder (starting at its upstream limit at the beginning of Unit 3) would be demolished and removed for approximately

750 feet. The channel would be regraded with native material and designed to meet fish passage criteria during PED, in consultation with NMFS. Additional improvements include lowering of the right bank of the new creek channel in Allen Park to restore a historic floodplain and to increase flow capacity. At the downstream end of Allen Park, Corte Madera Creek would enter a new smooth transition to guide flow into the remaining existing concrete channel upstream of the Kentfield Hospital.

3.3.2 Floodwall Construction

For those portions of the action alternatives that include floodwall, the majority of the floodwall structure would be constructed using reinforced concrete. Floodwall thickness would be expected to vary from 12 to 24 inches, depending on the floodwall height, location, geotechnical data, and other design parameters and requirements that would be determined during the detailed project design phase. Any floodwalls that interfere with runoff or subsurface flow into the creek would be identified and accommodation would be made depending on the size, type, and depth of the drainage structure without impacting the intended operational purpose and integrity of both the floodwall and the drainage structure. Features such as pump stations and flap gates to convey flow, including to convey any flow changes from proposed alternatives, behind the walls both during normal operation and in flood events, would be defined during PED. Because detailed information about these features, including their location, number, and design, has not yet been developed, the analysis of environmental consequences of the action alternatives in Chapter 4 of this document examines the effects of constructing and operating these features only at a general level. When additional details of these features are developed, the District and the USACE will determine whether this document adequately analyzes their potential environmental effects, and whether supplemental environmental review pursuant to CEQA and NEPA is required.

All floodwalls and retaining walls would meet requirements of USACE Engineer Technical Letter (ETL) 1110-2-583 (USACE 2014) that requires a minimum of 15 feet vegetation-free zone along each face of the structure. Grass is allowed within this vegetation-free zone and variances can be obtained if the maximum area within the existing real estate interest is less than 15 feet. The riparian habitat impact analysis is conservative and addresses the loss to riparian habitat assuming a 15-foot buffer without a variance. ETL 1110-2-583 provides USACE design policy for vegetation near levees, dams, and floodwalls. Vegetation policy guidance letters (October 2017) indicate that vegetation variances may be granted in cases where the flood safety risks of the vegetation do not outweigh the benefits of allowing non-policy compliant vegetation. A risk analysis will be performed for Corte Madera Creek prior to PED and results of those findings will be included in the final design to assess compliance with ETL 1110-2-583. This will determine to what extent riparian vegetation could be restored at Frederick Allen Park Riparian Corridor within 15 feet of floodwalls.

The floodwalls would be designed to contain the water surface elevation of the 4 percent annual exceedance probability (AEP), plus an additional height for resiliency, to reduce and manage residual life safety risks associated with capacity exceedance (or unacceptable performance) against catastrophic economic and/or life loss scenarios. For the current phase, the floodwalls were designed using an estimated additional 3 feet for resiliency. The actual additional height would be determined in the PED using risk and uncertainty analysis and could be greater or less than the estimated height. Risk and uncertainty analysis has not been completed for the action alternatives.

Prior to the agency decision milestone, the selected plan will have risk and uncertainty performed for the selected plan and its optimized variations. Risk and uncertainty will eventually determine the National Economic Development (NED) plan and the additional height required. Closure structures would be needed where floodwalls connect to bridge crossings and cross roadways or bike paths. If the elevation of the roadway is higher than the top of the floodwall design, the floodwall would connect into the roadway abutment without a closure structure because the roadway would function as a closure structure with a continuous line of protection. Floodwalls in Unit 4 above the Lagunitas Road Bridge would require an access road for maintenance and flood fighting. The maintenance road would allow small vehicles to monitor the creek behind homes through Sylvan Lane properties. The access road location would be determined during PED.

3.3.3 Non-structural Components

All alternatives may also include flood warning systems, floodproofing measures, and floodplain management (risk communication, emergency action plan, training, flood preparedness, evacuation routes, and response).

3.4 Alternative A: Top-of-bank Floodwall

Alternative A would construct top-of-bank floodwalls along the length of Unit 4 (Figures 3-1a to 3-1f). Top-of-bank floodwalls would be constructed along Units 2 and 3 with setback floodwalls (floodwalls located away from channel) at the downstream end of Unit 2 near Kent Middle School. These floodwalls would tie into high ground so that floodwaters would not outflank and flow behind the walls. This alternative would require full purchase of 30 parcels. Purchase of residential parcels would require relocation of residents and the land would be purchased at fair market value. Permanent easements would total 13.62 acres and temporary easements would affect 3.14 acres. Permanent easements may be required for operations and maintenance roads, flowage (to flood or submerge), utility, and channel improvement, and temporary easements would be for access or staging. Real estate costs (purchases and easements) were estimated to be $92,393,000. The need for real estate purchase results from the location of floodwalls on property and the requirement for clearance around floodwalls.

3.4.1 Unit 4 Top-of-bank Floodwall

Alternative A would involve construction of top-of-bank floodwalls on both sides of the channel from Station 392+00 downstream to Lagunitas Road Bridge (as shown in Figures 3-1b and 3-1c). Floodwalls along the top of banks would vary in height with the maximum height at about 9 feet above ground surface.

3.4.2 Units 3 and 2 Downstream from the Fish Ladder

Alternative A would involve construction of top-of-bank floodwalls on both sides of the concrete channel downstream of the Denil fish ladder except along the right bank of Unit 2 around the Kent Middle School Ball Fields (Figures 3-1c to 3-1f). Top-of-bank floodwalls would be constructed adjacent to both sides of the concrete channel to a maximum height of 11 feet from the former fish ladder to Kent Middle School (between Stations 369+70 and 330+73). At Kent Middle School, setback floodwalls would be constructed around the athletic fields on the right bank, where real estate is available, and top-of-bank floodwalls would be constructed on the left bank between Stations 330+73 and 318+75. The maximum height of setback and top-of-bank floodwalls near Kent Middle School would be about 7 feet above ground surface.

College Avenue Bridge Culverts

Alternative A would increase the channel capacity in Units 2 and 3 that would require more capacity under College Avenue Bridge. As a means to resolve this flow capacity limitation, three underground bypass culverts are proposed adjacent to the College Avenue Bridge for Alternatives A, B, F, and G. The reinforced concrete box culverts would be constructed from 10-foot x 10-foot reinforced concrete material. Flow capacity under College Ave bridge combined with the culverts would increase for Alternatives A, B, F, and G. College Ave with the culverts in place reaches conveyance capacity at approximately a 1 percent ACE flood. To accommodate culverts, both banks would require some type of grading and benching or trenching.

3.5 Alternative B: Top-of-bank Floodwall/Setback Floodwall/College of Marin Widening

Alternative B would utilize a combination of top-of-bank and setback floodwalls (Figures 3-2a to 3-2f). For College of Marin Widening, 2,740 feet of concrete channel would be removed in portions of Unit 3 (around the College of Marin) and Unit 2 (around Kent Middle School) and replaced with features that replicate a natural tidal creek. This alternative would require purchase of 18 parcels. Permanent easements would total 13.54 acres and temporary easements would affect 3.07 acres. Real estate costs were estimated to be $75,794,000.

3.5.1 Unit 4 Top-of-bank and Setback Floodwall

Alternative B would construct a combination of top-of-bank and setback floodwalls upstream of Lagunitas Road Bridge. Setback floodwalls would be constructed on the west side of Sylvan Lane across the street from the front side of five homes, on higher ground from 16 Sylvan Lane to 8 Sylvan Lane (Station 389+17 to 382+97). The setback wall would then transition across Sylvan Lane back to Corte Madera Creek placing the entire parcels in a regulatory flood zone. The transition across Sylvan Lane would be in the form of a closure structure that would only be activated when a heavy storm event is anticipated. Residents would be notified beforehand and closure would only be anticipated for short periods. At the right bank of the channel, the setback wall would transition to top-of-bank floodwall which would continue to Lagunitas Road Bridge. A second setback floodwall would be constructed on the right bank at Station 389+17 to Sir Francis Drake Boulevard. Top-of-bank floodwalls would be constructed on the left bank from Station 389+17 downstream to Lagunitas Road Bridge (as shown in Figure 3-2b). Setback and top-of-bank floodwalls would be as tall as 7 feet above ground surface.

3.5.2 Units 3 and 2 Downstream from the Fish Ladder

Alternative B would increase the channel capacity through a combination of channel widening bounded by retaining walls, top-of-bank floodwalls, and setback floodwalls. Bench excavation would be conducted downstream of the fish ladder and College of Marin Widening would occur further downstream. Descriptions follow.

Bench Excavation

From the upstream end of Unit 3 at Station 369+70 to Station 349+00 (Figures 3-2c and 3-2d) the right bank of the channel would be widened up to 20 feet and excavated as low as 5 feet below the existing top-of-bank elevation. The existing bicycle-pedestrian path would be lowered as a result of the bench excavation. Where modifications to the bicycle-pedestrian path occur, the path would be designed with ADA standards. A closure structure would be constructed for use during high flows. The extent of widening would be dependent on availability of real estate. Top-of-bank floodwalls with a maximum height of 5 feet from existing top of grade elevation would be constructed on the left bank of the creek between the Denil fish ladder and Station 349+00 and on the right bank from Station 354+90 to 349+00. Retaining walls would line the right bench excavation slope between the fish ladder and Station 354+90 at top-of-bank ground surface.

College of Marin Widening

Further downstream from Station 349+00 to 318+10, Alternative B would result in multiple modifications along the creek in close proximity to College of Marin and Kent Middle School (upstream and downstream from College Avenue). All or part of the left bank channel wall would be retained (in part to avoid impacts to Ross Valley Sanitary District's (RVSD) sewer line bordering the left side of the channel) but would be benched near College Avenue to accommodate the bypass culverts. From Station 345+50 to 318+10, 2,740 feet of concrete channel floor and some right bank wall would be removed and the channel restored with low floodplain-tidal benches and slopes stabilized with native vegetation.

Top-of-bank floodwalls would be constructed along the right bank from Station 349+00 to 345+55 with a maximum height of 4 feet. A combination of top-of-bank floodwalls and retaining walls would be constructed along the right bank from Station 345+55 to 318+10 with a maximum height of 6 feet. Setback floodwalls would be constructed along the left bank from Station 349+00 to 335+40 with a maximum height of 4 feet. Top-of-bank floodwalls and retaining walls would be constructed along the left bank from Station 336+00 to 318+10 with a maximum height of 4 feet. Retaining walls would be constructed near the College of Marin Parking Lot on the west bank of the College of Marin Science, Math, and Nursing (SMN) Bridge and along both sides of the channel near the College Avenue Bridge where the bank would be benched to accommodate the three 10-foot by 10-foot bypass culverts common to all alternatives.

College Avenue Bridge Culverts

Alternative B would include the College Avenue culverts, identical to Alternative A.

Alternative B would also include replacement and improvement of bicycle-pedestrian pathways from the fish ladder to the project end. Addition of flood closures or relocation of the pathway to higher on the bank or to the other bank would be considered during PED.

3.6 Alternative F: Bypass/Allen Park Riparian Corridor/College of Marin Widening

Alternative F would utilize a combination of top-of-bank and setback floodwalls, an underground bypass, Allen Park Riparian Corridor, and College of Marin Widening (Figures 3-3a to 3-3f). Alternative F would include an underground bypass culvert along Sir Francis Drake Boulevard to convey flow from the upstream portion of Unit 4 downstream to the Allen Park Riparian Corridor downstream from the Denil fish ladder. The underground bypass would alleviate the need to construct any floodwalls in Unit 4. Downstream of the Allen Park Riparian Corridor, the channel would be identical to Alternative B, including removal of 2,740 feet of concrete channel to restore natural features between Stations 345 +50 and 318+10, construction of floodwalls, and construction of box culverts at College Avenue Bridge. Alternative F would also include replacement and improvement of the bicycle-pedestrian path along Units 3 and 2. This alternative would not require purchase of any parcels. Permanent easements would total 12.18 acres and temporary easements would affect 3.17 acres. Real estate costs were estimated to be $22,318,000.

3.6.1 Unit 4 Bypass

Alternative F would leave the natural channel as it exists all the way to the upstream portion of Unit 3. Instead of floodwalls, an underground bypass would be constructed in the form of two parallel culverts, each 12 feet wide by 7 feet high with a length of approximately 2,200 feet. Three smaller box culverts may be substituted to address traffic and construction concerns. The bypass would begin on the left bank at Station 390+30 and the majority of the proposed alignment would run under Sir Francis Drake Boulevard (Figure 3-3b). The bypass would exit and re-enter the creek at properties on Sir Francis Drake Boulevard that are owned by the District. The inflow and outflow parcels are owned by the District. The downstream termination point of the underground bypass would connect with the Allen Park Riparian Corridor near Station 368+00. Activities would include trenching portions of Sir Francis Drake Boulevard up to 20 feet deep by 30 feet wide for installation of the prefabricated box culverts. The full trench excavation may not be open for the full 30-foot width at one time. Construction of the bypass would require relocation of underground utilities that exist underneath Sir Francis Drake Boulevard. These utilities would be realigned in trenches along one or both sides of Sir Francis Drake Boulevard outside of the box culverts. The excavation schedule would be established during PED. Although site preparation work would still be necessary, Alternative F would require minimal riparian vegetation removal because the majority of work would occur along an existing roadway.

3.6.2 Units 3 and 2 Downstream from the Fish Ladder

Alternative F would be similar to Alternative B in this section, with the addition of Allen Park Riparian corridor that would further enhance naturalistic features.

Allen Park Riparian Corridor

Alternative F would include the Allen Park Riparian Corridor, constructed at Frederick P. Allen Park, that would extend approximately 900 feet and encompass approximately 2 acres from the upstream end of the Denil fish ladder to Station 361+40 (Figure 3-3c). The riparian corridor would include a widened, native substrate channel that allows higher flows to spread over a larger area and include floodwalls (top-of-bank or setback) on both banks to a maximum height of 4 feet (Figure 3-3c). At the upstream end of the left bank, the channel could not be widened due to limited space. The floodwall at this location would be constructed at the left limit of the existing concrete channel. An existing sanitary sewer trunk line that runs parallel to the creek could require relocation. Allen Park Riparian Corridor is designed so that the widened restored channel is gradually narrowed to smoothly transition to the existing 33-foot wide concrete channel at the downstream end for hydraulic efficiency and minimizing upstream water surface elevations.

Construction of Allen Park Corridor could require relocation of the sewer line that crosses underneath the fish ladder and extends along the left bank of Corte Madera Creek on the landward side of the concrete wall. The pipe was likely built concurrently with the flood control channel. If realignment is necessary, the new line would be constructed before the current line is demolished. A temporary bypass line could be required during part of the construction. The length of demolished line would be approximately 1,115 feet and the added line would be approximately 1,031 feet. The new line would include a new inverted syphon beneath the creek that connects with the line from Sir Francis Drake Boulevard and a second inverted syphon to re-connect with the existing trunk line downstream near College of Marin. The current line is within an existing right-of-way and the new location would be located on public property.

Bench Excavation

Between the Allen Park Riparian Corridor and College of Marin Widening, from Station 361+40 to 349+00, the channel would be identical to Alternative B, including channel widening and floodwalls. The only difference would be a maximum floodwall height of 6 feet for Alternative F rather than 5 feet for Alternative B. Channel widening would include bench excavation, where the channel would be widened up to 20 feet as real estate is available and as much as 5 feet below the existing top of channel bank. Tree removal would be required where the floodwall would be constructed.

College of Marin Widening

Near the College of Marin to the end of the concrete-lined channel, from Station 349+00 to 318+10, Alternative F would be identical to Alternative B and would include naturalistic features along the creek in close proximity to College of Marin and Kent Middle School (upstream and downstream from College Avenue).

College Avenue Bridge Culverts

Alternative F would include the College Avenue culverts, identical to Alternative A.

Alternative F would also include replacement and improvement of bicycle-pedestrian pathways in the Allen Park Riparian Corridor and College of Marin and Kent Middle School areas. Detailed proposed changes would be prepared by the District during PED.

3.7 Alternative G: Top-of-bank Floodwall/ Allen Park Riparian Corridor/ College of Marin Widening

Alternative G would utilize a combination of floodwalls, Allen Park Riparian Corridor, and College of Marin Widening (Figures 3-4a to 3-5f). This alternative is identical to Alternative F downstream of the fish ladder, but would construct floodwalls instead of bypass culverts for Unit 4. Top-of-bank floodwalls would be constructed in Unit 4 similar to Alternative A. In Units 2 and 3, construction would be identical to Alternative F. Alternative G would also include replacement and improvement of the bicycle-pedestrian path along Units 3 and 2. This alternative would result in purchase of 18 parcels. Permanent easements would total 14.44 acres and temporary easements would affect 2.98 acres. Real estate costs were estimated to be $75,238,000.

3.7.1 Unit 4

Alternative G would implement identical measures to the right bank of Alternative A and the left bank of Alternative B in Unit 4; however, Alternative G floodwalls would only require a maximum height of 6 feet upstream of Lagunitas Road Bridge and 5 feet downstream of the bridge to provide protection of design flows, as compared to 9 feet and 7 feet in Alternatives A and B, respectively. Project activities would include general grade changes, tree removal, clearing and grubbing, and other site preparation work as needed throughout.

3.7.2 Units 3 and 2 Downstream from the Fish Ladder

Alternative G would be identical to Alternative F downstream from the fish ladder.

Alternative G would also include replacement and improvement of bicycle-pedestrian pathways in the Allen Park Riparian Corridor and College of Marin and Kent Middle School areas. Detailed proposed changes would be prepared by the District.

3.8 Alternative J: Bypass/Allen Park Riparian Corridor/Floodwall (Agency Preferred Plan)

Alternative J would utilize a combination of an underground bypass, Allen Park Riparian Corridor, and floodwalls (Figures 3-5a to 3-5f). Alternative J would be identical to Alternative F in Unit 4 and include an underground bypass culvert along Sir Francis Drake Boulevard to convey flow from the upstream portion of Unit 4 downstream to the Allen Park Riparian Corridor. Maximum floodwall height around Allen Park

Corridor would be 2 feet. Like Alternative F, the underground bypass would alleviate the need to construct any floodwalls in Unit 4. Alternative J would provide flood protection for a 4 percent AEP flood event within and upstream of the Allen Park Riparian Corridor, but does not afford this level of protection downstream of the Allen Park Riparian Corridor. Downstream of the Allen Park Riparian Corridor, floodwalls would be constructed on the left bank near the Granton Park neighborhood and adjacent to College Avenue. No floodwalls would be constructed on the right bank. The box culverts at College Avenue were not included in this alternative. The flood reduction benefit of the College Avenue box culverts would not be sufficient to cover the cost of construction. Therefore, the underground culverts adjacent to the bridge were not included in Alternative J. Overflow on the right bank would occur in the event of a 4 percent AEP because floodwall would only be constructed on the left bank. This alternative would not require purchase of any parcels. Permanent easements would total 3.44 acres and temporary easements would affect 3.87 acres. Real estate costs were estimated to be $19,232,000.

3.8.1 Unit 4 Bypass

Alternative J would be identical to Alternative F in Unit 4.

3.8.2 Units 3 and 2 Downstream from the Fish Ladder

Alternative J would include Allen Park Riparian Corridor, similar to Alternative F. Downstream of the Allen Park Riparian Corridor, floodwalls would be constructed near the Granton Park neighborhood and College Avenue. The right bank of the creek is higher than the left bank and is not prone to flooding. Therefore, floodwalls would not be necessary on the right bank downstream of Allen Park.

The College Avenue culverts would not be included in Alternative J. In the other action alternatives, the culverts would reduce the water surface elevation and increase conveyance at College Avenue to reduce the height of the floodwalls needed in Units 2 and 3. However, unlike the other action alternatives, Alternative J does not include floodwalls along both channel banks in Units 2 and 3 that provide resiliency of 3 feet. In Alternative J, the channel overtops along the right bank upstream from College Avenue for the design 4 percent AEP flood; therefore, the College Avenue culverts were not included in Alternative J.

Allen Park Riparian Corridor

Alternative J would be similar to Alternative F in Allen Park Riparian Corridor. The only difference for this Alternative would be a maximum floodwall height of 2 feet versus 4 feet for Alternative F.

Granton Park Floodwall

A floodwall would be constructed along the left bank of the creek near the Granton Park neighborhood and extend approximately 1,050 feet terminating at the SMN Bridge on the western boundary of the College of Marin campus (Station 355+00 to 344+00). The height of the Granton Park floodwall would vary. At its upstream end, the wall would be about 2 feet high and gradually increase to a height of about 6 feet downstream. The new floodwall would be installed as a separate wall offset from the existing concrete wall.

College of Marin Floodwall

Alternative J would also construct a short top-of-bank floodwall upstream of College Avenue Bridge, starting at station 335+83 and extending approximately 75 feet, and a longer floodwall downstream of College Avenue Bridge extending approximately 950 feet to Station 325+70. Floodwalls near the College Avenue Bridge would be angled to funnel flow under the bridge (known as a wingwall). The College

Avenue floodwall would be constructed along the left bank and at its upstream limit have a maximum height of 4 feet and gradually taper down to a height of 2 feet downstream at its terminus.

3.9 Summary of Action Alternative Features

Table 3-2 summarizes features for each alternative and floodwall heights along various segments of the creek where the proposed measures change. The references to right and left banks of the creek use the perspective of looking downstream (from Unit 4 towards Unit 2). For example, the right bank is on the west/south side of the creek and the left bank is on the east/north side of the creek.

TABLE 3-2 SUMMARY OF FEATURES FOR CORTE MADERA CREEK ALTERNATIVES					
Feature	**Alternative A**	**Alternative B**	**Alternative F**	**Alternative G**	**Alternative J**
Fish Ladder Removal	Approximately 950 feet in length Removes Fish Passage Barrier	Approximately 950 feet in length Removes Fish Passage Barrier	Approximately 950 feet in length Removes Fish Passage Barrier	Approximately 950 feet in length Removes Fish Passage Barrier	Approximately 950 feet in length Removes Fish Passage Barrier
Bench Excavation (Channel Widening)	--	Bench excavation on right bank 2,740 feet 20 feet wide increase 5 feet below current channel top-of-bank	Bench excavation on right bank 2,740 feet 20 feet wide increase 5 feet below current channel top-of-bank	Bench excavation on right bank 2,740 feet 20 feet wide increase 5 feet below current channel top-of-bank	--
Allen Park Riparian Corridor	--	--	Total 2.02 acres and 900 feet along channel. Benefit of increase in riparian habitat	Total 2.02 acres and 900 feet along channel. Benefit of increase in riparian habitat	Total 2.02 acres and 900 feet along channel. Benefit of increase in riparian habitat
Bypass Culverts	--	--	Bypass culverts under Sir Francis Drake Boulevard (2 culverts each 12 feet wide and 7 feet high). Approximate length 2,200 feet	--	Bypass culverts under Sir Francis Drake Boulevard (2 culverts each 12 feet wide and 7 feet high). Approximate length 2,200 feet
College Avenue Bridge Culverts	3 College Avenue box culverts. One culvert on north side and two on south side of bridge.	3 College Avenue box culverts. One culvert on north side and two on south side of bridge.	3 College Avenue box culverts. One culvert on north side and two on south side of bridge.	3 College Avenue box culverts. One culvert on north side and two on south side of bridge.	--
College of Marin Widening	--	Removal of 2,740 feet of concrete channel bottom and right bank along channel.	Removal of 2,740 feet of concrete channel bottom and right bank along channel.	Removal of 2,740 feet of concrete channel bottom and right bank along channel.	--
Real Estate	30 parcels would be acquired, with permanent easements of 14.34 acres. Estimated real estate cost $92,393,000	18 parcels would be acquired, with permanent easements of 12.59 acres. Estimated real estate cost $75,794,000	No parcels would be acquired, with permanent easements of 12.18 acres. Estimated real estate cost $22,318,000	18 parcels would be acquired, with permanent easements of 14.44 acres. Estimated real estate cost $75,238,000.	No parcels would be acquired, with permanent easements of 3.44 acres. Estimated real estate cost $19,232.

TABLE 3-2 SUMMARY OF FEATURES FOR CORTE MADERA CREEK ALTERNATIVES CONTINUED										
	Alternative A		Alternative B		Alternative F		Alternative G		Alternative J	
Channel Walls	Left Bank Linear Feet	Right Bank Linear Feet	Left Bank Linear Feet	Right Bank Linear Feet	Left Bank Linear Feet	Right Bank Linear Feet	Left Bank Linear Feet	Right Bank Linear Feet	Left Bank Linear Feet	Right Bank Linear Feet
Retaining Walls	--	--	923	2,663	923	1,477	923	1,477	--	--
Sir Francis Drake Boulevard (linear feet/maximum feet height)	--	--	48/6	--	--	--	48/5	--	--	--
Sylvan Setback Wall (maximum 6 feet height)	--	--	--	741	--	--	--	--	--	--
Middle School Setback Wall (maximum 7 feet height)	--	1,092	--	--	--	--	--	--	--	--
College of Marin Setback Wall (maximum 4 feet height)	--	--	1,236	--	1,236	--	1,236	--	--	--
Top-of-bank Floodwall (10.5-11 feet max height)	2,019	2,064	--	--	--	--	--	--	--	--
Top-of-bank Floodwall (8-9 feet maximum height)	2,496	2,394	--	--	--	--	--	--	--	--
Top-of-bank Floodwall (7 - 7.5 feet	2,673	604	1,275	--	--	--	1,275	--	--	--

TABLE 3-2 SUMMARY OF FEATURES FOR CORTE MADERA CREEK ALTERNATIVES CONTINUED										
	Alternative A		Alternative B		Alternative F		Alternative G		Alternative J	
Channel Walls	Left Bank Linear Feet	Right Bank Linear Feet	Left Bank Linear Feet	Right Bank Linear Feet	Left Bank Linear Feet	Right Bank Linear Feet	Left Bank Linear Feet	Right Bank Linear Feet	Left Bank Linear Feet	Right Bank Linear Feet
maximum height)										
Top-of-bank Floodwall (6-6.5 feet maximum height)	--	--	568	2,510	--	1,902	548	3,485	1,083	--
Top-of-bank Floodwall (5-5.5 feet maximum height)	--	969	1,042	--	--	--	--	--	--	--
Top-of-bank Floodwall (3.5-4 feet maximum height)	--	--	1,037	1,539	2,079	953	2,079	1,509	996	--
Top-of-bank Floodwall (2) feet maximum height)	--	--	--	--	--	--	--	--	832	900
Top-of-bank Floodwall (1-1.5 feet maximum height)	--	--	1,104	--	1,035	790	1,035	789	--	--
Total Top-of-bank Floodwall Length	13,220		8,985		6,759		10,721		3,811	

3.10 Project Characteristics

Construction of action alternatives would be completed by tasks, which are common among alternatives. Anticipated tasks are presented in Table 3-3. Construction for Alternatives A and B would begin at the downstream end of the Project area and progress upstream to Unit 4 whereas construction would start at Allen Park Corridor for Alternatives F, G, and J.

TABLE 3-3 CONSTRUCTION MEASURES FOR EACH ALTERNATIVE

Task ID	Task	A	B	F	G	J
	Phase 1 (Unit 3)					
1.1	Prepare site (grade changes, clearing and grubbing, tree removal)			●	●	●
1.2	Construct Allen Park Riparian Corridor			●	●	●
1.3	Remove existing Denil fish ladder and replace with a smooth transition between Units 3 and 4			●	●	●
	Phase 2 (Unit 2)					
2.1	Prepare site (grade changes, clearing and grubbing, tree removal)	●	●	●	●	●
2.2	Construct setback floodwall at Kent Middle School athletic fields	●				
2.3	Remove concrete channel floor and right bank (Station 335 + 00 – 318 + 10)		●	●	●	
2.4	Construct floodwalls (top of bank, or setback)	●	●	●	●	●
2.5	Replace and improve bicycle-pedestrian pathways		●	●	●	
	Phase 3 (Unit 3)					
3.1	Prepare site (grade changes, clearing and grubbing, tree removal)	●	●	●	●	●
3.2	Widen creek to create benches near College Avenue and construct retaining wall		●	●	●	
3.3	Remove concrete channel floor and right bank (Station 345 + 50 – 335 + 00)		●	●	●	
3.4	Install three 10’ x 10’ box culverts at College Avenue Bridge	●	●	●	●	
3.5	Construct floodwalls (top of bank, or setback)	●	●	●	●	●
3.6	Replace and improve bicycle-pedestrian pathways			●	●	
	Phase 4 (Unit 4)					
4.1	Prepare site (grade changes, clearing and grubbing, tree removal)	●	●	●	●	●
4.2	Construct top of bank floodwalls on both sides of the channel	●	●		●	
4.3	Construct setback floodwalls		●			
4.4	Install two parallel underground bypass under San Francis Drake Boulevard			●		●
4.5	Remove existing Denil fish ladder and replace with a smooth transition between Units 3 and 4	●	●			

3.10.1 Project Schedule for Construction

Construction would be expected to begin in 2020 and be completed within 5 years. The construction window within Corte Madera Creek is between June 15 and October 15 in accordance with requirements to protect federally threatened steelhead trout (*Oncorhynchus mykiss*) and federally endangered coho salmon (*Oncorhynchus kisutch*), although coho salmon are considered extirpated from Corte Madera Creek. In-stream construction would be limited by a 120-day window although out-of-channel construction would not be subjected to these constraints. The project would be conducted in four phases, as presented in Table 3-4.

TABLE 3-4 CONSTRUCTION SCHEDULE FOR EACH PHASE				
Construction Phase	Unit	Description	Alternative	Construction Period (days)
Phase 1	Unit 3	Allen Park Riparian Corridor Station 370+51 to 361+40	F	95
			G	95
			J	95
Phase 2	Unit 2	Unit 2 – From downstream end of the concrete-lined channel to College Avenue Bridge Station 318+10 to 335+00	A	155
			B	115
			F	110
			G	110
			J	70
Phase 3	Unit 3	Unit 3 - From College Avenue Bridge to upstream end of concrete lined section (the fish ladder) Station 335+00 to 369+70	A	215
			B	335
			F	255
			G	255
			J	70
Phase 4	Unit 4	Unit 4 – From the fish ladder to the upstream end of project Station 369+70 to 393+00	A	335
			B	285
			F	300
			G	320
			J	300

Note: All days are calendar days and there is a 10-day buffer built between phases

3.10.2 Personnel and Equipment Required

Construction personnel would mobilize to the work site. Table 3-5 presents the equipment required for each construction task. The specific duration and number of personnel for each task of each alternative is listed in Appendix B. The list of equipment is expected to include:

1. Articulated Haulers
2. Earth Moving Dozers
3. Dump Trucks
4. Wheeled Excavators
5. Walking Excavators
6. Compact Excavators
7. Electric Crawler Excavators
8. Back Hoe Loader
9. Long Arm Backhoe Loader
10. Soil Compactor
11. Manual Soil Compactors
12. Tracked Carriers
13. Trencher Machines
14. Truck Concrete Pumps
15. Concrete Pumps
16. Pile Driver (Hammer/Vibratory)
17. Truck Mounted Crane
18. Mobile Crane
19. Heavy Concrete Cutters
20. Multi-Processor Concrete Cutter/crusher
21. Mountable tree, shrub and stump remover
22. Asphalt Drum Compactor

TABLE 3-5 EQUIPMENT REQUIRED FOR EACH TASK		
Task ID	Task	Task Equipment
	Phase 1 (Unit 3)	
1.1	Prepare site (grade changes, clearing and grubbing, tree removal)	3, 5, 6, 9, 10, 11, and 21
1.2	Construct Allen Park Riparian Corridor	1, 2, 3, 4, 5, 7, 8, 10, 13, and 21
1.3	Remove existing Denil fish ladder and replace with a smooth transition between Units 3 and 4	3, 5, 6, 7, 9, 10, 11, 13, and 14
	Phase 2 (Unit 2)	
2.1	Prepare site (grade changes, clearing and grubbing, tree removal)	3, 5, 6, 9, 10, 11, and 21
2.2	Construct setback floodwall at Kent Middle School athletic fields	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 15, and 18
2.3	Remove concrete channel floor and right bank	3, 8, 9, 19, 20, and 21
2.4	Construct floodwalls (top of bank or setback)	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 15, and 18
2.5	Replace and improve bicycle-pedestrian pathways	2, 3, 4, 6, 8, 10, 11, 13, and 22
	Phase 3 (Unit 3)	
3.1	Prepare site (grade changes, clearing and grubbing, tree removal)	3, 5, 6, 9, 10, 11, and 21
3.2	Widen creek to create benches near College Avenue and construct retaining wall	3, 5, 6, 7, 9, 10, 11, 13, 14, 15, 16, 18, 19, and 20
3.3	Remove concrete channel floor and right bank	3, 8, 9, 19, 20, and 21
3.4	Install three 10' x 10' box culverts at College Avenue Bridge	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, and 18
3.5	Construct floodwalls (top of bank or setback)	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 15, and 18
3.6	Replace and improve bicycle-pedestrian pathways	2, 3, 4, 6, 8, 10, 11, 13, and 22
	Phase 4 (Unit 4)	
4.1	Prepare site (grade changes, clearing and grubbing, tree removal)	3, 5, 6, 9, 10, 11, and 21
4.2	Construct top of bank floodwalls on both sides of the channel	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 15, 16, 17, and 18
4.3	Construct setback floodwalls	1, 2, 3, 4, 5, 6, 7, 8, 10, 11, 13, 14, 15, 16, 17, and 18
4.4	Install two parallel underground bypass under Sir Francis Drake Boulevard	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 13, 14, 15, and 18
4.5	Remove existing Denil fish ladder and replace with a smooth transition between Units 3 and 4	3, 5, 6, 7, 9, 10, 11, 13, and 14

3.10.3 Regulatory Permits and Agency Reviews

Table 3-6 provides a summary of the permits and agency reviews that would be required for the project. Environmental compliance is discussed in detail in Chapter 8 and under each resource area evaluated in Chapter 4.

TABLE 3-6 SUMMARY OF AGENCIES END SPECIFIC REVIEW, APPROVAL, OR OTHER RESPONSIBILITIES	
Agency	**Permit, Decision, Approval, or Other Action**
National Marine Fisheries Service	Endangered Species Act (ESA) Biological Opinion (Section 7 of the ESA) Incidental Take Statement Essential Fish Habitat Under Magnuson-Stevens Fisheries Conservation and Management Act
U.S. Army Corps of Engineers	National Environmental Policy Act Clean Water Act Section 404 Permit Protection of Wetlands (11990) Section 10 Rivers and Harbors Act
U.S. Fish and Wildlife Service	Fish and Wildlife Coordination Act Report Migratory Bird Treaty Act
California Department of Fish and Wildlife	California Endangered Species Act Fish and Game Code Section 1602 Fish and Game Code Section 2050 *et seq*. California Endangered Species Act Section 2081 Incidental Take Permit California Department of Fish and Wildlife (CDFW) Nests and Eggs, Section 3503 Fish and Wildlife Coordination Act (FWCA), 16 United States Code (USC) 661–667e Fully Protected Birds, Section 3511(b) Fully Protected Mammals, Section 4700 Migratory Birds, Section 3513 Raptors, Section 3503.5
State Office of Historic Preservation	National Historic Preservation Act Section 106 review
State Water Resources Control Board	Clean Water Act Section 402 National Pollutant Discharge Elimination System Permit Compliance Clean Water Act Section 402 National Pollutant Discharge Elimination System (NPDES) Construction Storm Water General Permit (Water Quality Order 99-08-DWQ: General Permit for Storm Water Discharges Associated with Construction Activity [33 USC 1342]) Identified impaired waters and Total Maximum Daily Loads established under Clean Water Act Section 303(d) General Certification Order for Dredging for Restoration Projects Groundwater Quality Monitoring Act Porter-Cologne Act State Water Resource Control Board (SWRCB) Decision 1641 (Water Quality) Water Quality Control Plan for San Francisco Bay/Sacramento–San Joaquin Delta Estuary
Bay Area Air Quality Management District, California Air Resources Control Board	Greenhouse Gas Emissions Permit to Operate an Internal Combustion Engine Stationary Source Permit Use of Portable Equipment During Construction
San Francisco Bay Conservation and Development Commission	Coastal Zone Management Act (CZMA), 16 USC 1451 *et seq*.
San Francisco Regional Water Quality Control Board	Basin Plan Section 401 Water Quality Certification Stormwater Permit Waste Discharge Requirements for Dredging Projects or Fill-Related Activities

TABLE 3-6 SUMMARY OF AGENCIES END SPECIFIC REVIEW, APPROVAL, OR OTHER RESPONSIBILITIES	
Agency	**Permit, Decision, Approval, or Other Action**
Marin County Flood Control and Water Conservation District	Lead Local Agency (CEQA)
Marin County	Project Planning and Review
Town of Ross	Project Consultation and Permitting
State Lands Commissions	Land Owner

3.10.4 Avoidance and Minimization Measures

Table 3-7 provides a summary of avoidance and minimization measures (AMMs) included by the USACE as part of the project that would reduce environmental consequences and impacts associated with construction activities. These are further discussed in Chapter 4 under each resource area evaluated.

TABLE 3-7 AVOIDANCE AND MINIMIZATION MEASURES		
Number	**Resource Area**	**Avoidance and Minimization Measure**
HYD-1	Hydrology	**Flood Warnings -** Install public warning signs and sirens to improve public awareness and response to inundation emergencies (e.g. flooding). This action will enhance safety for people using and working in the area.
WQ-1	Water Quality	**Staging Area -** Establish staging areas for activities such as fueling, equipment storage, and fill storage.
WQ-2		**Fuel Management Plan -** Develop and incorporate a Fuel Management Plan.
WQ-3		**Turbidity Management Plan -** Implement Water Quality and Turbidity Management Plan; plan will include stormwater management.
WQ-4		**Construction Timing -** Conduct construction activities during the dry season to minimize turbidity and water quality degradation.
WQ-5		**Hazardous Spill Plan -** develop and incorporate a Hazardous Spill Plan.
WQ-6		**In-stream Sediment Control -** Use coffer dams and/or silt curtains to the extent feasible during construction.
WQ-7		**Minimize In-water Construction -** In-water construction activities will be minimized to the extent practical.
WQ-8		**Turbidity Control -** The use of best management practices for turbidity control shall be employed during all in-water work conducted in the creek, where appropriate.
WQ-9		**Stormwater Runoff Control -** No debris, soil, silt, sand, cement, concrete, or washings thereof, or other construction-related materials or wastes, oil, or petroleum products, or other organic or earthen material shall be allowed to enter into or be placed where it may be washed from the construction sites by rainfall or runoff into waters of the state.
WQ-10		**Stormwater Management Plan -** A Stormwater Management Plan will be developed to ensure that, during rain events, construction activities do not increase the levels of erosion and sedimentation. This plan will include the use of erosion-control materials and erosion-control measures to minimize any impacts that may occur due to increased mobilization of sediments.
WQ-11		**Prepare SWPPP -** Erosion will be controlled based on the Storm Water Pollution Prevention Plan (Stormwater Pollution Prevention Plan) to be prepared for the project. Implementing the SWPPP measures will minimize soil erosion and related sedimentation.

TABLE 3-7 AVOIDANCE AND MINIMIZATION MEASURES		
Number	**Resource Area**	**Avoidance and Minimization Measure**
WQ-12	Water Quality	**Clear Area Sediment Control on Both Sides of Floodwalls -** Grass will be planted in the 15 feet clear area on both sides of floodwalls to prevent post-construction erosion and sedimentation.
GEO-1	Geology	**Floodwall Design -** New floodwalls will be designed and constructed to reduce or otherwise account for potential geologic hazards such as ground shaking, liquefaction, settlement, and lateral spreading. Geotechnical investigations will be completed to support project design to ensure that potential geologic hazards will not cause the project to fail. Before construction begins, for all project phases, a final geotechnical subsurface investigation report for the proposed project shall be submitted to Marin County. The final geotechnical engineering report shall be prepared according to the current California Building Code standards. The geotechnical investigation shall include subsurface testing of soil and groundwater conditions for both on-site and off-site project elements and shall determine appropriate foundation designs. All recommendations contained in the final geotechnical engineering report shall be implemented by the USACE and sponsor of all project phases
GEO-2		**Reuse of Soils -** Reuse of earth materials will reduce the amount of import material, stockpile, and landfill material, which will minimize soil effects.
GEO-3		**Grading and Erosion Control Plan** - A grading and erosion control plan would be prepared by a California Registered Civil Engineer. The grading and erosion control plan shall be submitted to Marin County before issuance of grading permits for all new development on the project site and all supporting elements. The plan shall be consistent with the State's NPDES permit requirements and shall include the site-specific grading associated with development for all project phases.
GEO-4		**Stop Work after Seismic Activity -** In the event of an earthquake or tsunami warning, the contractor will stop all work until it is determined that conditions are safe to commence work. This action will enhance safety for people working in the area.
AIR-1	Air Quality and Climate Change	**Dust Control Measures** - the contractor will implement standard dust control methods recommended by the Bay Area Air Quality Management District (BAAQMD), including: • All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times a day; • All haul trucks transporting soil, sand, or other loose material off site shall be covered; • All visible mud or dirt track-out 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; • All vehicles speeds on unpaved roads shall be limited to 15 mph; • 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; and All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation.
AIR-2		• **Limit Idling Time -** Idling times shall be minimized either by shutting equipment off when not in use or reducing maximum idling time to 5 minutes

TABLE 3-7 AVOIDANCE AND MINIMIZATION MEASURES		
Number	**Resource Area**	**Avoidance and Minimization Measure**
	Air Quality and Climate Change	(as required by the California airborne toxic control measure California Code of Regulations [CCR] Title 12, Section 2485). Clear signage shall be provided for construction workers at all access points.
AIR-3		**Cleaner Construction Equipment -** All off-road diesel-powered construction equipment greater than 50 horsepower shall meet Tier-4 emission off-road emission standards, at a minimum or shall be retrofitted with a CARB certified Level 3 diesel emissions control device.
AIR-4		**Use Electrical Power where Possible** - Use electricity from the grid rather than portable diesel-powered generators, where possible.
AIR-5		**Air Quality Liaison -** A publicly visible sign shall be posted with a telephone number and person to contact at the lead agency regarding air quality complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.
AIR-6		**Haul Bay Mud -** If excavated Bay Mud material creates odor issues with the public, the Bay Mud material shall be hauled out by truck from the project site. If the material is wet, water-tight trucks shall be used. All odorous material causing odor impacts shall be removed within 24 hours of excavation.
CC-1		**Greenhouse Gas Best Management Practices** - The contractor would utilize alternatively fueled construction equipment for at least 15% of the fleet, use local building materials for at least 10% of the total, and recycle or reuse at least 65% of construction waste or demolition materials.
BIO-1	Biological Resources	**Conduct Preconstruction Surveys -** Pre-construction biological clearance surveys shall be performed to minimize impacts on special-status plants or wildlife species and nesting migratory birds excluding salmonids. Minimizing action would be taken if species are found, as described below. Pre-construction surveys would include the following: **Nesting Migratory Birds** • To the extent feasible, tree removal will take place outside the migratory bird and raptor nesting period (February 1 through August 31 for most birds). • If tree removal or construction must occur during the nesting season, a qualified wildlife biologist will conduct pre-maintenance surveys for raptors and nesting birds within suitable habitat within 300 feet of the worksite. The surveys should be conducted within one week before initiation of activities. • If no active nests are detected during surveys, activities may proceed. If active nests are identified, non-disturbance buffers shall be established at a distance sufficient to minimize disturbance based on the nest location, topography, cover and species' tolerance to disturbance. Buffer size shall be determined in cooperation with the CDFW. • If construction work is resulting in nest disturbance, work shall cease and CDFW shall be contacted. **Western Pond Turtle** • A qualified biologist shall survey the work site no more than 72 hours before the onset of ground disturbing activities for signs of western pond turtles and/or western pond turtle nesting activity (i.e., recently excavated nests, nest plugs) or nest depredation (partially to fully excavated nest chambers, nest plugs, scattered egg shell remains, egg shell fragments).

TABLE 3-7 AVOIDANCE AND MINIMIZATION MEASURES

Number	Resource Area	Avoidance and Minimization Measure
BIO-1	Biological Resources	• Preconstruction surveys to detect western pond turtles should focus on suitable aerial and aquatic basking habitat such as logs, branches, root wads, and riprap, as well as the shoreline and adjacent warm, shallow waters where pond turtles may be present below the water surface beneath algal mats or other protective cover. • Preconstruction surveys to detect western pond turtle nesting activity should be concentrated within suitable aquatic habitat and should focus on areas along south- or west-facing slopes with bare hard-packed clay or silt soils or a sparse vegetation of short grasses or forbs. • If western pond turtles or their nesting sites are found, the biologist shall contact the CDFW to determine whether relocation and/or exclusion buffers and nest enclosures are appropriate. • If the CDFW approves moving the animal, the biologist shall be allowed sufficient time to move the western pond turtle(s) from the work site before work activities begin following guidelines according to USFWS. **Pallid Bat and Hoary Bat** • Prior to construction, a qualified biologist shall survey the trees within the project area and the underside of bridge structures for evidence of bat roosts (e.g., bat guano). If bat roosts are found in trees during pre-construction surveys the roosts shall be flagged and avoided during construction. • If roosts are found in trees or under existing bridges, they shall be removed in April, September, or October in order to avoid the hibernation and maternity seasons. Appropriate exclusion methods shall be used, as needed, during habitat removal. • If bats must be excluded, a qualified biologist shall work with CDFW to determine appropriate exclusion methods based upon the species found and their location within the project area. • If bats are found onsite and the proposed construction cannot be altered to avoid the species, the USACE and sponsor shall work with a qualified biologist and CDFW to determine additional mitigation measures based upon the species present and their specific ecological preferences/requirements. • Pre-construction surveys for roosting bats shall be conducted concurrent with those for land birds. If surveys occur during the daytime, the biologist shall look for presence of bat droppings at likely roost sites (under bridges and trees (in layers of bark, woodpecker holes, and hollow branches). The droppings are black and small, about 4 - 8 millimeters long. Bat droppings crumble into powder when crushed, as they consist of insect remains (in contrast, mouse droppings are sticky when fresh and hard when old). During evening hours bats may be confirmed visually at dusk although species identification cannot be ascertained without the use of sonar recordings and specialized software. If no signs of bats are detected during the pre-construction surveys, avoidance has been achieved and maintenance activities can proceed.
BIO-2		**Seasonal Restrictions -** Implement wet-season restrictions on construction for wildlife protection. Construction activities in or adjacent to the channel of Corte Madera Creek shall be conducted during the dry season (June 15 through October 15).

TABLE 3-7 AVOIDANCE AND MINIMIZATION MEASURES		
Number	Resource Area	Avoidance and Minimization Measure
BIO-3	Biological Resources	**Minimize Disturbance to Existing Vegetation -** Disturbance to existing vegetation shall be limited to the project area. Existing ingress and egress points shall be used, and staging and material storage areas shall be confined to the paved areas as much as possible.
BIO-4		**Minimize Footprint -** The amount of disturbance within the project area shall be reduced to the absolute minimum necessary to accomplish the proposed project. • Topsoil from the creek banks shall be removed, stockpiled, covered, and encircled with silt fencing to prevent loss or movement of the soil into Corte Madera Creek. All disturbed soils shall undergo erosion control treatment prior to the rainy season and after construction is terminated. • Treatment typically includes temporary seeding with native species and sterile straw mulch. All topsoil shall be replaced in a manner as close as possible to pre-disturbance conditions. • All construction-related holes in the ground will be covered to prevent entrapment of California red-legged frogs or foothill yellow-legged frogs.
BIO-5		**Site Restoration -** Exposed soil will be stabilized to prevent erosion and revegetated with native vegetation as soon as feasible after construction is complete. • Revegetation will occur at a ratio of at least 1.5:1 to account for initial mortality of plantings. Revegetation will occur with native species appropriate for site conditions. • If soil moisture is deficient, new vegetation will be supplied with supplemental water until vegetation is firmly established. • Erosion control fabric, hydromulch, or other mechanisms will be applied as appropriate to provide protection to seeds, hold them in place, and help retain moisture. • Revegetation shall be regularly monitored for survival for at least five years or until adequate ground cover and survival is achieved. Monitoring for colonization of invasive species will occur, and eradicated if established.
BIO-6		**Biological Construction Monitoring for non-Salmonids -** Biological monitors shall be assigned to the project when working in sensitive areas. The monitors shall be responsible for ensuring that impacts on special-status species, native vegetation, wildlife habitat, or unique resources shall be avoided to the fullest extent possible. Where appropriate, monitors shall flag the boundaries of areas where activities need to be restricted to protect native plants and wildlife or special-status species. These restricted areas shall be monitored to ensure their protection during construction. Monitoring would include the following: **Northwestern pond turtle** • Each day, before maintenance activities begin, the ECC shall make a quick survey for turtles, paying close attention to areas where turtles or burrows had been noted during the pre-construction survey. If turtles are observed, the ECC shall use any means necessary to avoid "take" of these species, including hand removal, installation of fencing, or other measures. The ECC shall assess the likelihood of project impacts to these species and coordinate

TABLE 3-7 AVOIDANCE AND MINIMIZATION MEASURES		
Number	**Resource Area**	**Avoidance and Minimization Measure**
BIO-6	Biological Resources	findings with the USFWS and CDFW to ensure that appropriate protective measures are applied. • At any time during maintenance activities, if a northwestern pond turtle is observed by the ECC, maintenance crew, or other knowledgeable persons, maintenance activities shall stop to avert the avoidable take of these species. **Ridgway's rail and California black rail** • The following measures apply to all sites in or near salt or brackish marshland and will also serve to protect other tidal-marsh dependent species such as saltmarsh common yellowthroat and San Pablo song sparrow. • When working within 250 ft. of salt or brackish marshland during the period February 1 through August 31, presence for either rail species shall be assumed. • When possible, activities shall be scheduled to occur between September 1 and January 31 to avoid the rail breeding season. • Work shall be scheduled to occur between 8:00 AM and 4:00 PM in order to avoid early morning and late afternoon/evening hours when rails are most active. • Work shall be scheduled to avoid periods of high tides, as the high water reduces the amount of refugial habitat for the rails. No work shall occur near salt marsh habitats within two hours before or after predicted extreme high tides of 6.5 ft. above the National Geodetic Vertical Datum (NGVD), as measured at the Golden Gate Bridge, and adjusted to the timing of local extreme high tide events at the project sites. • Activities shall proceed as quickly as possible to reduce disturbance from noise, dust, etc. • Removal or disturbance of emergent tidal marsh vegetation shall be avoided, and removal or disturbance of vegetation at the tidal marsh/upland interface shall be avoided to provide a buffer of refugial habitat within as wide a swath as possible (3 meter minimum) from the Mean Higher High Water (MHHW) line. If removal is necessary, the work shall be scheduled outside of the breeding season (February 1 - August 31); all vegetation shall be salvaged and retained for replacement after work is completed. **Raptors and Wading Birds** • Several of the sites are adjacent to suitable habitat for raptors and wading birds. Although none of these species are listed, they are protected by the Migratory Bird Act, and impacts to them shall be minimized. • If work is scheduled to occur between August 31 - January 31 after the nesting season, then avoidance has been achieved and work can proceed; however, to protect late- or second-nesters, the a qualified biologist shall walk the site before work occurs to check for nests and presence of birds at the work site. • During nesting season, (February 1 - September 1), a qualified biologist shall walk the area of proposed activity each day before maintenance activities

TABLE 3-7 AVOIDANCE AND MINIMIZATION MEASURES		
Number	**Resource Area**	**Avoidance and Minimization Measure**
BIO-6	Biological Resources	begin to determine presence of nesting raptors and wading birds. If none are observed, avoidance can be assumed and work can proceed. **Landbirds** • Many of the project sites are along riparian corridors that potentially support many passerine and non-passerine birds, some of which are seasonal and some of which are year-round residents. These birds are known to occur along Corte Madera Creek, particularly within Unit 4. • Any removal of trees or shrubs, or maintenance activities in the vicinity of active bird nests, could result in nest abandonment, nest failure, or premature fledging. Destruction or disturbance of active nests violates the federal Migratory Bird Treaty Act and California Department of Fish and Game (CDFW) Code. • Avoidance will be achieved if construction activities are scheduled for August 1st to January 31 to avoid the nesting season (February 1 to July 31); however, to protect late- or second-nesters, a qualified biologist shall walk the site before work occurs to check for nests and presence of birds at the work site. • If construction activities are scheduled during the nesting season, then the following AMMs should be followed: • The removal of any trees or shrubs shall occur in August, after the nesting season. If removal of trees or shrubs occurs, or maintenance begins between February 1 and July 31 (includes nesting season for passerine or non-passerine birds, and raptors), a nesting bird survey shall be performed within 14 days prior to the removal or disturbance of potential nesting trees or shrubs. • All trees with active nests shall be flagged and a non-disturbance buffer zone shall be established around the nesting tree, or the site shall be avoided until it has been determined that the young have fledged. Buffer zones typically range between 5090 ft. for passerines and non-passerine land birds. Active nests shall be monitored to determine when the young have fledged and are feeding on their own. • In addition to surveying trees and shrubs for nesting birds, surveys shall be conducted for ground nesting birds by walking narrow transects through the grassland adjacent to the project site within 14 days prior to the commencement of project related activities. • A qualified biologist shall be present at the commencement of construction activities to ensure that nesting birds and sensitive bird species have not inhabited the project site during the window following pre-construction surveys. The biologist shall also review all staging areas to ensure nesting and special-status birds are not present. **Roosting bats** • If bats were detected during the pre-construction survey, and removal of trees, shrubs, or dense ivy is scheduled to occur during bat breeding season, a qualified biologist shall conduct a bat presence-absence survey. If bats are detected, work should be re-scheduled to occur within these dates: March 1 - April 15 and/or September 1 - October 15 in order to avoid the breeding season.

TABLE 3-7 AVOIDANCE AND MINIMIZATION MEASURES		
Number	**Resource Area**	**Avoidance and Minimization Measure**
		• Removal of vegetation where bats have been known to roost shall follow the two- phased removal system: Day 1, in the afternoon, limbs and branches are removed by a tree cutter using chainsaws only. Limbs with cavities, crevices, or deep bark fissures will be avoided, and only branches or limbs with those features will be removed. Day 2: the entire tree will be removed.
BIO-7	Biological Resources	**Environmental Awareness Training -** A Worker Environmental Awareness Program (WEAP) shall be prepared, and all construction crews and contractors shall be required to participate in WEAP training prior to starting work on the project. The WEAP training shall include a review of the special-status species and other sensitive resources that could exist in the project area, the locations of sensitive biological resources as well as their legal status and protections, and measures to be implemented for avoidance of these sensitive resources. A record of all personnel trained shall be maintained. Species-specific training would include: • A qualified biologist shall conduct a training session for all construction personnel. At minimum, the training shall include a description of the western pond turtle and its aquatic and upland nesting habitat, the general measures to implement to avoid and minimize impacts to habitat in the project area as they relate to the western pond turtle, and the boundaries within which construction activities can take place. • Training sessions shall be given to all workers during bat breeding season to inform them of protective measures, details about the two-phase tree removal protocol, and inform them of when work needs to be stopped and appropriate officials informed of species presence if bats are identified during pre-construction surveys.
BIO-8		**Signing -** Interpretive signs prohibiting access to areas that are closed to the public, and indicating the importance of protection of sensitive biological resources, will be placed in key locations, such as along trails near sensitive habitats. • A qualified biologist shall determine the appropriate buffer size, in consultation with CDFW, and delineate the buffer using Environmentally Sensitive Area fencing, pin flags, and yellow caution-tape. The project area shall be delineated with high-visibility temporary orange-colored fence at least 4 feet in height, flagging, or other barriers. • Signs shall be posted that clearly state that construction personnel and equipment will not move outside of the marked area. The fencing shall be inspected by a qualified biologist and maintained daily until project completion. The fencing shall be removed only when all construction equipment is removed from the site. No construction activities shall take place outside the delineated project area. • Buffers shall be established around active migratory bird nests and marked by a qualified biologist using ESA fencing, pin flags, and/or yellow caution tape. The size of the buffer may vary for different species and shall be determined in coordination with CDFW. A buffer zone shall be maintained around all active nest sites until the young have fledged and are foraging independently. In the event that an active nest is found after the completion of preconstruction surveys and after construction begins, all construction

TABLE 3-7 AVOIDANCE AND MINIMIZATION MEASURES		
Number	Resource Area	Avoidance and Minimization Measure
	Biological Resources	activities shall be stopped until a qualified biologist has evaluated the nest and erected the appropriate buffer around it.
BIO-9		**Cleaning of Equipment and Vehicles -** Equipment will be cleaned of any sediment or vegetation before transfer and use between sites to prevent spreading pathogens or exotic/invasive species. Vehicle and equipment washing will occur on-site as needed. No runoff from vehicle or equipment washing will be permitted to enter waters of the State without adequate treatment.
BIO-10		**Project Site Maintenance -** Project sites will be maintained trash-free, and food refuse will be contained in secure bins and removed daily.
BIO-11		**Vehicle Staging and Fueling** - Vehicle staging, cleaning, maintenance, refueling, and fuel storage will be located 150 feet or more from Corte Madera Creek. All fueling shall be equipped with secondary containment and avoid a direct connection to underlying soil, surface water, and storm drains.
BIO-12		**Vehicle and Equipment Maintenance -** All equipment will be maintained free of petroleum leaks and kept clean. • No equipment will enter live water except for aquatic equipment or amphibious equipment designed specifically for aquatic or amphibious use. All vehicles operated within 150 feet of any body of water will be inspected daily for leaks and, if necessary, repaired before leaving the staging area. Inspections will be documented in a record that is available for review on request.
BIO-13		**Hazardous Materials Management/Fuel Spill Containment Plan -** A hazardous materials management and fuel spill containment plan will be developed prior to construction and given to all contractors and biological monitors working on the project. The plan will require: • Equipment and materials for cleanup of spill be available on site and that spills and leaks will be cleaned up immediately and disposed of properly. Authorities will be notified of spills as required by 40 CFR 110. • Prior to entering the work site, all field personnel shall be appropriately trained in spill prevention, hazardous material control, and clean-up of accidental spills. • Field personnel shall implement measures to ensure that hazardous materials are properly handled and the quality of water resources is protected by all reasonable means. Preventative measures will be implemented, such as vehicle and equipment staging, cleaning, maintenance, and refueling; and contaminant (including fuel) management and storage. • The agency will perform compliance monitoring.
BIO-14		**Salmonid Monitoring -** If Coho salmon are observed in the project area during winter months or during preconstruction fish capture and relocation activities, all project activities shall cease and DFW and NMFS shall immediately be notified. If steelhead are determined or presumed to be present in the project site, then the following Avoidance and Minimization Measures shall be implemented:

TABLE 3-7 AVOIDANCE AND MINIMIZATION MEASURES		
Number	**Resource Area**	**Avoidance and Minimization Measure**
BIO-14	Biological Resources	• All in-stream maintenance activities will be restricted to the low-flow period of June 15 through October 15. Work above the top of bank or outside of the channel will not be subject to this modified work period. • To minimize turbidity and stress to special-status species, personnel shall avoid walking through stream pools and the thalweg of the channel, and shall instead walk across riffles or outside of the stream bed to access a project site. • No equipment is to be operated from within the active stream channel unless the stream has been dewatered and fish have been relocated by a qualified and permitted biologist. • If anadromous salmonids are present, a fisheries biologist with appropriate licenses and equipment (buckets, aerators, etc.) must be on-site to catch and move fish downstream as dewatering proceeds. Captured fish shall be handled with extreme care and kept in water to the maximum extent possible during relocation activities. All captured fish shall be kept in cool shaded, aerated water protected from excessive noise, jostling, or overcrowding any time they are not in the stream and fish shall not be removed from this water except when released. To avoid predation, the biologist shall have at least two containers and segregate young-of-year fish from larger age-classes and other potential aquatic predators. Captured salmonids will be relocated, as soon as possible, to a suitable instream location in which habitat condition are present to allow for adequate survival of transported fish and fish already present. Cofferdams used to divert water shall be constructed with clean river gravel or sand bags and sealed with sheet plastic. • If any salmonids are found dead or injured, the biologist shall contact NMFS biologist Rick Rogers by phone immediately at (707) 578-8552 or the NMFS North Central Coast Office at (707) 575-6050. The purpose of the contact is to review the activities resulting in take and to determine if additional' protective measures are required. All salmonid mortalities shall be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location of collection, fork length measured, and frozen as soon as possible. Frozen samples shall be retained by the biologist until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than the NMFS North Central Coast Office without obtaining prior written approval from the North Central Coast Office, Supervisor of the Protected Resources Division. Any such transfer will be subject to such conditions as NMFS deems appropriate. • Intakes and outlets shall be designed to minimize turbidity and the potential to wash contaminants into the stream. • If a work site is to be temporarily dewatered by pumping, intakes shall be completely screened with wire mesh not larger than 5 millimeters to prevent amphibians from entering the pump system. On salmonid streams, the intake pipe shall be fitted with fish screens meeting CDFW and NOAA Fisheries' criteria to prevent entrainment or impingement of small fish (National Marine Fisheries Service 1997: http://swr.nmfs.noaa.gov/hcdlfishscm.pdf). • A filtration/settling system must be included to reduce downstream turbidity (i.e. filter fabric, turbidity curtain). The selection of an appropriate system is based on the rate of discharge. If feasible, water that is pumped

TABLE 3-7 AVOIDANCE AND MINIMIZATION MEASURES		
Number	**Resource Area**	**Avoidance and Minimization Measure**
BIO-14	Biological Resources	into a pipe shall discharge onto the top of bank into a densely vegetated area, which may require extra hose length. • Once the project work is complete, water shall be slowly released back into the work area to prevent erosion and increased turbidity. • The channel and soil surface shall be restored to its original or design configuration after the work is complete. Any material added to the channel or basin to provide support for the work approved under this provision shall be removed unless required for erosion control or habitat enhancement and/or restoration. • For minor actions where the disturbance to construct cofferdams to isolate the work site would be greater than that which would occur in completing the proposed action, measures will be put in place immediately downstream of the work site to capture suspended sediment. This may include installation of silt catchment fences across the drainage or placement of a straw wattle or filter berm of clean river gravel. Silt fences and other non-native materials will be removed from the stream following completion of the activity. Gravel berms may be left in place after breaching, provided they do not impede the stream flow.
BIO-15		**Night Lighting During Construction -** During nighttime work for project construction, night lighting shall be used only in the area actively being worked on and focused on the direct area of work.
CUL-1	Cultural Resources	**Avoid Cultural Resources -** Prior to construction, implement a program of subsurface testing where project construction and known sites overlap to determine the potential for impacts.
	Aesthetics	None
	Recreation	None
NOI-1	Noise	**Work Hours -** Truck delivery and use of heavy construction equipment would be restricted to hours between 8 am and 5 pm, Monday through Friday. Seasonal restrictions and buffers would be imposed on construction to avoid impacts to biological resources (see Chapter 4.6 Biological Resources).
NOI-2		**AMM-NOI-2: Noise Best Management Practices** - The contractor would implement practices that minimize the disturbances to residential neighborhoods surrounding work sites, including: • Internal combustion engines would be equipped with adequate mufflers; • Excessive idling of vehicles would be prohibited; • All construction equipment would be equipped with manufacturer's standard noise control devices; and, The use of Jake brakes would be prohibited in residential areas
	Land Use	• None
HAZ-1	Human Health and Safety	**Compliance with Federal, State, and Local Regulations** - Compliance with applicable regulations would reduce the potential for accidental release of hazardous materials during construction. The contractor would be required to prepare a SWPPP and Spill Prevention, Control, and Countermeasure that details the contractor's plan to prevent discharge from the construction site into drainage systems, lakes, or rivers. This plan would include best management practices and a spill cleanup plan for implementation at each construction site.
HAZ-2		**Prepare Health and Safety Plan** - A worker health and safety plan would be prepared before the start of construction activities that identifies, at a minimum,

TABLE 3-7 AVOIDANCE AND MINIMIZATION MEASURES		
Number	**Resource Area**	**Avoidance and Minimization Measure**
HAZ-2	Human Health and Safety	all the contaminants that could be encountered during construction activities; all appropriate worker, public health, and environmental protection equipment and procedures to be used during Project activities; emergency response procedures; the most direct route to the nearest hospitals; and a Site Safety Officer. The plan would describe action to be taken should hazardous materials be encountered on site, including protocols for handling hazardous materials and preventing their spread, and emergency procedures to be taken in the event of a spill.
HAZ-3		**Records Review Prior to Construction** - If significant time has elapsed between approval of the document and construction, a second records review would be completed to reduce the risk of encountering a hazardous site during constriction.
HAZ-4		**Implement Fire Prevention Measures** - Fire prevention measures will be implemented to reduce the risk of fire from construction equipment. • All earthmoving equipment with internal combustion engines will be equipped with spark arrestor. • During the high fire danger period (April 1 – December 1), work crews will have appropriate fire suppression equipment available at the work site. • On days when fire danger is high and a burn permit is required (as issued by the relevant Air Pollution Control District), flammable materials, including flammable vegetation slash, will be kept at least 10 feet away from any equipment that could produce a spark, fire, or flame. On days when the fire danger is high and a burn permit is required, portable tools powered by gasoline-fueled internal combustion engines will not be used within 25 feet of any flammable materials unless at least one round-point shovel or fire extinguisher is within immediate reach of the work crew (no more than 25 feet away from the work area).
TRF-1	Traffic	**Avoid Peak Hours**- Truck delivery would be outside the a.m. and p.m. peak traffic hours, so project-related trips would occur predominantly outside peak traffic hours and would minimize impacts on the area transportation system.
TRF-2		**AMM-TRF-2: Traffic Control Plan -** A Traffic Control Plan will be prepared and submitted to Marin County Department of Public Works for review and approval. During construction activities, the Marin County Department of Public Works and the project contractors working on the project shall adhere to all requirements of the Traffic Control Plan. The Traffic Control Plan shall include the following: • The route selection for movement of heavy equipment in the project vicinity shall be coordinated with the Marin County Department of Public Works, Marin County Sheriff's Department, and Police Departments for applicable cities and unincorporated communities (Town of Ross and Kentfield) to minimize traffic and physical road impacts. Truck drivers shall be notified and be required to use the most direct route between the project site and Highway 101. • Heavy equipment transport, material transportation, or exportation to and from the project site shall not occur during weekday commute peak traffic periods and shall be coordinated by the contractor with the Marin County Department of Public Works, Marin County Sheriff's Department, and relevant city/town police departments. • The Traffic Control Plan will define the use of flaggers, warning signs, lights, barricades, and cones, etc., according to standard guidelines required by the County and Town of Ross as appropriate. Further, the contractor will maintain

TABLE 3-7 AVOIDANCE AND MINIMIZATION MEASURES		
Number	Resource Area	Avoidance and Minimization Measure
TRF-2	Traffic	the work site, including traffic control, in a safe condition at all times, even outside of normal work hours. • Construction activities completed within public street rights-of-way shall require the use of a traffic control service, and any lane closures or traffic control measures shall be consistent with those published in the California Joint Utility Traffic Control Manual (California Inter-Utility Coordinating Committee 2010). Implementing measures contained within the California Joint Utility Traffic Control Manual would facilitate safe passage of both construction vehicles and private vehicles. A roadway cleaning program shall be instituted to address debris and mud caused by trucks on Sir Francis Drake Boulevard and other access and haul routes.
	Environmental Justice	None
	Socioeconomics	None
UTL-1	Public Utilities and Services	**Locate Utilities -** Contact Underground Service Alert (DigAlert) to mark known utilities and use a subsurface utility locator prior to construction.
UTL-2		**Relocate Utilities** - Relocate utilities in conflict with project features either before or in conjunction with construction of project features to minimize impacts.

3.10.5 Operation and Maintenance Activities

Once constructed, for any alternative, there would be ongoing operations and maintenance activities associated with the Project. An operations and maintenance manual would be developed in cooperation with the District describing the frequency, extent, and types of inspection and operation needed. These would include six types of maintenance activities:

1. Vegetation management
2. Sediment and debris removal
3. Erosion control
4. Maintenance and repair of all components of the Project including: floodwall, levee, drainage structures, channel lining, and all channel erosion protection features
5. Regular annual inspection.
6. Most maintenance activities would occur during the dry season from April 15 to October 15.

Vegetation Management

Vegetation management activities are employed to achieve three main goals:

1. Maintain channel flow capacity
2. Reduce fire fuels
3. Restore creek habitat by removing invasive nonnative plants and revegetating with native plants

Vegetation management activities would not include ground-disturbing activities. These activities employ vegetation control methods such as cutting and removing vegetation above the ground by hand or with loppers, hand saws, chainsaws, pole saws, weed eaters, and other hand tools. Removal of nonnative vegetation, tree removal and thinning employ a mix of tools including chainsaws, loppers, hand saws, pole saws, hedge trimmers, and other hand tools.

Sediment and Debris Removal

Equipment types, equipment locations, crew sizes, and staging areas would vary depending on the need of each site. Equipment includes long-reach excavators, backhoes, haulers, and front loaders. Excavated sediment would be placed directly into dump trucks, or placed in or pushed to staging areas, then lifted into dump trucks.

Erosion Control

Erosion control is typically accomplished by armoring the critical areas (bends and steep banks) along the channel with ripraps and by means of other biotechnical methods. Equipment typically used for erosion control work can include excavators, haulers, front loaders, and bulldozers.

Maintenance and Repair of Flood Control Structures

Flood control structures are defined to include all structures built or maintained by the District, including, but not limited to floodwalls, levees, closure gates, weirs, diversion structures, trash racks, stream gage structures, grade control structures, energy dissipaters, utility line crossings, culverts, outfalls, storm drain or pump station inlet/outlet structures, and similar structures.

Regular Annual Inspection

Annual routine inspection would be performed to make sure the Project is capable of performing as intended. The government may perform inspections every 5 years depending on the availability of funds. Any deficiencies discovered during inspection would be the responsibility of the District.

3.11 Summary of Alternative Impacts

Impacts and mitigation measures for Project alternatives are described in depth in Chapter 4. Table 3-8 summarizes the impacts of each alternative.

TABLE 3-8 SUMMARY OF ALTERNATIVE IMPACTS						
Effect	A	B	F	G	J	No Action Alternative
Hydrology						
HYD-1: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).	LTS	LTS	LTS	LTS	LTS	NI
HYD-2: Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site.	LTS	LTS	LTS	LTS	LTS	NI
HYD-3: Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site.	NI	NI	NI	NI	NI	NI
HYD-4: Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.	NI	NI	NI	NI	NI	NI
HYD-5: Place a structure within a 1% AEP flood hazard area which could impede or redirect flood flows.	NI	NI	NI	NI	NI	NI
HYD-6: Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam.	B	B	B	B	B	NI
Water Quality						
WQ-1: Violate any water quality standards or waste discharge requirements or otherwise substantially degrade water quality.	SU	SU	LTS	LTS	LTS	NI
WQ-2: Provide substantial additional sources of polluted runoff.	LTS	LTS	LTS	LTS	LTS	NI
WQ-3: Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.	SU	SU	SU	SU	SU	NI
Geology						
GEO-1: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: • Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issues by the state geologist for the area or based on other substantial evidence of a known fault;	LTS/M	LTS/M	LTS/M	LTS/M	LTS/M	NI

TABLE 3-8 SUMMARY OF ALTERNATIVE IMPACTS						
Effect	**A**	**B**	**F**	**G**	**J**	**No Action Alternative**
• Strong seismic ground shaking; • Seismic-related ground failure, including liquefaction; • Landslides.						
GEO-2: Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.	NI	NI	NI	NI	NI	NI
GEO-3: Result in substantial soil erosion or the loss of topsoil.	LTS	LTS	LTS	LTS	LTS	NI
GEO-4: Be located on expansive soil, as defined in Table 18-1-B of the UBC (1994), creating substantial risks to life or property.	LTS	LTS	LTS	LTS	LTS	NI
GEO-5: Inundation by seiche, tsunami, or mudflow.	NI	NI	NI	NI	NI	NI
Air Quality						
AIR-1: Conflict with or obstruct implementation of the applicable air quality plan.	LTS	LTS	LTS	LTS	LTS	NI
AIR-2: Violate any air quality standard or contribute substantially to an existing or projected air quality violation.	LTS	LTS	LTS	LTS	LTS	NI
AIR-3: Result in a cumulative net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard.	LTS	LTS	LTS	LTS	LTS	NI
AIR-4: Expose sensitive receptors to substantial pollution concentrations.	LTS	LTS	LTS	LTS	LTS	NI
AIR-5: Create objectionable odors affecting a substantial number of people.	LTS	LTS	LTS	LTS	LTS	NI
Climate Change						
CC-1: Generate greenhouse gases (GHG) emissions, either directly or indirectly, that may have a significant impact on the environment.	LTS	LTS	LTS	LTS	LTS	NI
CC-2: Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.	LTS	LTS	LTS	LTS	LTS	NI
Biology						
BIO-1: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the NMFS, USFWS, and CDFW.	SU	SU	LTS	SU	LTS	S
BIO-2: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the NMFS, USFWS, and CDFW.	SU	SU	LTS	SU	LTS	S

TABLE 3-8 SUMMARY OF ALTERNATIVE IMPACTS						
Effect	A	B	F	G	J	No Action Alternative
BIO-3: Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the Clean Water Act (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.	LTS	LTS	LTS	LTS	LTS	NI
BIO-4: Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.	SU	SU	LTS	SU	LTS	S
BIO-5: Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.	LTS/M	LTS/M	LTS	LTS/M	LTS	NI
Cultural Resources						
CUL-1: Cause a substantial adverse change in the significance of a unique archaeological resource or an historical resource as defined in CEQA Guidelines Section 15064.5 or 36 Code of Federal Regulations (CFR) 800.5 of Section 106 of the National Register of Historic Places (NRHP).	LTS/M	LTS/M	LTS/M	LTS/M	LTS/M	NI
CUL-2: Disturb any human remains, including those interred outside of formal cemeteries.	LTS/M	LTS/M	LTS/M	LTS/M	LTS/M	NI
CUL-3: Cause a substantial adverse change in the significance of a tribal cultural resource	LTS/M	LTS/M	LTS/M	LTS/M	LTS/M	NI
Aesthetics						
AES-1: Substantially degrade the existing visual character or quality of the study area and its surroundings.	SU	SU	LTS	SU	LTS	NI
AES-2: Have a substantial adverse effect on a scenic vista.	SU	SU	LTS	SU	LTS	NI
AES-3: Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway.	N/A	N/A	N/A	N/A	N/A	N/A
AES-4: Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.	N/A	N/A	LTS	N/A	LTS	NI
Recreation						
REC-1: Limit or impede existing recreational uses in the project area.	LTS	LTS	LTS	LTS	LTS	NI
REC-2: Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment.	LTS	LTS	LTS	LTS	LTS	NI

TABLE 3-8 SUMMARY OF ALTERNATIVE IMPACTS						
Effect	**A**	**B**	**F**	**G**	**J**	**No Action Alternative**
REC-3: Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.	LTS	LTS	LTS	LTS	LTS	NI
Noise						
NOI-1: Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.	SU	SU	SU	SU	SU	NI
NOI-2: A substantial temporary or periodic increase in ambient noise levels in the project vicinity, above levels existing without the project.	SU	SU	SU	SU	SU	NI
NOI-3: A substantial permanent increase in ambient noise levels in the project vicinity, above levels existing without the project.	LTS	LTS	LTS	LTS	LTS	NI
NOI-4: Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.	LTS/M	LTS/M	LTS/M	LTS/M	LTS/M	NI
NOI-5: Result in adverse effects on biological resources due to noise or groundborne vibration.	LTS/M	LTS/M	LTS/M	LTS/M	LTS/M	NI
NOI-6: For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, exposure of people residing or working in the project area to excessive noise levels.	N/A	N/A	N/A	N/A	N/A	N/A
NOI-7: For a project within the vicinity of a private airstrip, exposure of people residing or working in the project area to excessive noise levels.	N/A	N/A	N/A	N/A	N/A	N/A
Land Use						
LND-1: Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.	LTS	LTS	LTS	LTS	LTS	NI
LND-2: Physically divide an established community.	NI	NI	NI	NI	NI	NI
LND-3: Conflict with any applicable habitat conservation plan or natural community conservation plan.	N/A	N/A	N/A	N/A	N/A	N/A
LND-4: Result in permanent conversion of existing land uses.	SU	SU	LTS	SU	LTS	NI
Public Health and Safety						
HAZ-1: Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.	LTS	LTS	LTS	LTS	LTS	NI

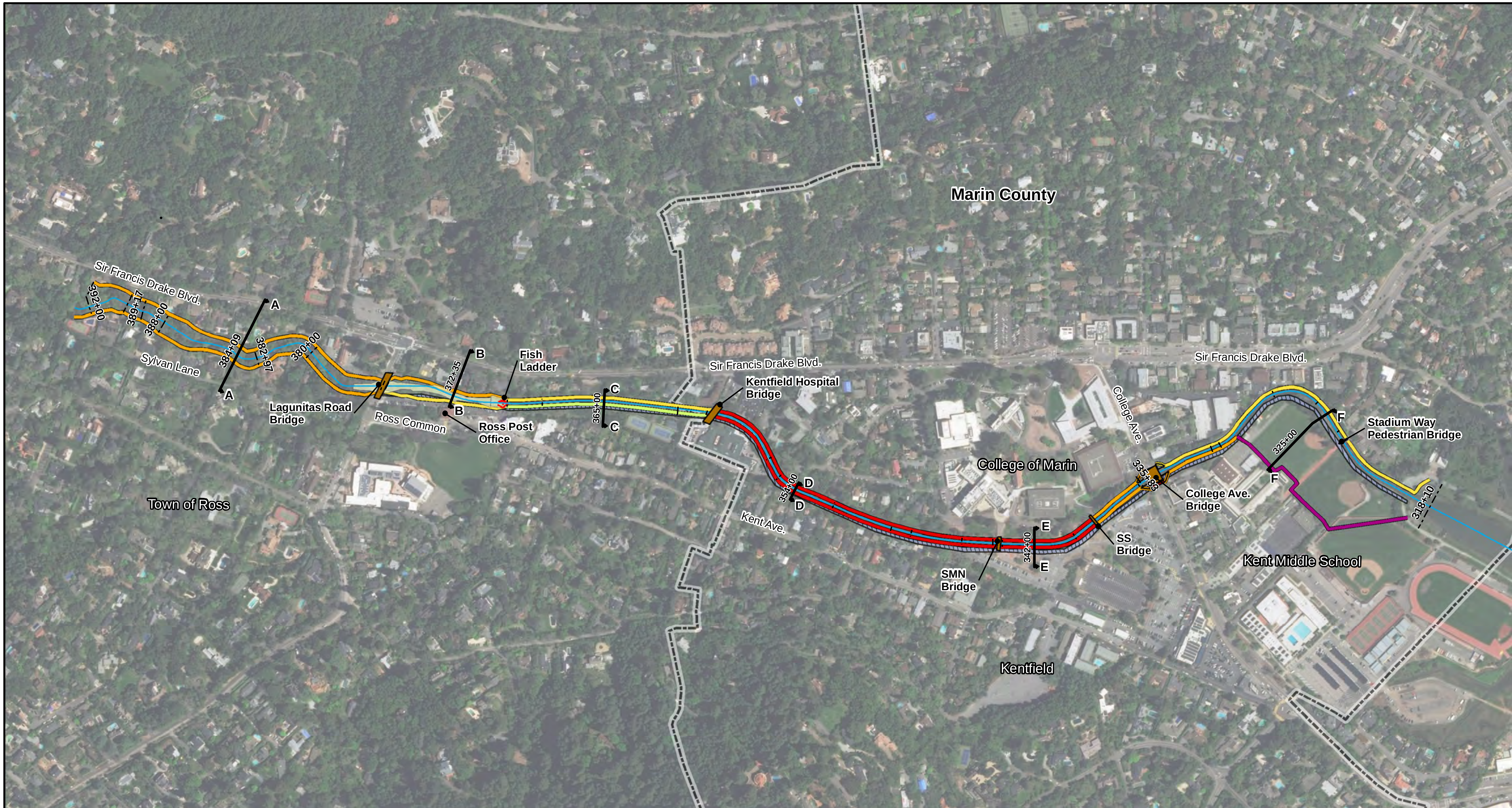
TABLE 3-8 SUMMARY OF ALTERNATIVE IMPACTS						
Effect	**A**	**B**	**F**	**G**	**J**	**No Action Alternative**
HAZ-2: Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials.	LTS	LTS	LTS	LTS	LTS	NI
HAZ-3: Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school.	LTS	LTS	LTS	LTS	LTS	NI
HAZ-4: Be located on a site which is included in a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment.	NI	NI	NI	NI	NI	NI
HAZ-5: Impair implementation of or physically interfere with an adopted emergency response or evacuation plan.	LTS	LTS	LTS/M	LTS	LTS/M	NI
HAZ-6: Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.	LTS	LTS	LTS	LTS	LTS	NI
HAZ-7: If located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public-use airport, the project would result in a safety hazard for people residing or working in the project area.	N/A	N/A	N/A	N/A	N/A	N/A
HAZ-8: If located within the vicinity of a private airstrip, the project would result in a safety hazard for people residing or working in the project area.	N/A	N/A	N/A	N/A	N/A	N/A
Transportation						
TRF-1: The project conflicts with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.	LTS	LTS	SU	LTS	SU	NI
TRF-2: The project conflicts with an applicable congestion management program, including but not limited to level of service standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways.	LTS	LTS	SU	LTS	SU	NI
TRF-3: The project results in inadequate emergency access.	LTS	LTS	LTS/M	LTS	LTS/M	NI

TABLE 3-8 SUMMARY OF ALTERNATIVE IMPACTS						
Effect	A	B	F	G	J	No Action Alternative
TRF-4: The project conflicts with adopted policies, plans, or programs regarding public transit, bicycle or pedestrian facilities, or otherwise decreases the performance or safety of such facilities.	LTS	LTS	LTS	LTS	LTS	NI
TRF-5: The project results in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risk.	N/A	N/A	N/A	N/A	N/A	N/A
TRF-6: The project substantially increases traffic hazards due to design features (e.g. sharp curves or dangerous intersections) or incompatible uses (e.g. farm equipment).	N/A	N/A	N/A	N/A	N/A	N/A
Environmental Justice						
EJ-1: Cause a disproportionately high and adverse effect on a minority and/or low-income population in the surrounding community, as described in Section 4.14.2, including but not limited to both physical and economic effects.	LTS	LTS	LTS	LTS	LTS	NI
Socioeconomics						
SOC-1: Induce substantial population growth in and around the study area, either directly (e.g. by creating new homes and businesses) or indirectly (e.g. by extending roads and infrastructure).	NI	NI	NI	NI	NI	NI
SOC-2: Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere.	SU	SU	LTS	SU	LTS	S
SOC-3: Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.	SU	SU	LTS	SU	LTS	S
Public Services and Utilities						
UTL-1: Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services.	LTS	LTS	LTS	LTS	LTS	NI
UTL-2: Require or result in the construction of new water and/or wastewater treatment facilities, or the expansion of existing facilities, which would cause significant environmental effects.	LTS	LTS	LTS	LTS	LTS	NI
UTL-3: Require or result in the construction of new storm water drainage facilities, or the expansion of existing facilities, which would cause significant environmental effects.	LTS	LTS	LTS	LTS	LTS	NI

TABLE 3-8 SUMMARY OF ALTERNATIVE IMPACTS

Effect	A	B	F	G	J	No Action Alternative
UTL-4: Have insufficient water supplies available to serve the project from existing entitlements and resources and require new or expanded entitlements.	LTS	LTS	LTS	LTS	LTS	NI
UTL-5: Exceed wastewater treatment requirements of the applicable Regional Water Quality Control Board (RWQCB).	LTS	LTS	LTS	LTS	LTS	NI
UTL-6: Result in a determination by the wastewater treatment provider which serves or may serve the project that it does not have the capacity to serve the project's projected demand in addition to currently existing commitments.	LTS	LTS	LTS	LTS	LTS	NI
UTL-7: Require new or expanded solid waste (landfill) services in order to meet the needs of the project work.	LTS	LTS	LTS	LTS	LTS	NI
UTL-8: The project is unable to comply with federal, state, and/or local statutes and regulations related to solid waste.	N/A	N/A	N/A	N/A	N/A	N/A

B = beneficial
LTS = less than significant
LTS/M = less than significant with mitigation
N/A = not applicable
NI = no impact
S = significant
SU = significant and unavoidable



Alternative A

- Fish Ladder Removal
- Fish Passage Transition Grading
- Grading
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 5 - 5.5
- 7 - 7.5
- 8 - 9
- 10.5 - 11

Maximum Setback Floodwall Heights (feet)

- 7

Existing Features

- Corte Madera Creek Centerline
- Bridges
- Existing Bike Lane

- Channel Stations
- Cross-Section Location

0 200 400 800 Feet

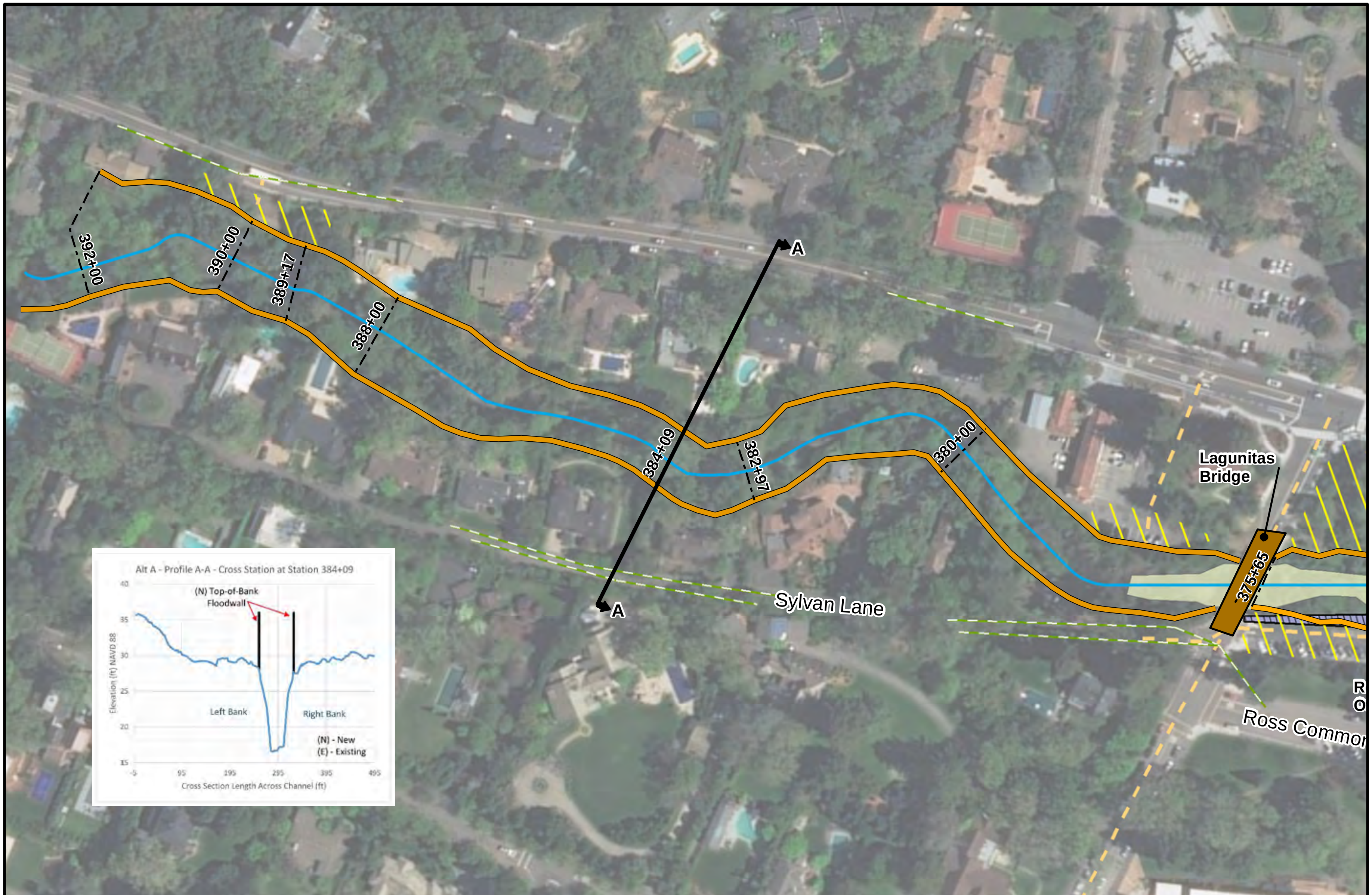
Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative A
Figure 3 - 1a Overview

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative A

- Fish Ladder Removal
- Fish Passage Transition Grading
- Grading
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 10.5 - 11
- 5 - 5.5
- 7 - 7.5
- 8 - 9

Maximum Setback Floodwall Heights (feet)

- 7

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area

- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Date: 10/4/2018

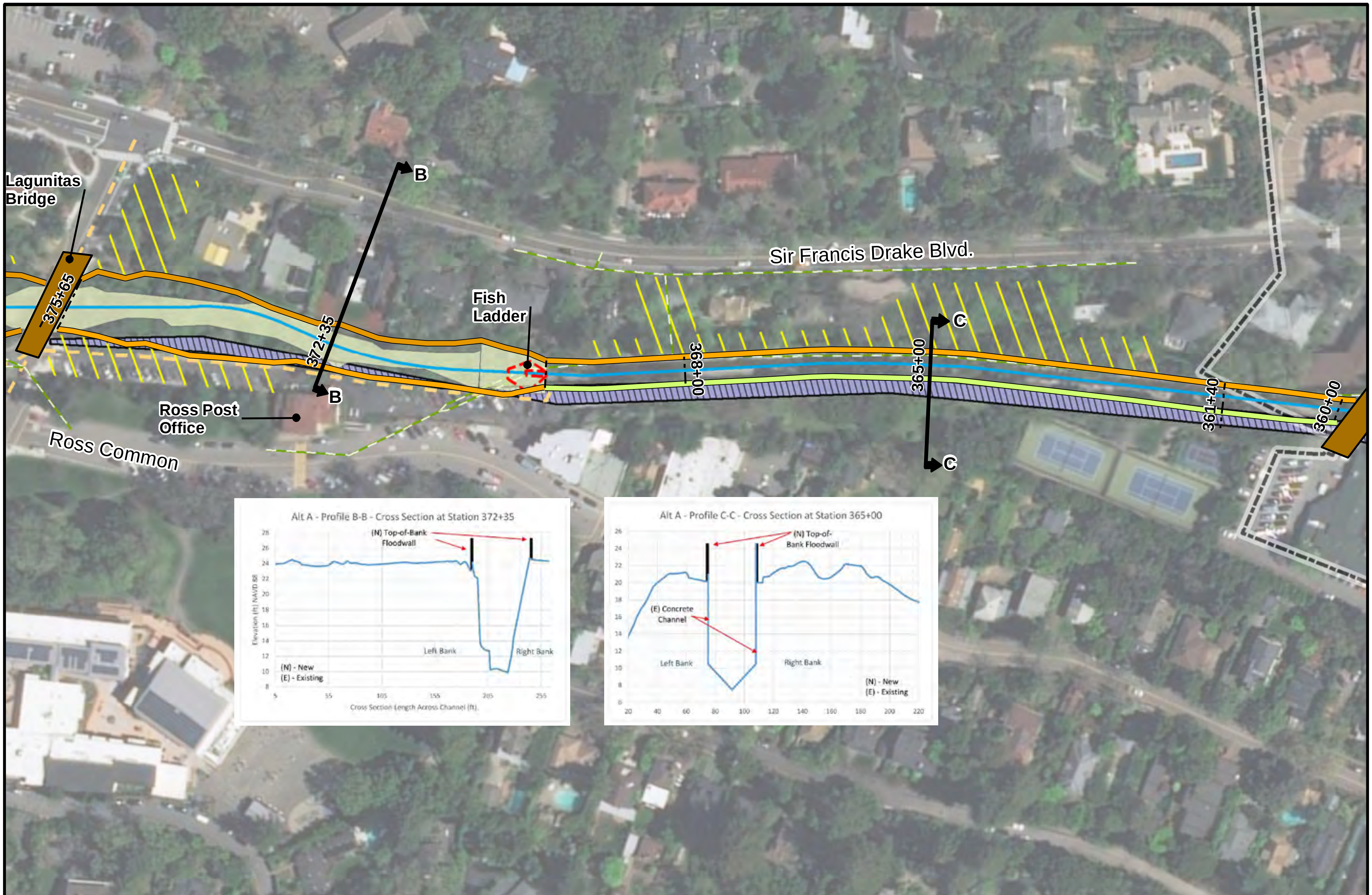
Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative A

Figure 3-1b Upstream Limit to Lagunitas Road Bridge

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative A

- Fish Ladder Removal
- Fish Passage Transition Grading
- Grading
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 10.5 - 11
- 5 - 5.5
- 7 - 7.5
- 8 - 9

Maximum Setback Floodwall Heights (feet)

- 7

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Date: 10/4/2018

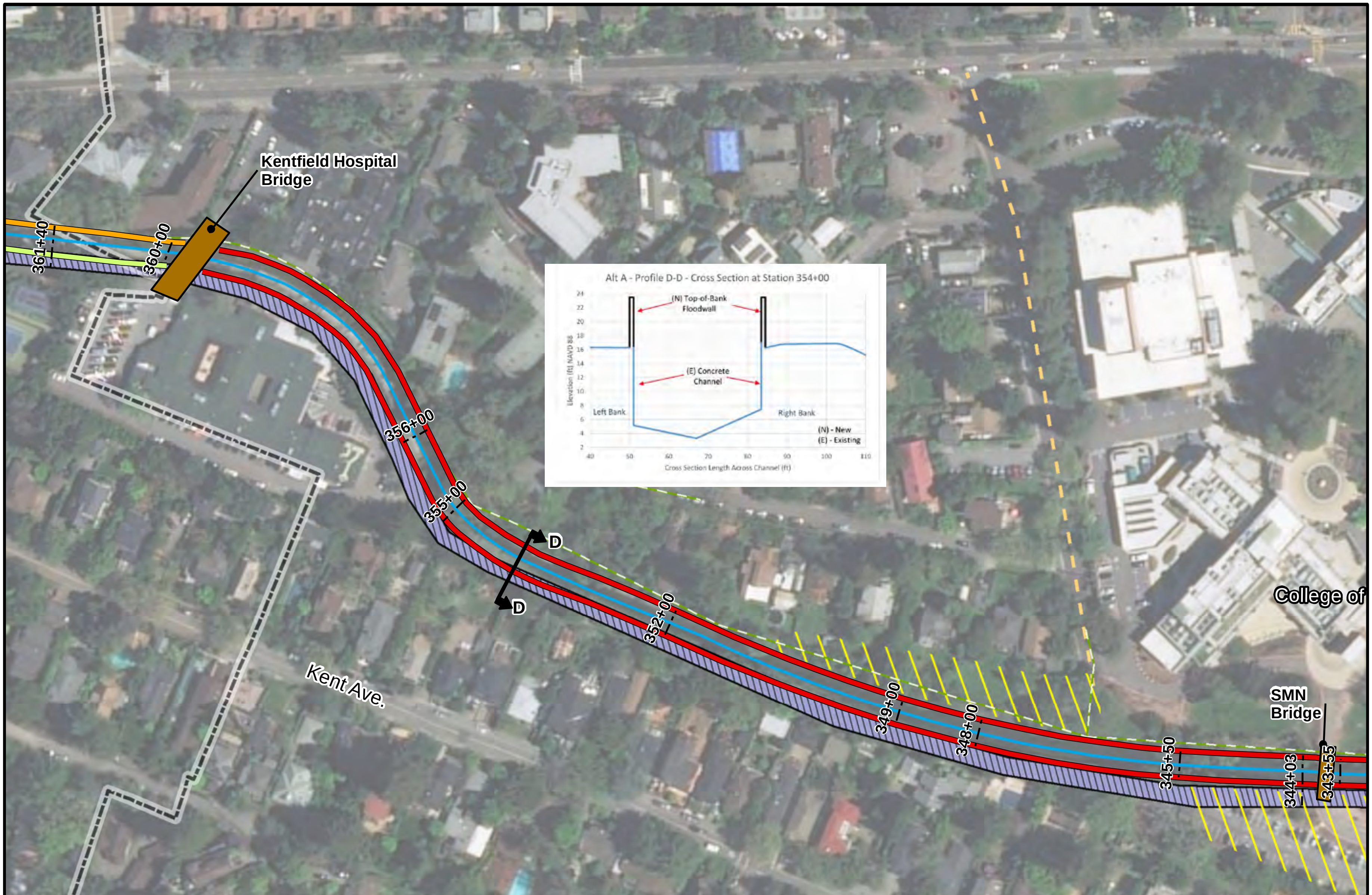
Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative A

Figure 3-1c Lagunitas Road Bridge to End of Allen Park

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative A

- Fish Ladder Removal
- Fish Passage Transition Grading
- Grading
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 10.5 - 11
- 5 - 5.5
- 7 - 7.5
- 8 - 9

Maximum Setback Floodwall Heights (feet)

- 7

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area

- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Date: 10/4/2018

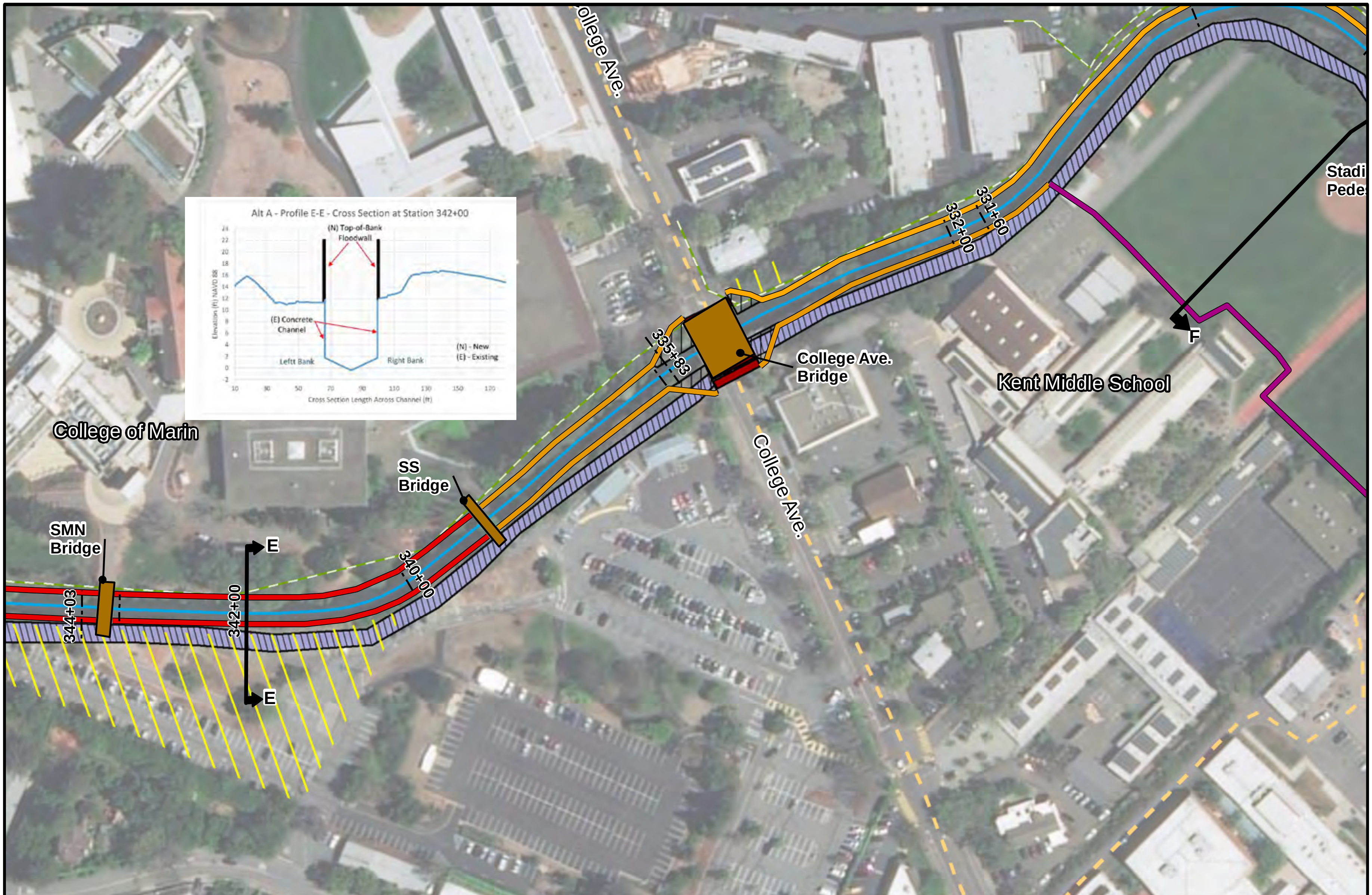
Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative A

Figure 3-1d End of Allen Park to College of Marin

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative A
- Fish Ladder Removal
- Fish Passage Transition Grading
- Grading
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)
- 10.5 - 11
- 5 - 5.5
- 7 - 7.5
- 8 - 9

Maximum Setback Floodwall Heights (feet)
- 7

Existing Features
- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area

- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Date: 10/4/2018

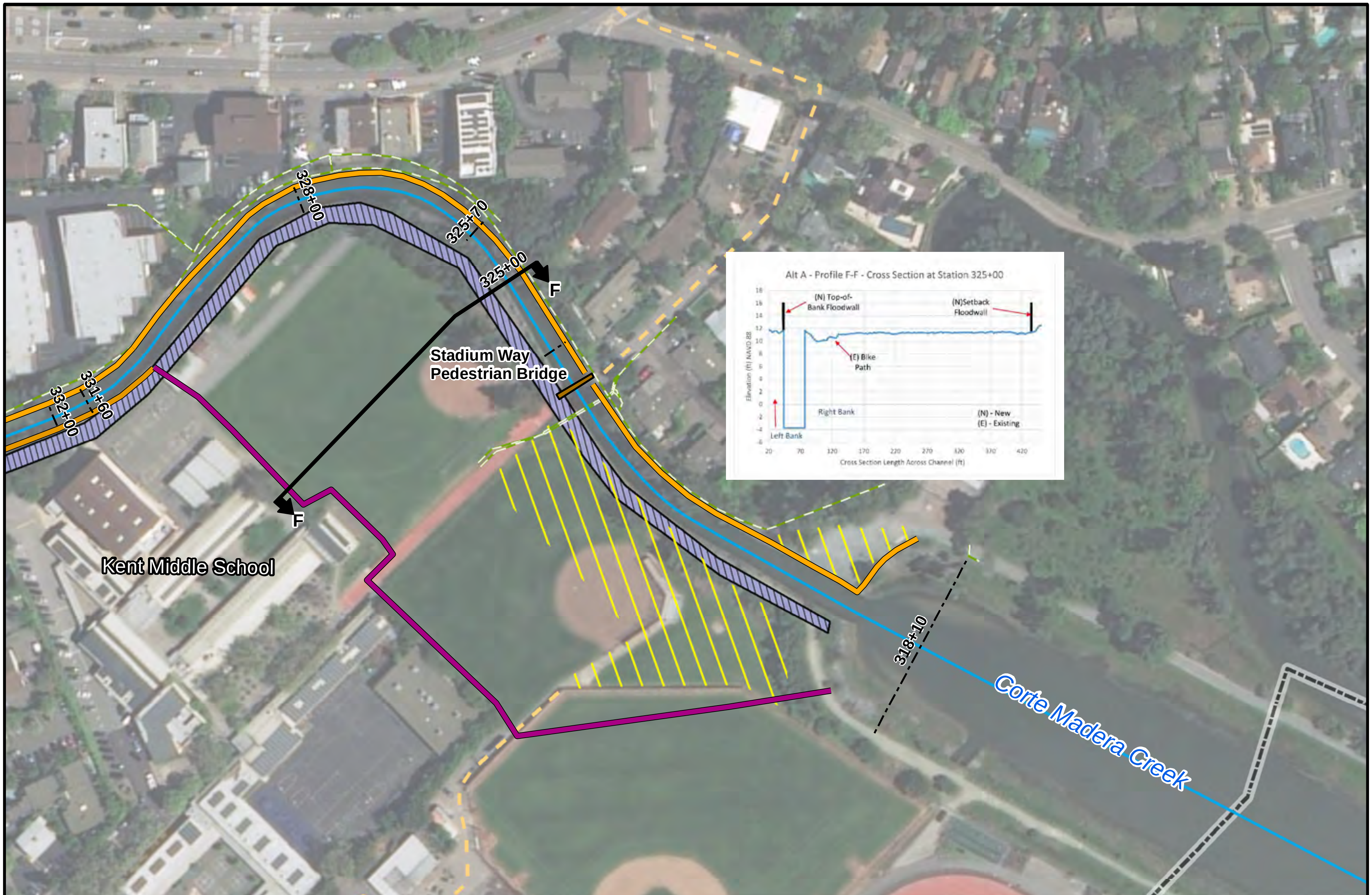
Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative A

Figure 3-1e SMN Bridge to Kent Middle School

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative A

- Fish Ladder Removal
- Fish Passage Transition Grading
- Grading
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 10.5 - 11
- 5 - 5.5
- 7 - 7.5
- 8 - 9

Maximum Setback Floodwall Heights (feet)

- 7

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area

- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative A

Figure 3-1f Kent Middle School to Downstream Limit

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

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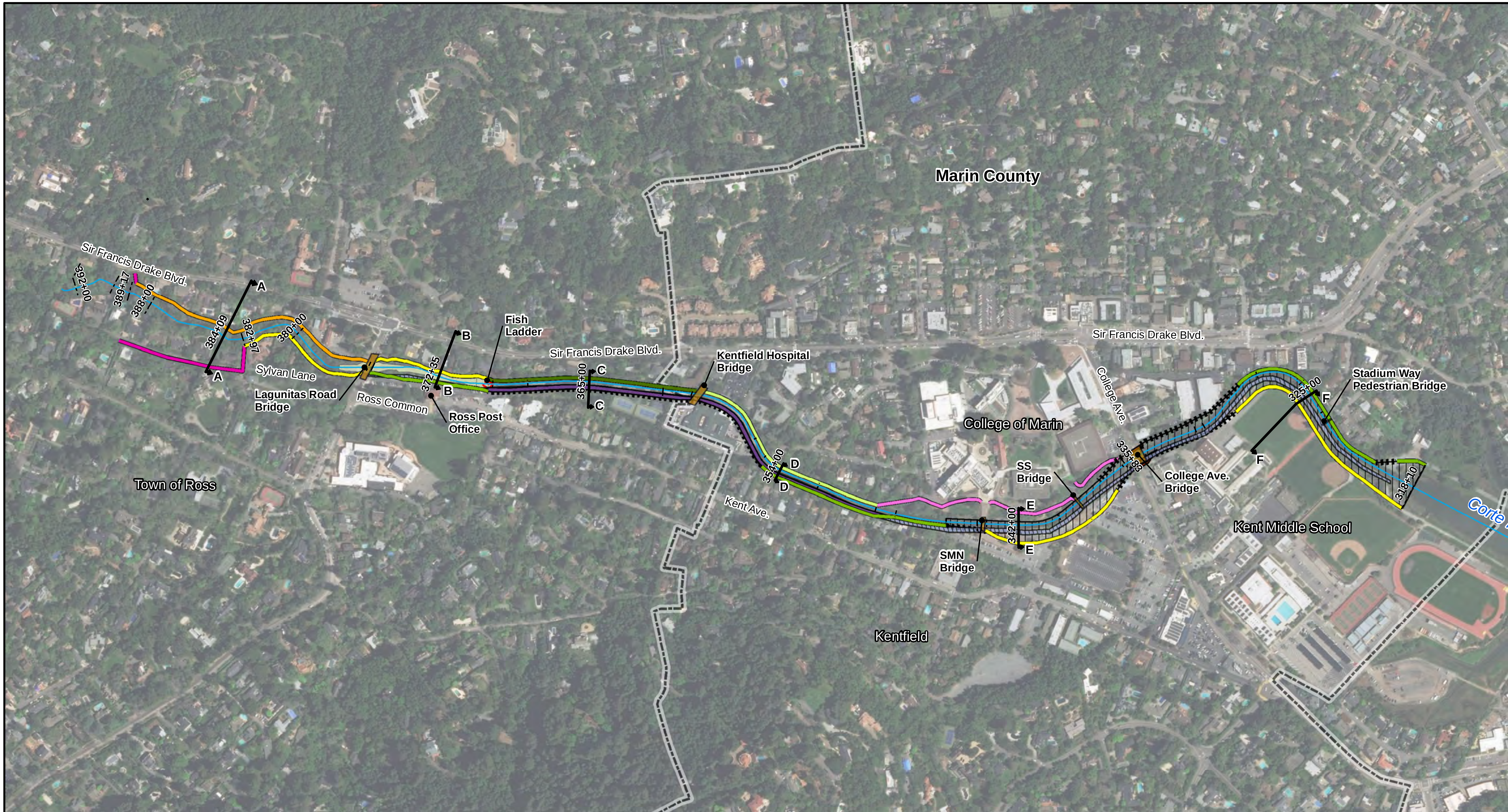


Alternative B

- Retaining Walls
- Fish Ladder Removal
- Fish Passage Transition Grading
- Grading
- Bench Excavation
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 5 - 5.5
- 6 - 6.5
- 7 - 7.5

Maximum Setback Floodwall Heights (feet)

- 6
- 4

Existing Features

- Corte Madera Creek Centerline
- Bridges
- Existing Bike Lane
- Channel Stations
- Cross-Section Location

0 237.5 475 950 Feet

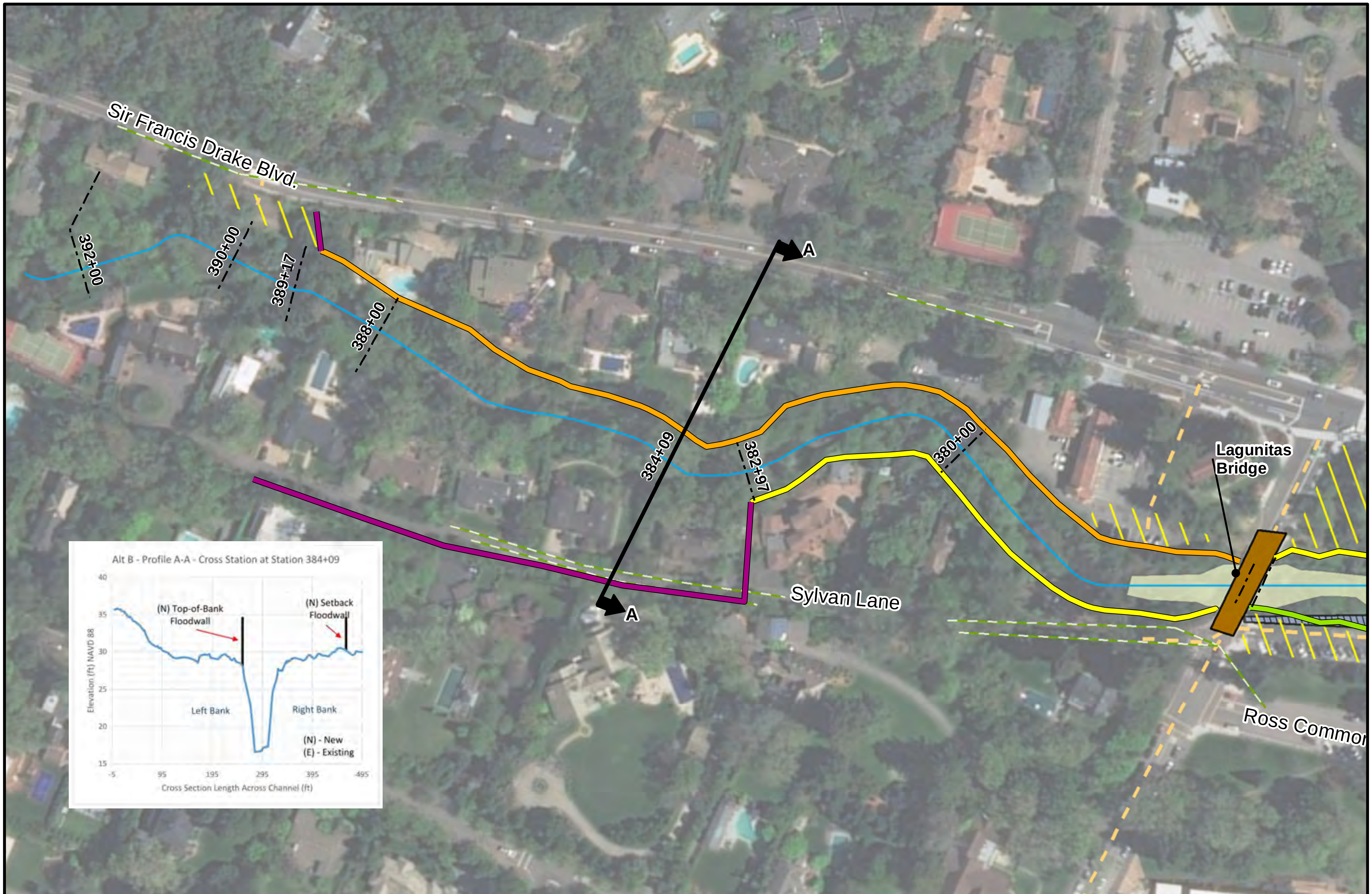
Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative B
Figure 3 - 2a Overview

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative B

- Alt_BFG_Retaining Walls
- Fish Ladder Removal
- Fish Passage Transition Grading
- Grading
- Bench Excavation
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 5 - 5.5
- 6 - 6.5
- 7 - 7.5

Maximum Setback Floodwall Heights (feet)

- 4
- 6

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location

Page 1 of 5

0 50 100 200 Feet

Date: 10/4/2018

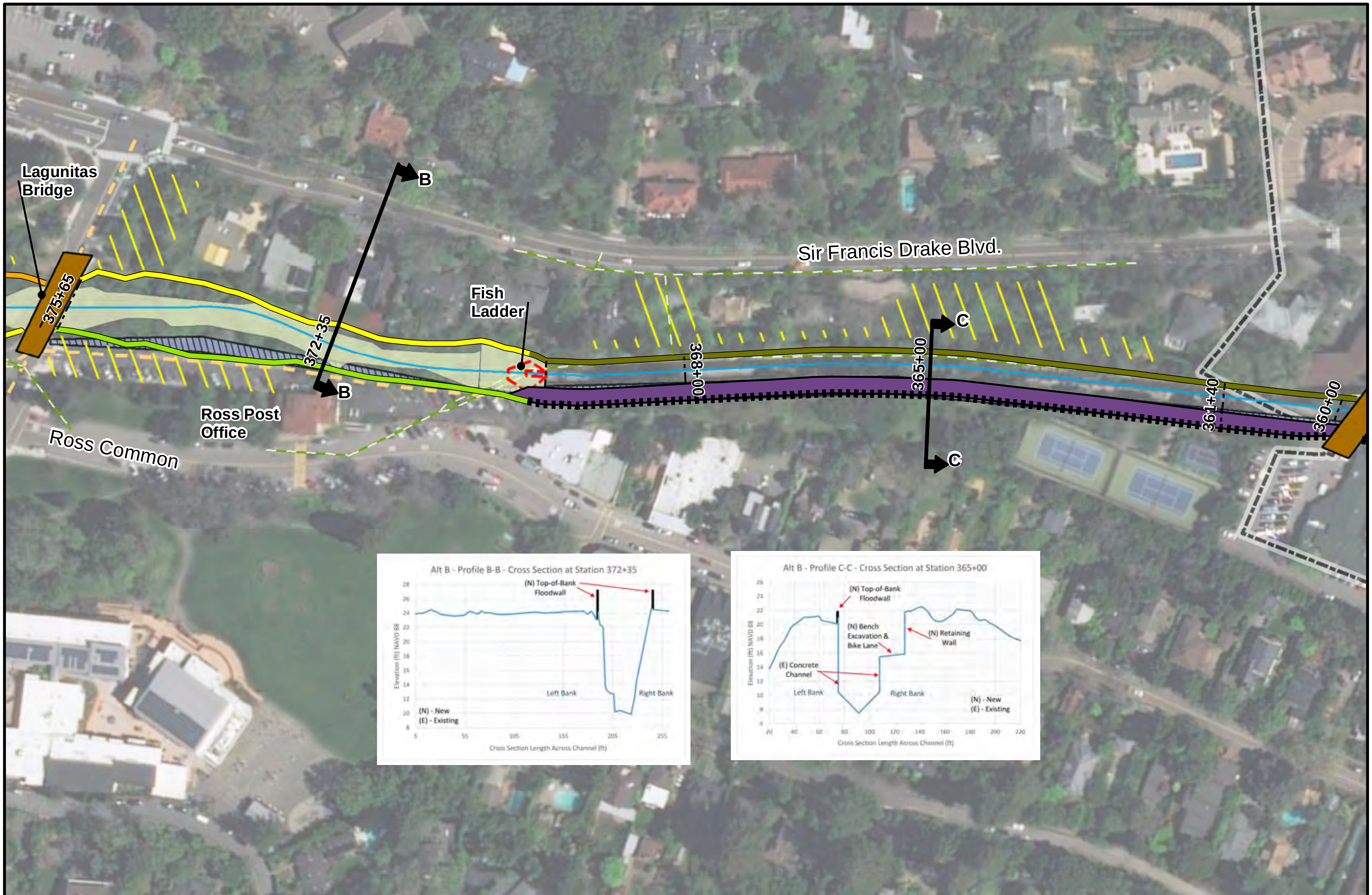
Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative B

Figure 3-2b Upstream Limit to Lagunitas Road Bridge

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative B

- Alt_BFG_Retaining Walls
- Fish Ladder Removal
- Fish Passage Transition Grading
- Grading
- Bench Excavation
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 5 - 5.5
- 6 - 6.5
- 7 - 7.5

Maximum Setback Floodwall Heights (feet)

- 4
- 6

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location

Page 2 of 5

0 50 100 200 Feet

Date: 10/4/2018

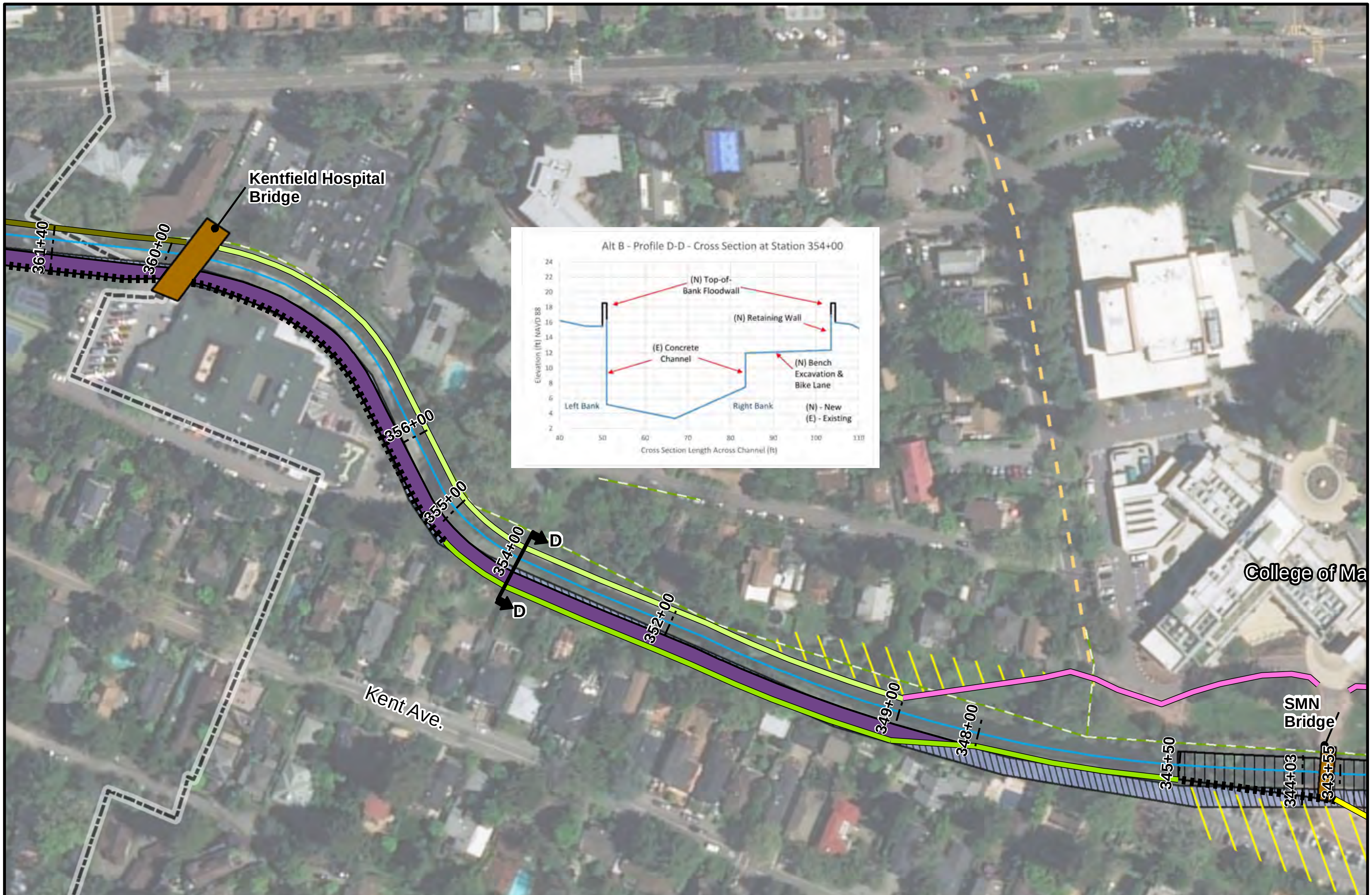
Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative B

Figure 3-2c Lagunitas Road Bridge to End of Allen Park

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative B

- Alt_BFG_Retaining Walls
- Fish Ladder Removal
- Fish Passage Transition Grading
- Grading
- Bench Excavation
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 5 - 5.5
- 6 - 6.5
- 7 - 7.5

Maximum Setback Floodwall Heights (feet)

- 4
- 6

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location

0 50 100 200 Feet

Date: 10/4/2018

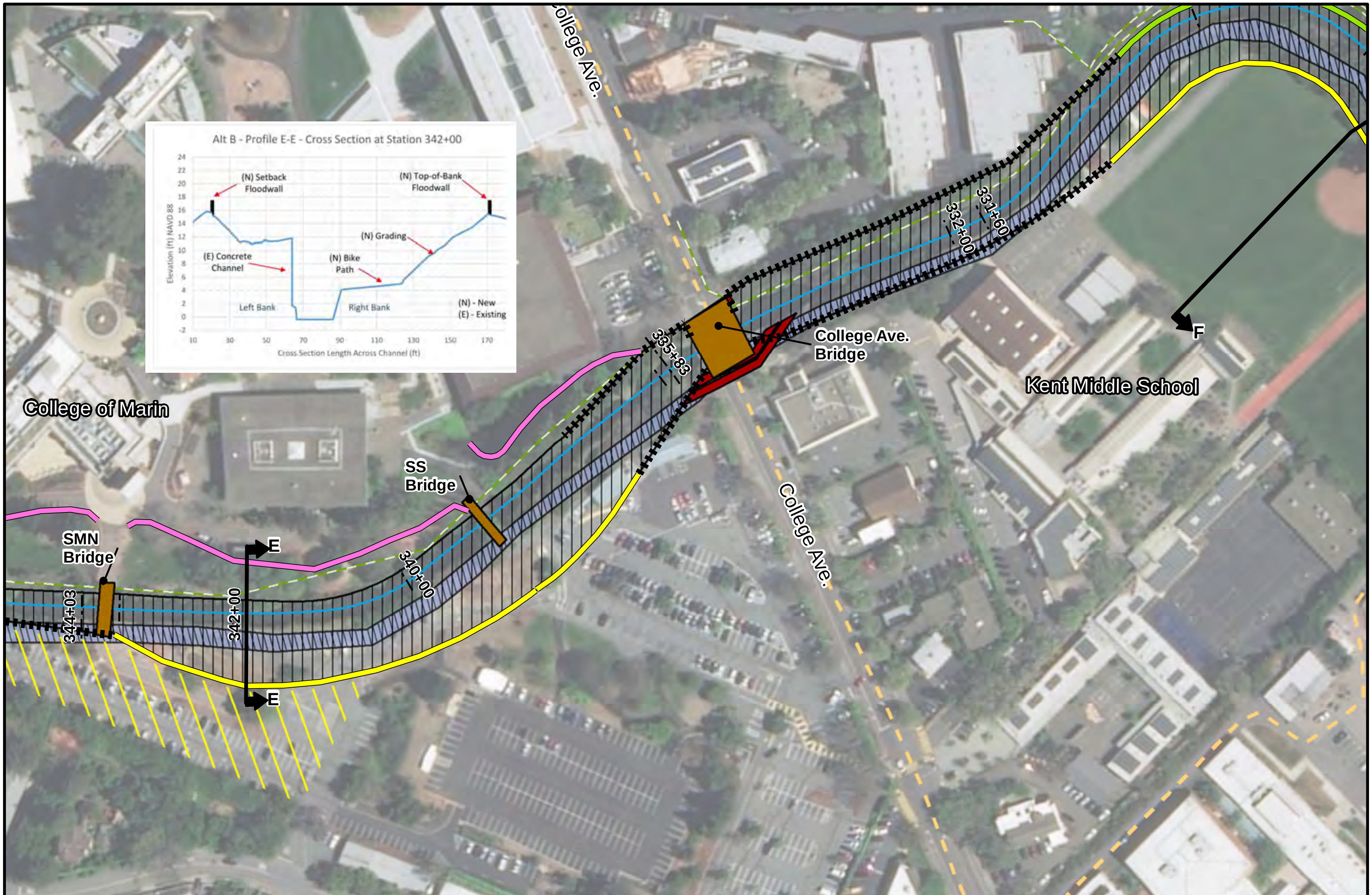
Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative B

Figure 3-2d End of Allen Park to College of Marin

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative B

- Alt_BFG_Retaining Walls
- Fish Ladder Removal
- Fish Passage Transition Grading
- Grading
- Bench Excavation
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 5 - 5.5
- 6 - 6.5
- 7 - 7.5

Maximum Setback Floodwall Heights (feet)

- 4
- 6

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location

0 50 100 200 Feet

Date: 10/4/2018

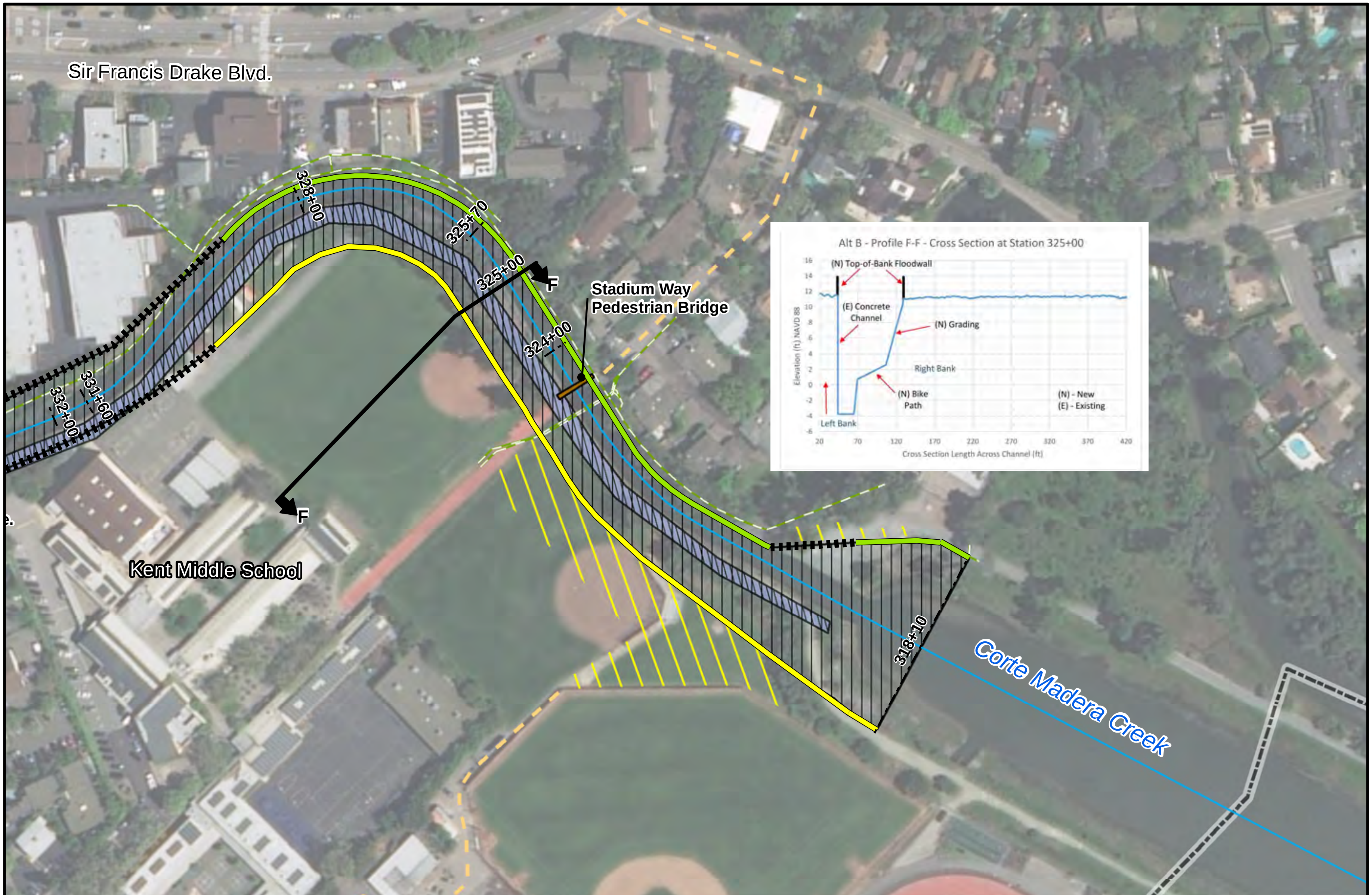
Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative B

Figure 3-2e SMN Bridge to Kent Middle School

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative B

- Alt_BFG_Retaining Walls
- Fish Ladder Removal
- Fish Passage Transition Grading
- Grading
- Bench Excavation
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 5 - 5.5
- 6 - 6.5
- 7 - 7.5

Maximum Setback Floodwall Heights (feet)

- 4
- 6

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location

0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative B

Figure 3-2f Kent Middle School to Downstream Limit

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

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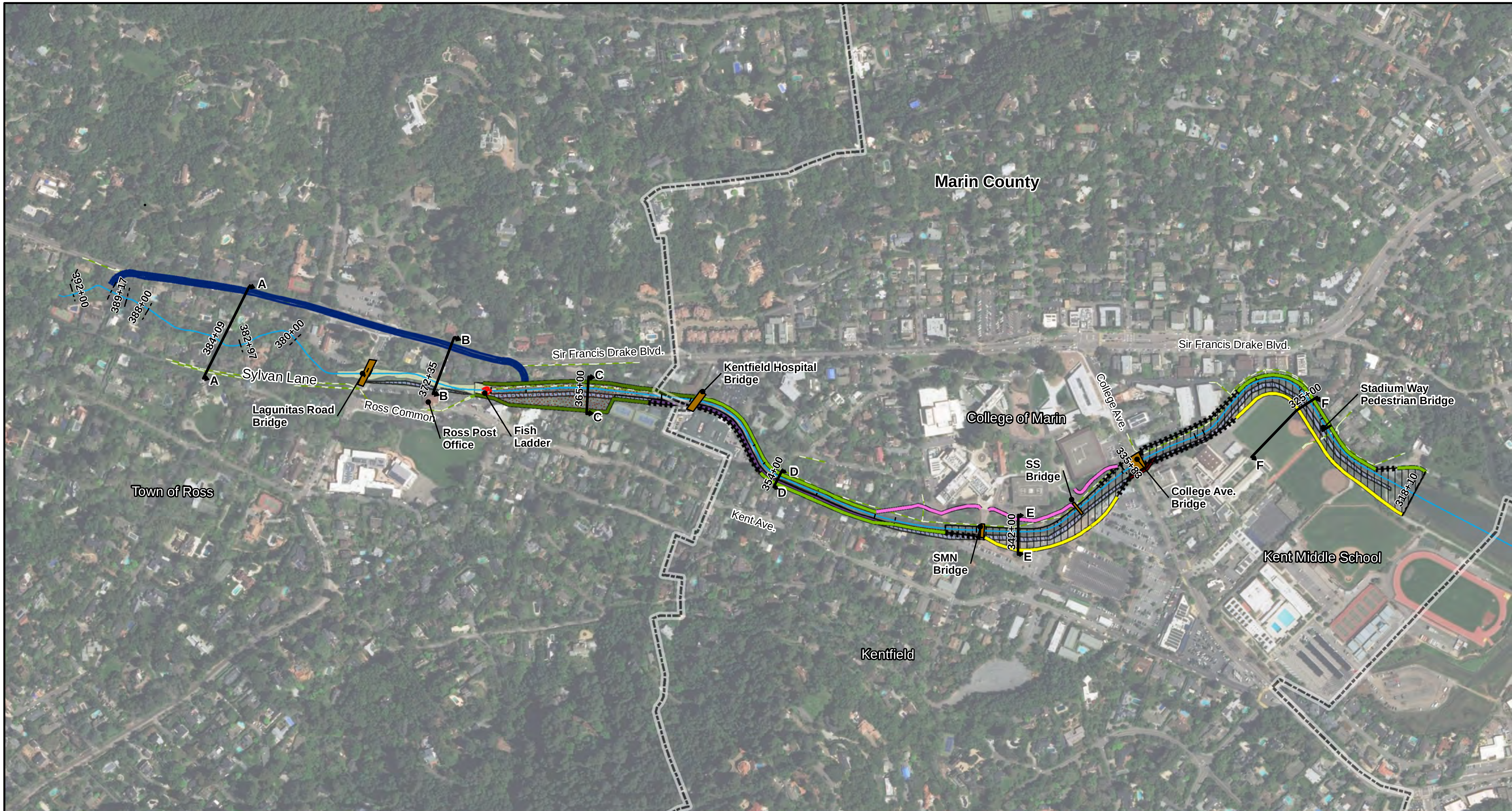


Alternative F

- Bypass Culverts
- Retaining Walls
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading
- Bench Excavation
- Grading Polygon
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 6 - 6.5

Maximum Setback Floodwall Heights (feet)

- 4

Existing Features

- Corte Madera Creek Centerline
- Bridges
- Existing Bike Lane
- Channel Stations
- Cross-Section Location

0 200 400 800 Feet

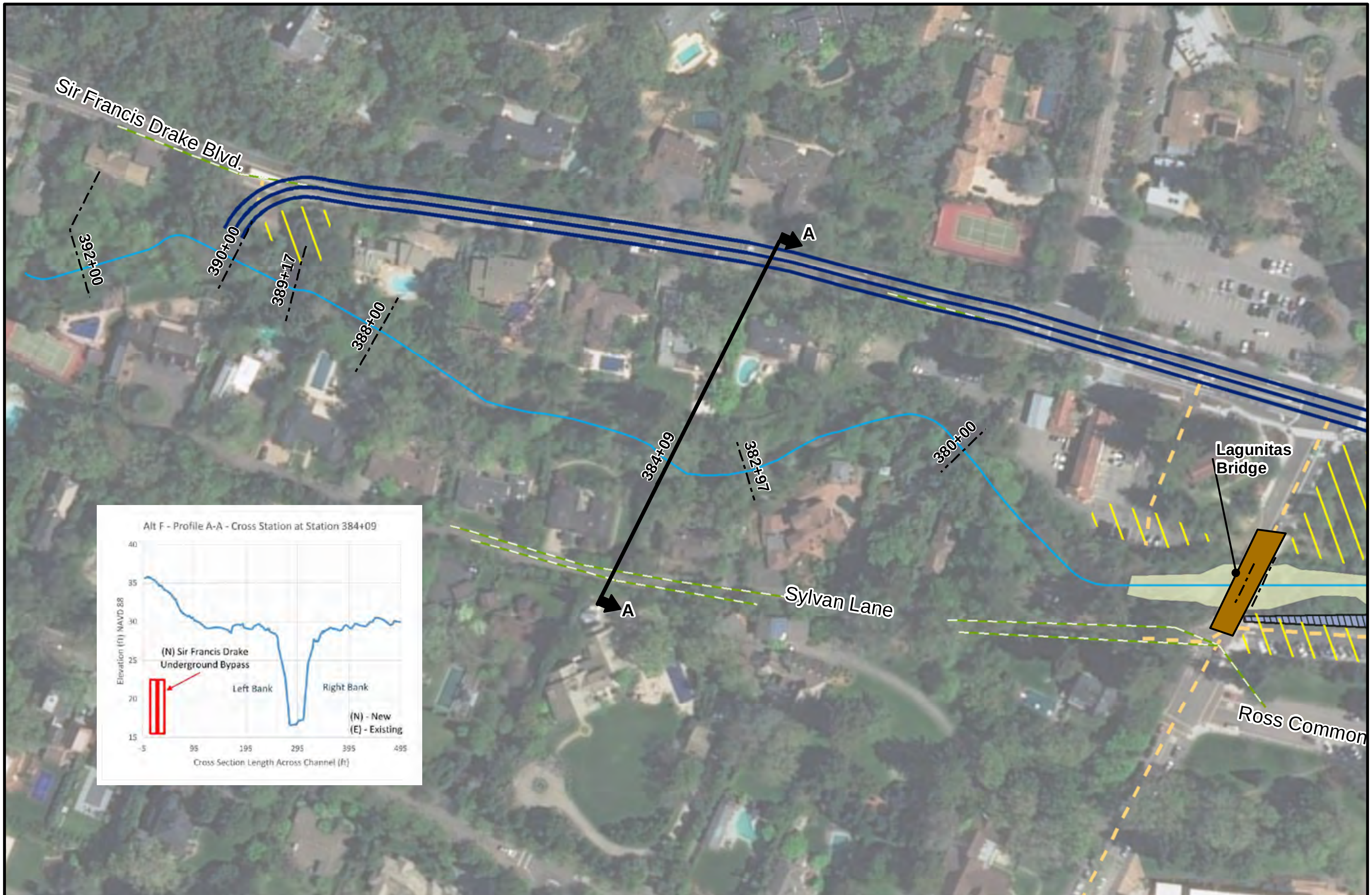
Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative F
Figure 3 - 3a Overview

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative F

- Bypass Culverts
- Retaining Walls
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading
- Bench Excavation
- Grading Polygon
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 6 - 6.5

Maximum Setback Floodwall Heights (feet)

- 4

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Page 1 of 5

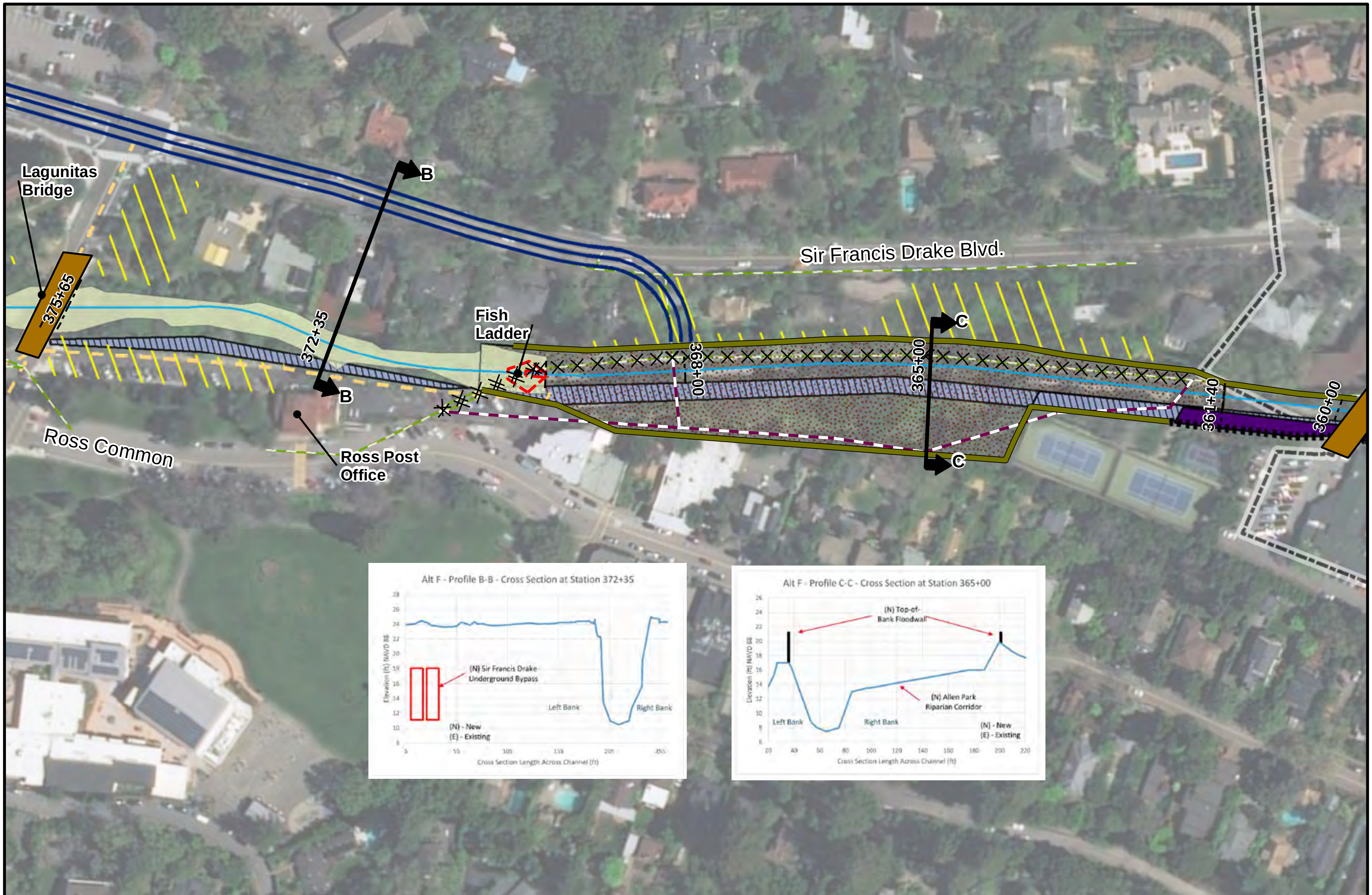
Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative F

Figure 3-3b Upstream Limit to Lagunitas Road Bridge
Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative F
- Bypass Culverts
- Retaining Walls
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading
- Bench Excavation
- Grading Polygon
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)
- 1 - 1.5
- 3.5 - 4
- 6 - 6.5

Maximum Setback Floodwall Heights (feet)
- 4

Existing Features
- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative F

Figure 3-3c Lagunitas Road Bridge to End of Allen Park
Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

Alternative F

- Bypass Culverts
- Retaining Walls
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading
- Bench Excavation
- Grading Polygon
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 6 - 6.5

Maximum Setback Floodwall Heights (feet)

- 4

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area

- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

Page 3 of 5

0 50 100 200 Feet

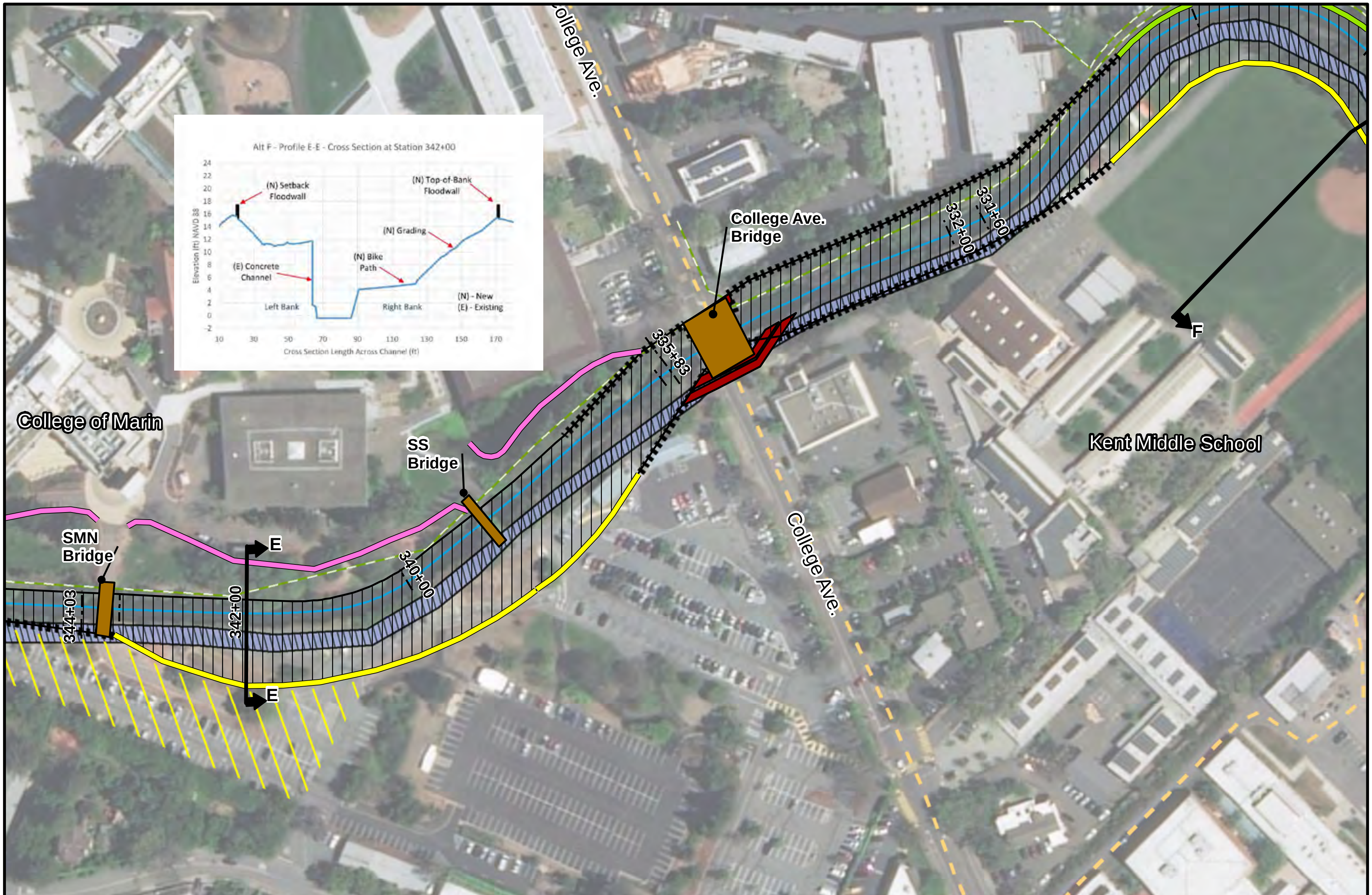
Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative F

Figure 3-3d End of Allen Park to College of Marin
Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative F

- Bypass Culverts
- Retaining Walls
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading
- Bench Excavation
- Grading Polygon
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 6 - 6.5

Maximum Setback Floodwall Heights (feet)

- 4

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

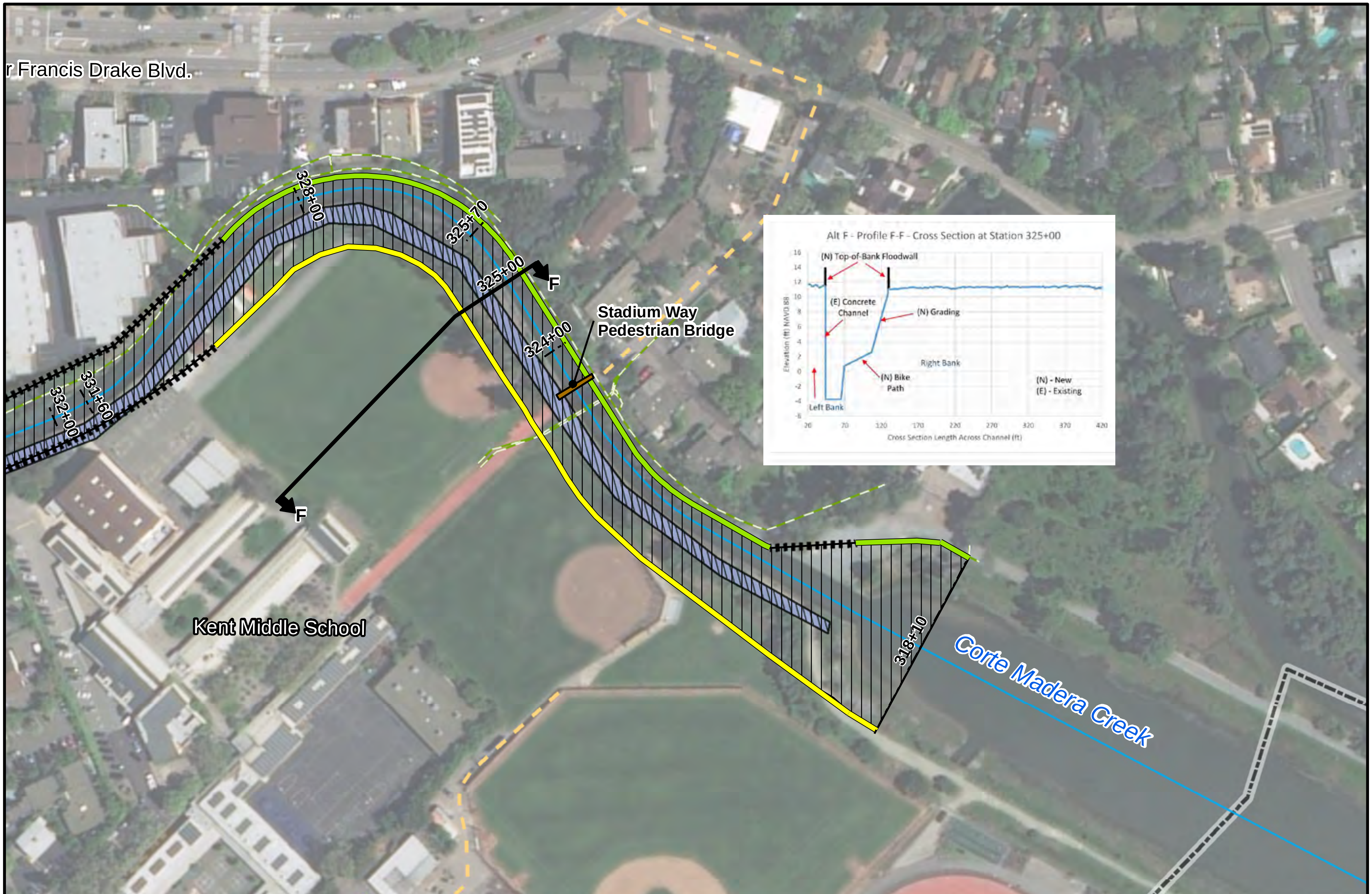
Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018; USACE, 2017; Atkins 2011; ESRI Data Server, 2012

Alternative F

Figure 3-3e SMN Bridge to Kent Middle School
Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative F

- Bypass Culverts
- Retaining Walls
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading
- Bench Excavation
- Grading Polygon
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 6 - 6.5

Maximum Setback Floodwall Heights (feet)

- 4

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Page 5 of 5

Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative F

Figure 3-3f Kent Middle School to Downstream Limit
Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

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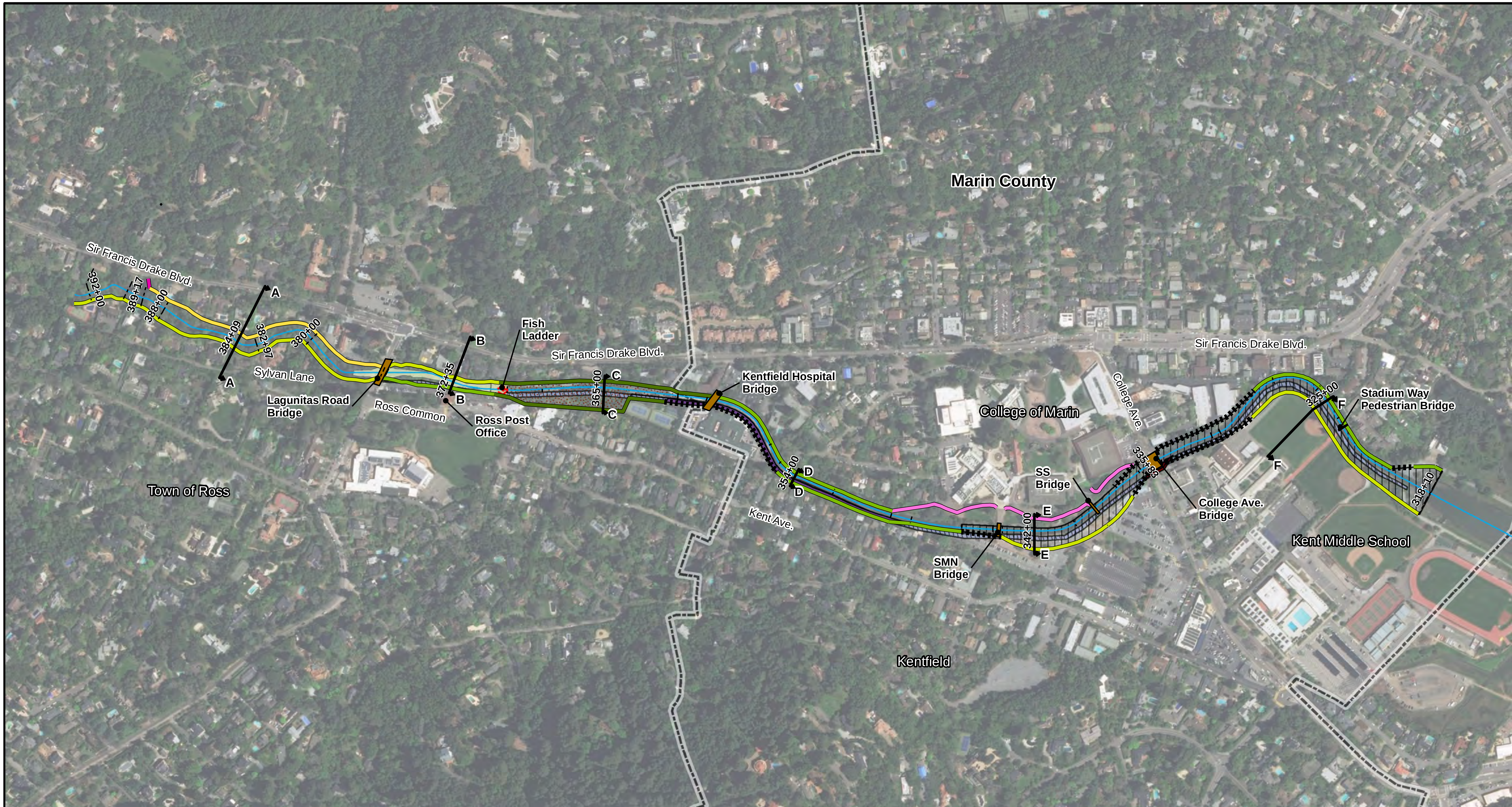


Alternative G

- Retaining Walls
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading
- BenchExcavation
- Grading
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 6 - 6.5
- 7 - 7.5

Maximum Setback Floodwall Heights (feet)

- 4
- 5

Existing Features

- Corte Madera Creek Centerline
- Bridges
- Existing Bike Lane
- Channel Stations
- Cross-Section Location

0 230 460 920 Feet

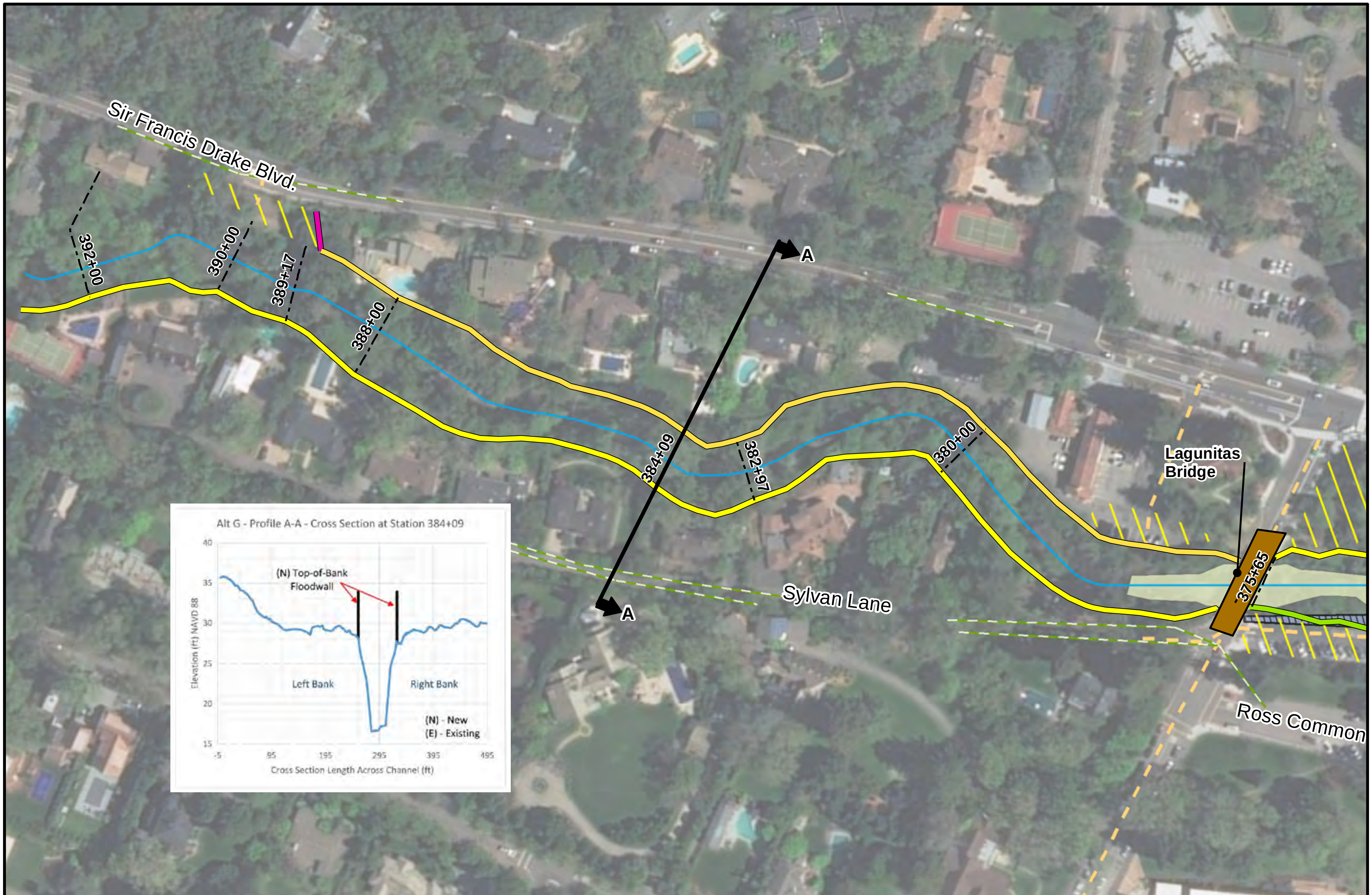
Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative G
Figure 3 - 4a Overview

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative G

- Retaining Walls
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading
- BenchExcavation
- Grading
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 6 - 6.5
- 7 - 7.5

Maximum Setback Floodwall Heights (feet)

- 4
- 5

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Date: 10/4/2018

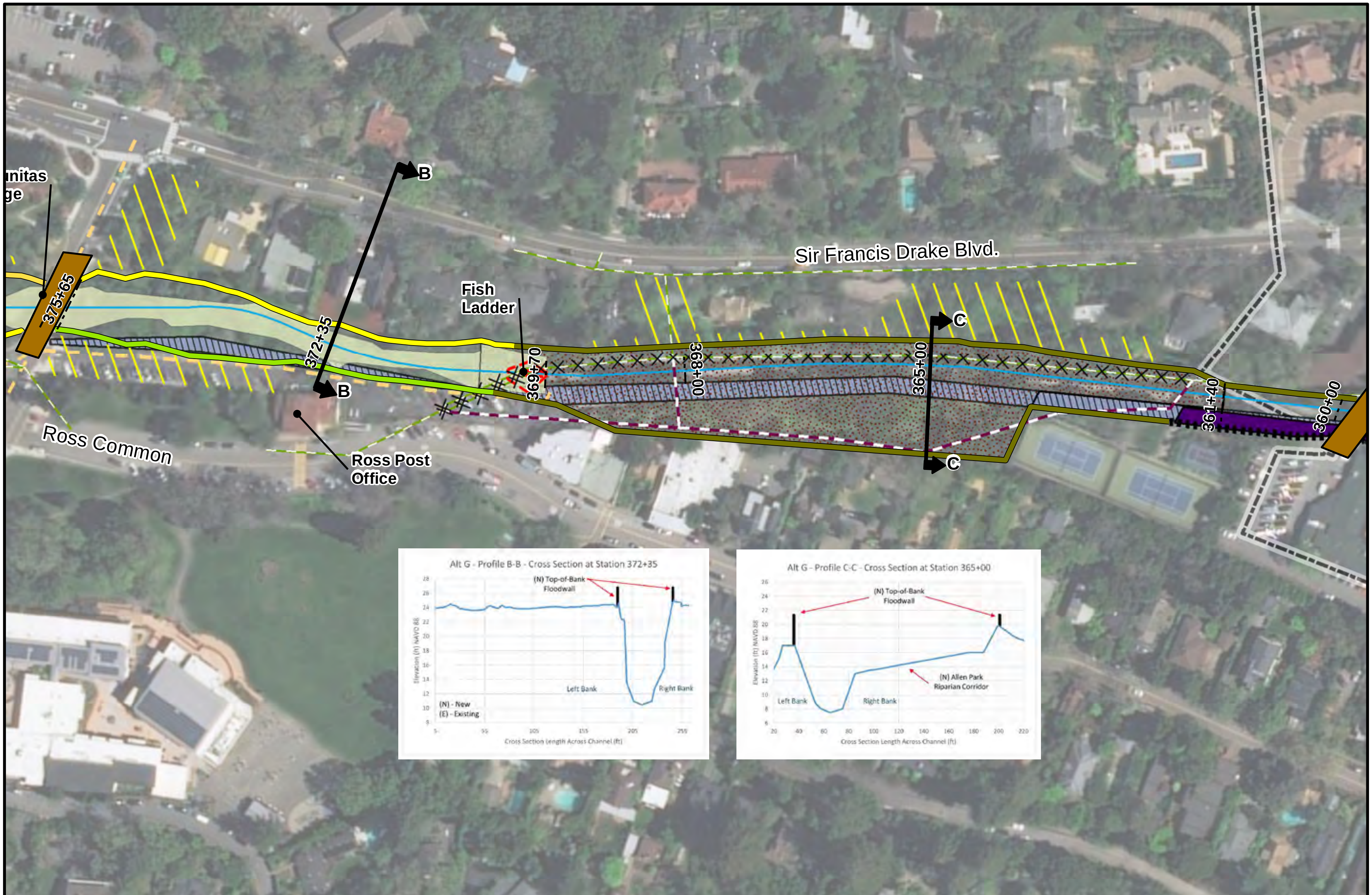
Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative G

Figure 3-4b Upstream Limit to Lagunitas Road Bridge

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative G

- Retaining Walls
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading
- BenchExcavation
- Grading
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 6 - 6.5
- 7 - 7.5

Maximum Setback Floodwall Heights (feet)

- 4
- 5

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative G

Figure 3-4c Lagunitas Road Bridge to End of Allen Park

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

Alternative G

- Retaining Walls
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading
- BenchExcavation
- Grading
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 6 - 6.5
- 7 - 7.5

Maximum Setback Floodwall Heights (feet)

- 4
- 5

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

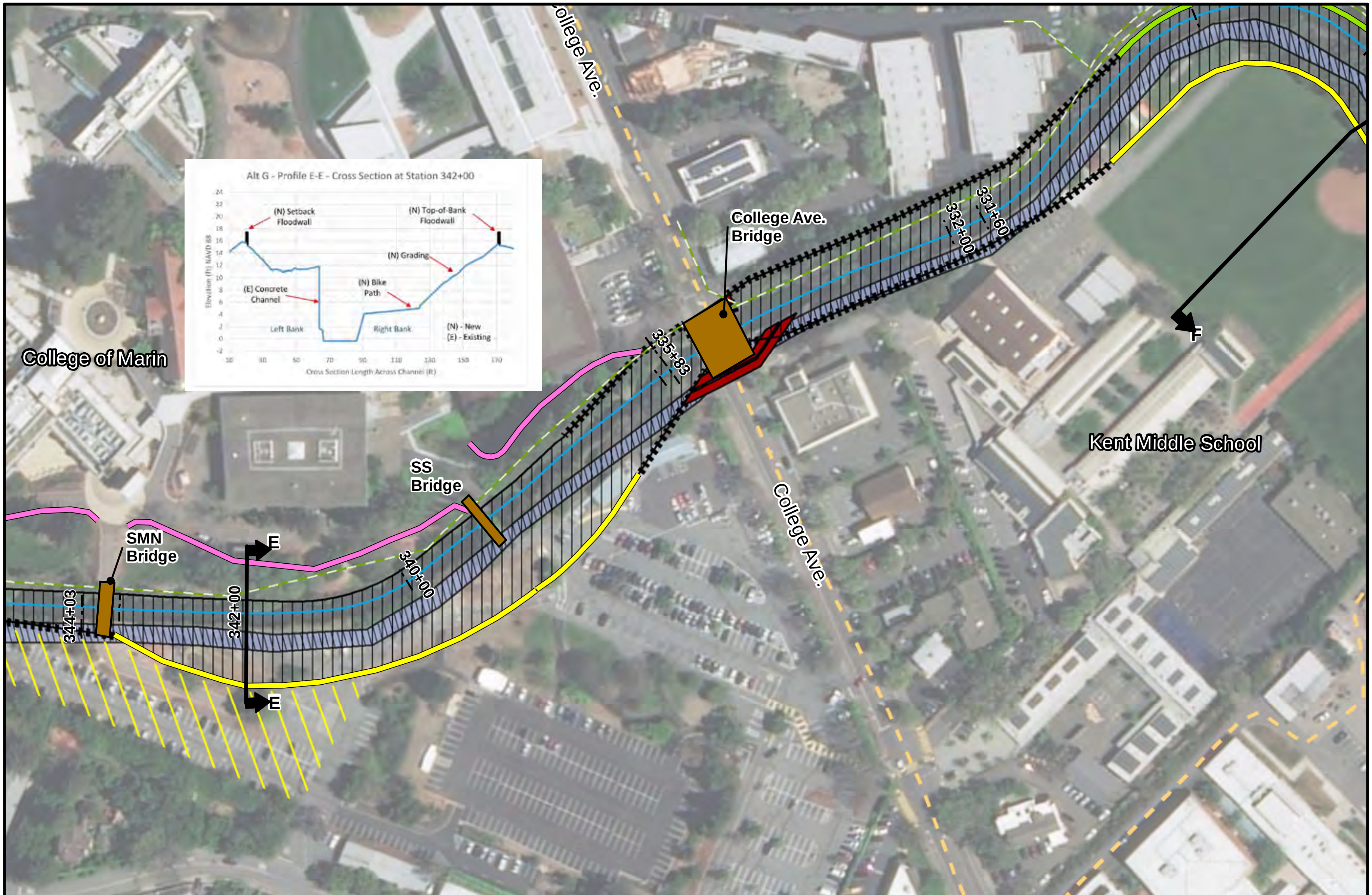
Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative G
Figure 3-4d End of Allen Park to College of Marin

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative G

- Retaining Walls
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading
- BenchExcavation
- Grading
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)

- 1 - 1.5
- 3.5 - 4
- 6 - 6.5
- 7 - 7.5

Maximum Setback Floodwall Heights (feet)

- 4
- 5

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Date: 10/4/2018

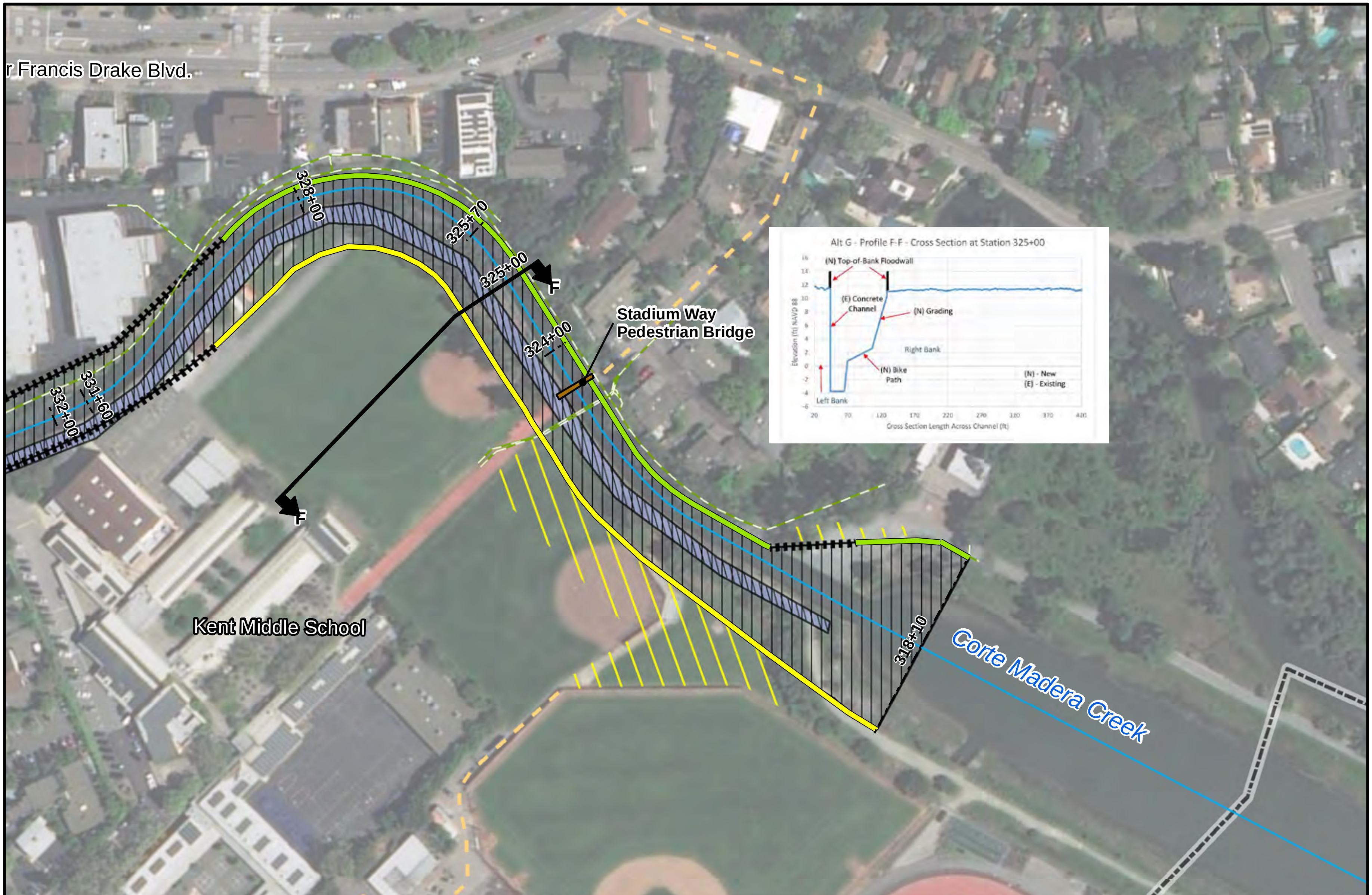
Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative G

Figure 3-4e SMN Bridge to Kent Middle School

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative G
- Retaining Walls
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading
- BenchExcavation
- Grading
- College Ave Culverts

Maximum Top of Bank Floodwall Heights (feet)
- 1 - 1.5
- 3.5 - 4
- 6 - 6.5
- 7 - 7.5

Maximum Setback Floodwall Heights (feet)
- 4
- 5

Existing Features
- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative G
Figure 3-4f Kent Middle School to Downstream Limit

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

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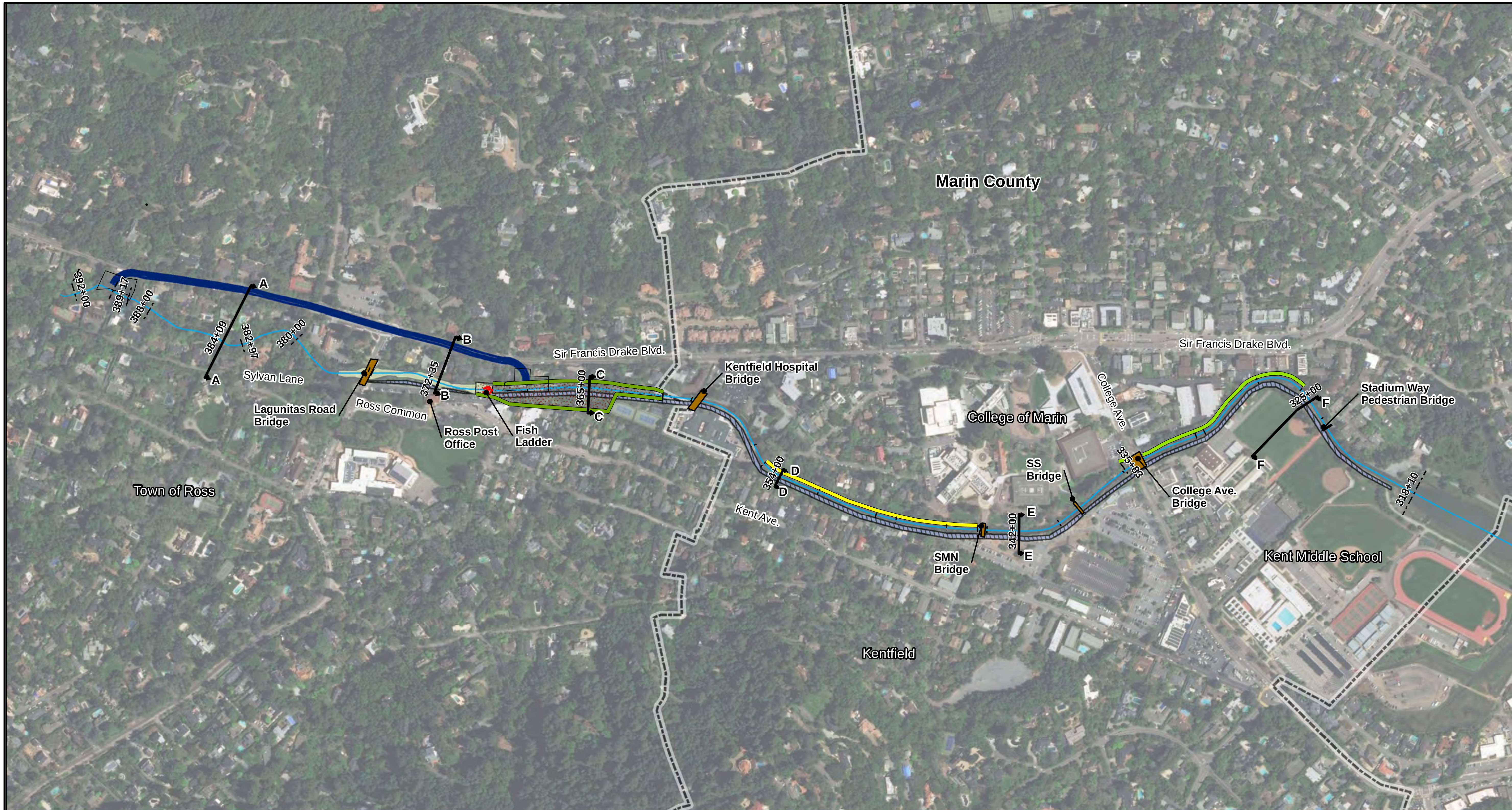


Alternative J

Underground Bypass

Fish Ladder Removal

Allen Park Riparian Corridor

Fish Passage Transition Grading

Maximum Top of Bank Floodwall Heights (feet)

2

3.5 - 4

6 - 6.5

Existing Features

Corte Madera Creek Centerline

Bridges

Existing Bike Lane

Channel Stations

Cross-Section Location

0 200 400 800 Feet

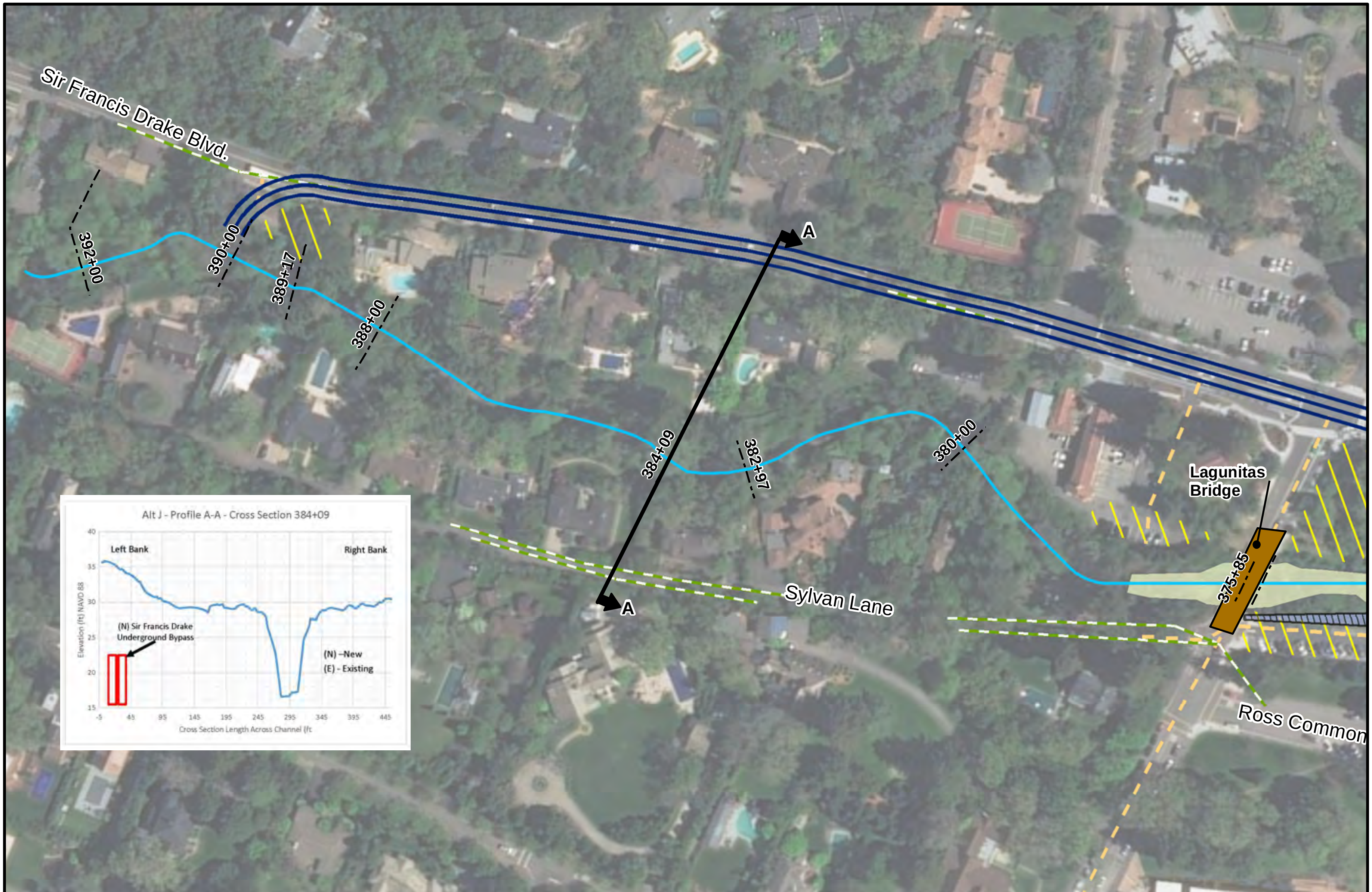
Date: 10/5/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative J
Figure 3 - 5a Overview

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative J

- Bypass Culverts
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading

Maximum Top of Bank Floodwall Heights (feet)

- 2
- 3.5 - 4
- 6 - 6.5

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

Page 1 of 5

0 50 100 200 Feet

Date: 10/4/2018

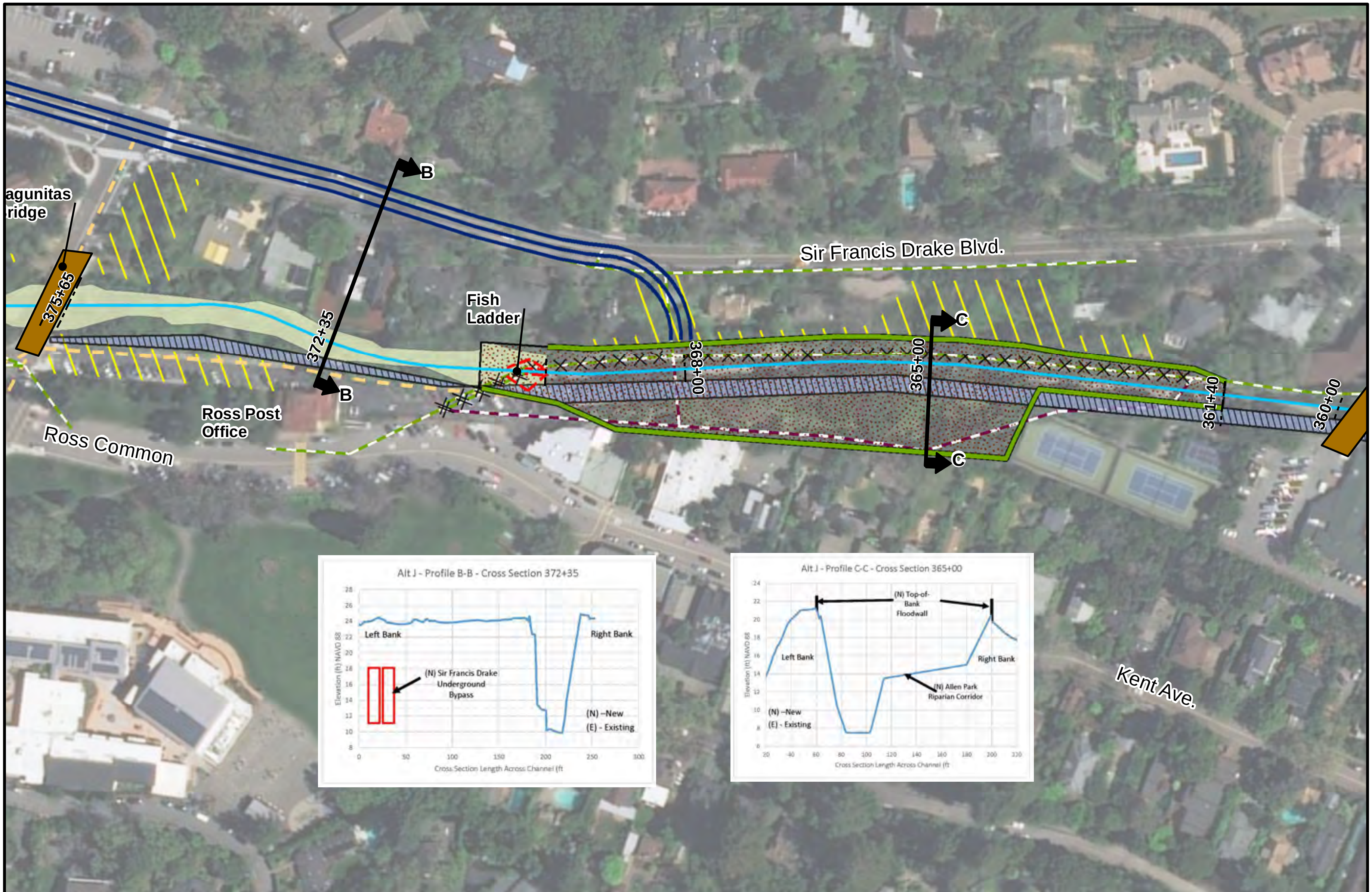
Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative J

Figure 3-5b Upstream Limit to Lagunitas Road Bridge

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative J

- Bypass Culverts
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading

Maximum Top of Bank Floodwall Heights (feet)

- 2
- 3.5 - 4
- 6 - 6.5

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

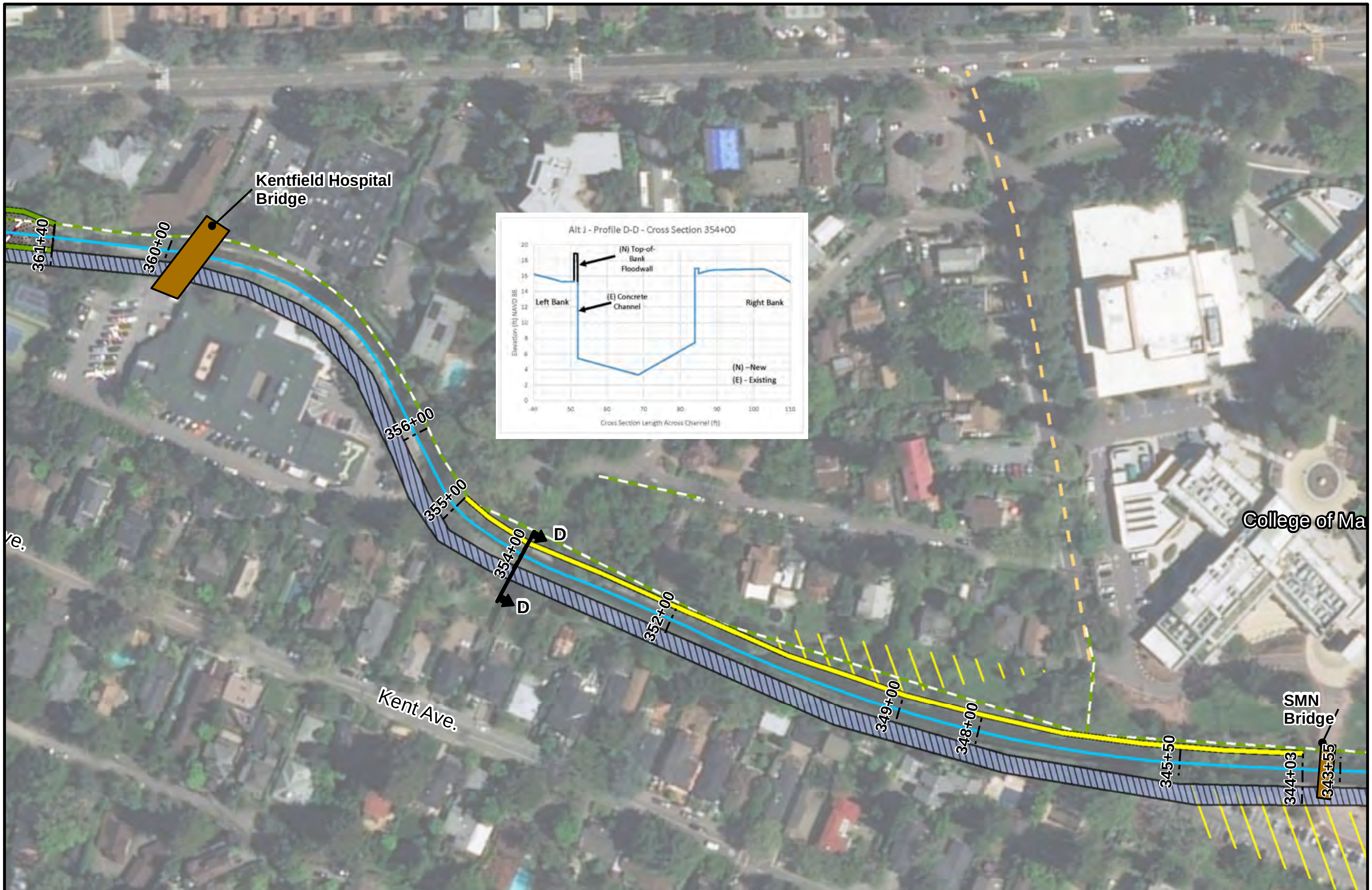
Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative J
Figure 3-5c Lagunitas Road Bridge to End of Allen Park

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative J
- Bypass Culverts
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading

Maximum Top of Bank Floodwall Heights (feet)
- 2
- 3.5 - 4
- 6 - 6.5

Existing Features
- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

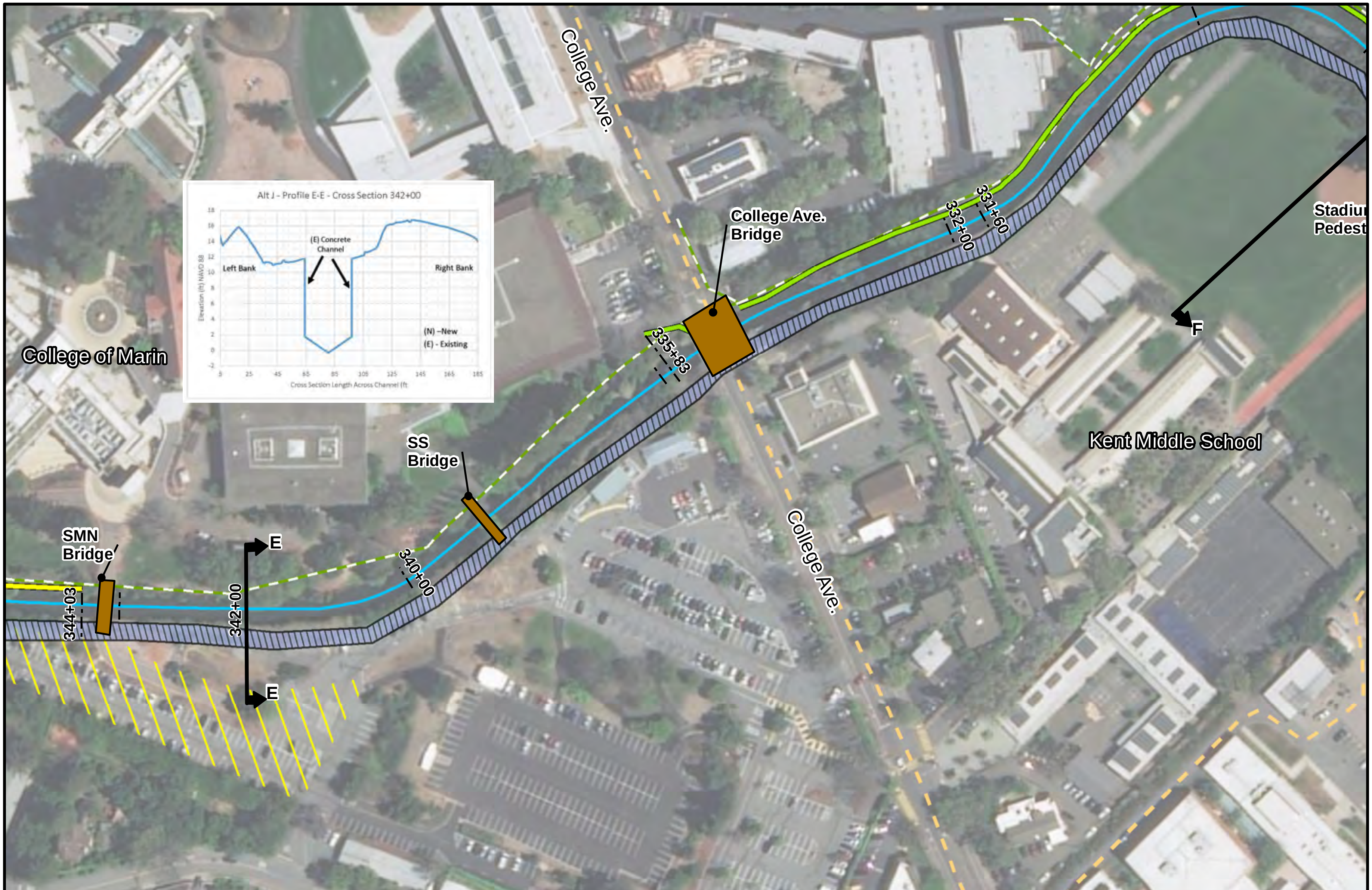
Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative J
Figure 3-5d End of Allen Park to College of Marin

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Alternative J

- Bypass Culverts
- Fish Ladder Removal
- Allen Park Riparian Corridor
- Fish Passage Transition Grading

Maximum Top of Bank Floodwall Heights (feet)

- 2
- 3.5 - 4
- 6 - 6.5

Existing Features

- Corte Madera Creek Centerline
- Ross Valley Sewer Line
- Access Routes
- Bridges
- Existing Bike Lane
- Staging Area
- Channel Stations
- Cross-Section Location
- Sewer Demolition
- Ross Valley Sewer Realignment

0 50 100 200 Feet

Date: 10/4/2018

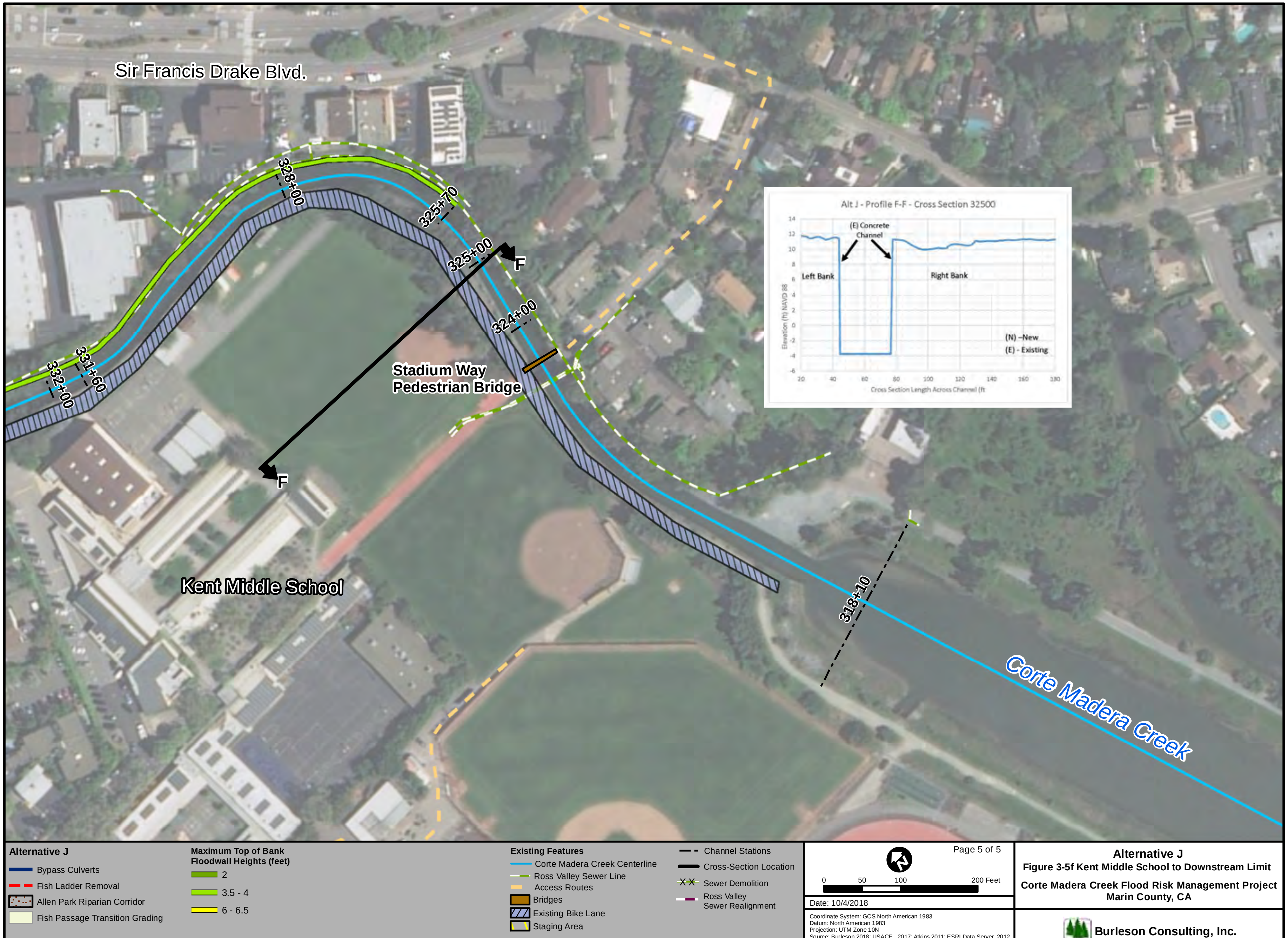
Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative J

Figure 3-5e SMN Bridge to Kent Middle School

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Page 5 of 5

Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative J

Figure 3-5f Kent Middle School to Downstream Limit

Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

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4 AFFECTED ENVIRONMENT, ENVIRONMENTAL CONSEQUENCES, AND CUMULATIVE EFFECTS

Approach to the Environmental Analysis

In accordance with National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA), this chapter evaluates the effects on the social, economic, and natural environment that would result from implementation of the final array of alternatives identified in Chapter 3 Description of Alternatives. This chapter fulfills the NEPA and CEQA requirements by evaluating the consequences of the Project alternatives. This chapter includes a discussion of the analysis for each resource area that may be affected by implementation of the Project. Each resource area is evaluated for effects (also called impacts) on each of the alternatives described in Chapter 3, including the no action alternative. Pursuant to NEPA, impacts are addressed in proportion to their significance (40 Code of Federal Regulations [CFR] § 1502[b]). Pursuant to CEQA, impacts that are less than significant are only briefly described (14 California Code of Regulations [CCR] § 15128), and for each significant impact and feasible mitigation measures are identified and their effectiveness in reducing or avoiding the impact evaluated.

Organization of This Chapter

The approach to the environmental analysis provides background information such as the general approach to evaluation; application of significance thresholds; descriptions of the study area and regional setting; a listing of resources considered but not studied in detail; and descriptions of resources found to be potentially significant or important in the study area.

Detailed evaluations of specific resource topics are included in Sections 4.1 to 4.16 (Table 4.1-11 Resources Evaluated in Detail). Information is presented in narrative, tabular, and graphic form as appropriate for the topic being evaluated.

TABLE 4-1 RESOURCES EVALUATED IN DETAIL

Section	Topics
4.1	Hydrology and Hydraulics
4.2	Water Quality
4.3	Geology and Soils
4.4	Air Quality
4.5	Climate Change
4.6	Biology Resources
4.7	Cultural Resources
4.8	Aesthetics
4.9	Recreation
4.10	Noise
4.11	Land Use
4.12	Human, Health, and Safety
4.13	Traffic, Transportation and Circulation
4.14	Environmental Justice
4.15	Socioeconomics
4.16	Utilities and Public Services

The Project was found to not have an impact to some resources, and therefore, those resources were not evaluated in detail, as further explained.

Resource Areas Not Evaluated in Detail

Agriculture, forestry, and mineral resources were not evaluated in detail as separate resource areas. All land uses in the study area are highly developed suburban property (residential, commercial, and public uses). Other than the creek bed itself, there is no undeveloped or open space land, farmland, or agricultural uses that would be potentially impacted by the project alternatives. No farmland would be converted to non-agricultural uses and the project would not conflict with zoning for agricultural uses. There would be no loss of forest land or conversion or rezoning of forest land to non-forest uses. Any tree that would be impacted or removed would be protected by the regulations and ordinances discussed in Section 4.6 Biological Resources. Therefore, agriculture and forestry resources were not further evaluated and would not be impacted by any of the alternative tasks.

Mineral resources were not evaluated in detail because the project and study area are located in a built environment. Other than the creek bed, all adjacent land uses are existing developed residential, commercial, or public uses. There would be no loss of availability of a known mineral resource or a mineral resource recovery site due to the project. Therefore, mineral resources were not further evaluated and would not be impacted by any of the Project alternatives.

Resources Evaluated in Detail

The analysis of each resource topic is organized into the following subsections:

- **Regulatory Setting.** This section describes the regulatory framework for each topic (i.e., the applicable federal, state, and local regulations that apply to the topic being discussed). Details of federal and state regulations which require permits or other approvals or are relevant to several resource categories are briefly mentioned in this section and the reader is referred to Chapter 9 for details regarding the respective regulation.
- **Affected Environment**. This section describes the local and regional conditions that provide the baseline condition and sufficient context for evaluating effects of the Corte Madera Creek Flood Risk Management Project (Project) alternatives.
- **Environmental Consequences**. This section provides the analysis of the potential effects of the project alternatives, including the no action alternative. This section begins by defining AMMs, topic-specific methodology used, and significance thresholds applied in the evaluation.
    - **Avoidance and Minimization Measures.** AMMs are those parameters that have been built into the design of the project alternatives and are committed to as part of project implementation. These measures are included in the alternatives description (Chapter 3), but, where appropriate, specific measures related to each impact evaluation are also summarized in the resource section.
- **Alternatives Evaluation**. This section, which is part of the environmental consequences discussion, provides detailed analysis of the no action and action alternatives.
    - **No Action Alternative.** This section describes the effects of not implementing an action alternative with respect to the topic being evaluated and provides a useful comparison against action alternatives. This section also includes a significance determination regarding impacts resulting from the no action alternative.
    - **Action Alternatives.** This section begins by describing the impacts common to all action alternatives, including effects from construction and operations and maintenance, if appropriate for the topic being evaluated. In addition, this section compares differences from impacts generated by alternatives.
- **Mitigation Measures**. The alternatives evaluation section includes mitigation measures that are needed to avoid, reduce, or minimize identified significant environmental impacts.

  - Mitigation measures are measures that would require implementation to avoid or minimize adverse effects of the project alternatives. Mitigation measures are requirements that have not been specifically included as part of the overall project (or alternative) description.
  - The word mitigation is defined in NEPA regulations 40 CFR § Sections 1508.20(a)–(e) as:
    - Avoiding the impact altogether by not taking a certain action or parts of an action.
    - Minimizing impacts by limiting the degree or magnitude of the action and its implementation.
    - Rectifying the impact by repairing, rehabilitating, or restoring the affected environment.
    - Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action.
    - Compensating for the impact by replacing or providing substitute resources or environments.
  - A Mitigation Monitoring and Reporting Program is included in Appendix L.
- **Cumulative Effects.** This section describes the cumulative effects of the action alternatives.
- **Summary.** Based on the preceding analysis, this section provides a summary of impacts resulting from the evaluation. This includes a determination that the action alternative(s) would result in no impact, a less-than-significant impact, or a significant impact, under CEQA.

NEPA/CEQA General Criteria for Determining Environmental Impact Significance

The NEPA and CEQA processes use several tools for determining thresholds for environmental impacts. For CEQA, these include the CEQA initial study checklist, defined mandatory findings of significance, agency thresholds of significance, and the active role of consultation with those agencies that manage resources with the potential for impacts.

For the NEPA process, significance requires considerations of context and intensity (40 CFR § 1508.27). Context means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend on local effects rather than on effects in the world as a whole. Both short- and long-term effects are relevant.

Intensity refers to the severity of impact. The following should be considered in evaluating intensity:

- Impacts that may be both beneficial and adverse. A significant effect may exist even if the federal agency believes that on balance the effect would be beneficial.
- The degree to which the proposed action affects public health or safety.
- Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.
- The degree to which the effects on the quality of the human environment are likely to be highly controversial.
- The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.
- The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.
- Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

- The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places (NRHP) or may cause loss or destruction of significant scientific, cultural, or historical resources.
- The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act (ESA) of 1973.
- Whether the action threatens a violation of federal, state, or local law or requirements imposed for the protection of the environment.

Following are additional details regarding CEQA and NEPA guidelines that are considered in the environmental evaluation.

Determining Impacts under the CEQA and CEQA Thresholds of Significance

The CEQA requires EIRs to evaluate the following types of impacts:

- **Direct impacts**: reasonably foreseeable impacts caused by the Project that occur at the same time and place.
- **Indirect impacts**: reasonably foreseeable impacts caused by the Project that may occur later in time or some distance away.
- **Irreversible environmental changes**: generally include loss of nonrenewable resources.
- **Growth-inducing impacts**: the extent to which the Project directly or indirectly fosters growth, removes an obstacle to growth, further taxes community services and facilities, or facilitates other activities that may cause significant environmental effects.
- **Cumulative impacts**: incremental impacts of the proposed Project when added to other closely related past, present, or reasonably foreseeable future projects.

Direct, indirect, and cumulative impacts are described in each resource topic.

For each resource studied, the potential for significant impacts to occur is determined by identifying significance criteria (that is, the conditions that would result in a significant impact) and measuring the expected project impacts against those criteria. If an impact is determined to be significant, and specific and enforceable mitigation to reduce or eliminate the impact is available, then the mitigation is listed in the appropriate resource section of this integrated document. This document also identifies instances in which mitigation reduces the impact but the impact remains significant.

The impact evaluation must take into account the whole action involved, including off-site as well as on-site impacts, cumulative as well as project-level impacts, indirect as well as direct impacts, and construction as well as operational impacts. In general, impacts found significant under CEQA would typically also be considered significant under NEPA.

Determining Impacts under the NEPA and NEPA Thresholds of Significance for Impact Assessment

The NEPA requires federal agencies to study the proposed action's effects on the quality of the human environment, including aspects of the natural environment, built environment, and human health. Federal agencies can use a qualitative or quantitative approach to evaluate effects and may also rely on thresholds used by other agencies. For instance, federal agencies may also consider the analysis under CEQA in determining project effects.

Determining whether proposed actions substantially affect the environment requires consideration of context and intensity. These terms can be further characterized as follows:

- Nature of impact (neutral, positive, or negative)
- Magnitude (major, moderate, or minor)
- Duration (long term, medium term, or short term)
- Potential for occurrence (probable, possible, or not likely)
- Geographical extent (extensive, local, or limited)

Cumulative Impacts

Cumulative impacts include the direct and indirect impacts of a project together with the impacts of other related past, present, and reasonably foreseeable future projects in the area, including those proposed or implemented by others. The analysis of cumulative impacts concentrates on whether the Project's impacts, combined with the impacts of other projects, would result in a significant cumulative impact, and if so, whether the Project's contribution to this impact would be "cumulatively considerable." Per CEQA Guidelines Section 15065, "Cumulatively considerable" means that the incremental effects of an individual project are significant when viewed in connection with the effects of past projects, the effects of other current projects, and the effects of probable future projects.

CEQA Guidelines Section 15130(b)(1) provides two approaches to a cumulative impact analysis. The analysis can be based (a) on a list of past, present, and probable future projects producing related or cumulative impacts; or (b) a summary of projections contained in a general plan or related planning document. This cumulative impact analysis uses the list-based approach, and considers the effects of the Project together with those of other past, present, or probable future projects proposed by the District or others, as shown in Table 4-2. These include other projects aimed at reducing flood risk and improving habitat within the Corte Madera Creek watershed, as well as other development projects within the watershed that have the potential to impact Corte Madera Creek and its tributaries, or to have impacts on other resources, such as traffic, that could combine with those of the project in a cumulative manner.

Cumulative effects are defined in the Council on Environmental Quality's (CEQ) guidance, Considering Cumulative Effects under the National Environmental Policy Act (DIRS 103162-CEQ 1997, all) as: the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions" (40 CFR 1508.7).

As with CEQA, under NEPA, cumulative effects pertain to the additive or interactive effects that would result from the incremental impact of the Project when added to other past, present, and reasonably foreseeable future actions. Interactive effects may be either greater or less than the sum of the individual effects; thus, the action's contribution to a cumulative impact could increase or decrease the net effects.

TABLE 4-2 PROJECTS CONSIDERED IN CUMULATIVE IMPACT ANALYSIS			
Project Name (Project Sponsor or Jurisdiction)	Project Description	Status	Construction Dates
Ross Valley Flood Protection and Watershed Program (Marin County)	The Ross Valley Flood Protection and Watershed Program (program) is a regional effort led by the Marin County Flood Control and Water Conservation District in partnership with the City of Larkspur, Town of Ross, Town of San Anselmo, and Town of Fairfax. The program would meet the overall objective of substantially reducing the frequency and severity of flooding throughout the Ross Valley Watershed in an economically viable manner while providing multiple benefits and minimizing environmental impacts. Phase One would include use of flood diversion and storage (FDS) basins, bridge replacements and selected elements in the creeks to increase capacity. Phase Two elements of the Program would implement additional creek improvements, bridge replacements, additional FDS basins, low impact development, flood preparation and education, and creek maintenance, after implementation of Phase One.	Undergoing Environmental Review	Phase One (2017-2027) Phase Two (2028-2050)
Ross Valley Flood Protection and Watershed Program's Bridge Replacement Projects (San Anselmo, Fairfax, Ross)	Several bridges in the same region of the Ross Valley as the proposed Project (i.e., on San Anselmo Creek or other tributaries in the Corte Madera Creek watershed) are planned for removal and replacement in such a way as to move their foundations out of the creek channels. The bridge replacements would include Azalea Avenue, Madrone Avenue, Nokomis Avenue, Sycamore Avenue/Center Boulevard, and Winship Avenue bridges.	Undergoing Environmental Review	Within the next 5 years; some could occur contemporaneously with the Project
San Anselmo Flood Risk Reduction Project (San Anselmo, Fairfax, Ross)	This Project involves implementing various flood risk reduction measures in Fairfax and San Anselmo. The Flood Control District would implement this Project to reduce flood risk by (1) reducing peak discharge by attenuating flows through use of a FDS basin at the former Nursery site along Fairfax Creek, and increasing creek capacity by removing existing obstructions to creek flow (a "building bridge" that spans San Anselmo Creek and has its foundations in the channel) and then regrading and improving the creek channel.	Environmental Review Completed	Summer 2019-December 2020
Victory Village-Affordable Housing (Fairfax)	This project, located at 2626 Sir Francis Drake Boulevard, will require the subdivision of the existing 20-acre site into three parcels, one 2-acres in size and two others that will each be 9	Planned	January 2018-January 2019

TABLE 4-2 PROJECTS CONSIDERED IN CUMULATIVE IMPACT ANALYSIS			
Project Name (Project Sponsor or Jurisdiction)	Project Description	Status	Construction Dates
	acres. The 2-acre parcel is proposed to be developed as a senior housing project affordable to extremely low and very low income households. Given these affordability parameters, the project applicant, Resources for Community Development, seeks a density bonus in order to construct 54 units at a density of 27 dwelling units per acre, where 20 dwelling units per acre would otherwise be permitted, and has requested density bonus waivers and/or concessions with respect to the project's proposed height (38' 7"), uncovered parking, and undergrounding of the existing above ground utility lines on Sir Francis Drake Boulevard.		
45 Ross Avenue (San Anselmo)	This project involves the demolition of existing housing and construction of a 10-unit apartment/condominium development. The 10 units will have between one and four bedrooms, and 17 parking spaces total.	Planned	Uncertain; unlikely before 2019
600 Red Hill Avenue (San Anselmo)	This project proposes for a subdivision to create a new 43,829 square feet (approximately 1 acre) lot behind an existing apartment building, with access from Spaulding Street. Four new residential townhomes are proposed. Each unit is approximately 3,000 square feet with four bedrooms and a two car garage.	Planned	Uncertain; unlikely before 2019
1 Lincoln Park (San Anselmo)	Rezoning of a narrow strip of land from R-1 (Single Family Residential) to C-3 (Commercial District). A 16-unit apartment building is proposed, to total approximately 15,300 square feet of floor area over an 8,000 square foot parking garage. The garage would provide 17 parking spaces, include 5 disables parking spaces. The applicant intends the project to be for senior housing, and the project includes two units that would be deed restricted for low income housing.	Planned	2018-2019
754 Sir Francis Drake Boulevard (San Anselmo)	The project proposes the demolition of existing 5,700 sf of commercial and office buildings, and construction of 16 apartments over 22 parking spaces on approximately a one-half acre site.	Planned	2018-2019
Sir Francis Drake Boulevard Rehabilitation (Ross)	The project proposes several traffic flow, pavement, safety improvements, and water main replacement along Sir Francis Drake Boulevard between Highway 101 and the Ross Town limits.	Environmental Review Completed	2019-2020

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4.1 Hydrology and Hydraulics

This section describes the existing conditions for hydrology and hydraulics within the study area, including basin geomorphology, rainfall and runoff, groundwater, tidal influences, and existing flood hazards. This section also describes the regulatory setting for flood control and the effects on flood control that would result from the no action alternative and Alternatives A, B, F, G and J and mitigation measures that would reduce significant effects. This section was developed based on field observations and recent hydrologic and hydraulic investigations undertaken on behalf of United States Army Corps of Engineers (USACE), the Federal Emergency Management Agency (FEMA), and the Marin County Flood Control and Water Conservation District (District).

4.1.1 Regulatory Setting

This section summarizes key federal, state, and local regulatory information that applies to flood control conditions.

4.1.1.1 Federal

Federal policies and programs are relevant to hydrology and flood control conditions are listed below. Details regarding the policies and programs are provided in Chapter 9.

- Executive Order 11988, Floodplain Management
- National Flood Insurance Program
- USACE Floodwall and Levee Design Criteria

4.1.1.2 State

The Department of Water Resources Urban Levee Design Criteria, which includes floodwalls, is relevant to hydrologic resources. Details of this criteria are discussed in Section 9.

4.1.1.3 Local

Marin Countywide Plan

The Marin Countywide Plan is made up of several elements that shape the manner in which development, including flood control projects, occurs within Marin County. These elements include: natural systems and agriculture, socioeconomics (which includes public safety), community development, noise, and built environment. As the study area is located within unincorporated portions of the county, the policies of the countywide plan that are germane to the project alternatives include, but are not limited to:

- **Policy WR-1.3: Improve Infiltration.** Enhance water infiltration throughout watersheds to decrease accelerated runoff rates and enhance groundwater recharge. Whenever possible, maintain or increase a site’s predevelopment infiltration to reduce downstream erosion and flooding.
- **Policy EH-3.2: Retain Natural Conditions**. Ensure that flow capacity is maintained in stream channels and floodplains, and achieve flood control using biotechnical techniques instead of storm drains, culverts, riprap, and other forms of structural stabilization.
- **Policy BIO-4.16: Regulate Channel and Flow Alteration.** Allow alteration of stream channels or reduction in flow volumes only after completion of environmental review, commitment to appropriate mitigation measures, and issuance of appropriate permits by jurisdictional agencies based on determination of adequate flows necessary to protect fish habitats, water quality, riparian

vegetation, natural dynamics of stream functions, groundwater recharge areas, and downstream users.

Marin County Code

The Marin County Code establishes standards for development in areas subject to flooding, grading and erosion control, protection of trees and riparian vegetation, management of parks and recreation facilities, and noise. The following sections of the Marin County Code are considered applicable to the project alternatives:

- **Title 19: Buildings:** Chapter 19.06 of the Marin County Code contains requirements to ensure that proper grading and erosion control procedures are implemented to protect the public health and welfare and to avoid the siltation of watercourses.
- **Title 23: Natural Resources**: Chapter 23.08 of the Marin County Code contains requirements for excavating, grading, and filling. Chapter 23.09 provides floodplain management regulations.

Town of Ross General Plan 2007–2025

Similar to the Marin Countywide Plan, the Town of Ross's General Plan 2007–2025 includes several applicable policies and direction with respect to social and physical resources. As the study area is located within the Town of Ross, the policies of the General Plan that are germane to the project alternatives include, but are not limited to:

- **Policy 6.2 Flood Control Improvements:** The town supports the construction of flood control improvements consistent with the natural environment, the design character of the Town of Ross and the safety and protection of persons and property.
- **Policy 6.3 Ross Valley Flood and Watershed Protection:** The town will work with other jurisdictions within the Ross Valley watershed to develop a comprehensive approach to flood protection and resource preservation strategies.
- **Policy 6.6 Creek and Drainageway Setbacks, Maintenance and Restoration:** Keep development away from creeks and drainageways. Setbacks from creeks shall be maximized to protect riparian areas and to protect residents from flooding and other hazards. Encourage restoration of runoff areas, to include but not be limited to such actions as sloping banks, providing native vegetation, protecting habitat, etc., and work with property owners to identify means of keeping debris from blocking drainageways.

4.1.2 Affected Environment

4.1.2.1 Hydrologic Setting

Corte Madera Creek is in the Corte Madera Creek watershed (also referred to as the Ross Valley watershed) located in central eastern Marin County. The total watershed contains approximately 44 linear miles of stream channels and has a total land area of approximately 28.6 square miles, including portions of unincorporated Marin County and the towns of Corte Madera, Ross, San Anselmo, and Fairfax. The drainage basin extends approximately 8 miles on a northwest-southeast axis and averages approximately 3 miles in width. Elevations within the basin range from sea level at San Francisco Bay to 2,600 feet above mean sea level (msl) at Mount Tamalpais. Fifty percent of the basin lies below elevation 300 feet msl and 90 percent below elevation 1,000 feet msl. Streambed slopes range from 0 feet per mile in flood control study units (Units) 1, 2, and 3 up to 20 feet per mile in the upper portions of Corte Madera Creek (USACE 1966).

Corte Madera Creek and San Anselmo Creek are perennial streams and form the mainstem waterway of the watershed. San Anselmo Creek and its tributaries drain the northwestern portion of the watershed. Ross Creek and its tributaries drain the northern slope of Mount Tamalpais, joining San Anselmo Creek from the west in the central part of the watershed. Downstream of the confluence, the mainstem channel is known as Corte Madera Creek, which continues through the study area (http://marinwatersheds.org/ross_valley.html). The study area covers a portion of Corte Madera Creek that extends from the Ross Creek confluence to approximately 1,500 feet downstream of College Avenue, which corresponds to portions of Units 2, 3, and 4. The portion of the total watershed area that is tributary to the study area is approximately 18.1 square miles, or 63.3 percent of the total watershed area.

Corte Madera Creek has a natural channel bottom through Unit 4 of the study area and is concrete-lined through Unit 3 and portions of Unit 2, a distance of over 1 mile. At the terminus of the concrete-lined segment, the creek opens to an earthen channel and is joined by Larkspur and Tamalpais creeks before flowing into San Francisco Bay at the Corte Madera Marsh State Marine Park.

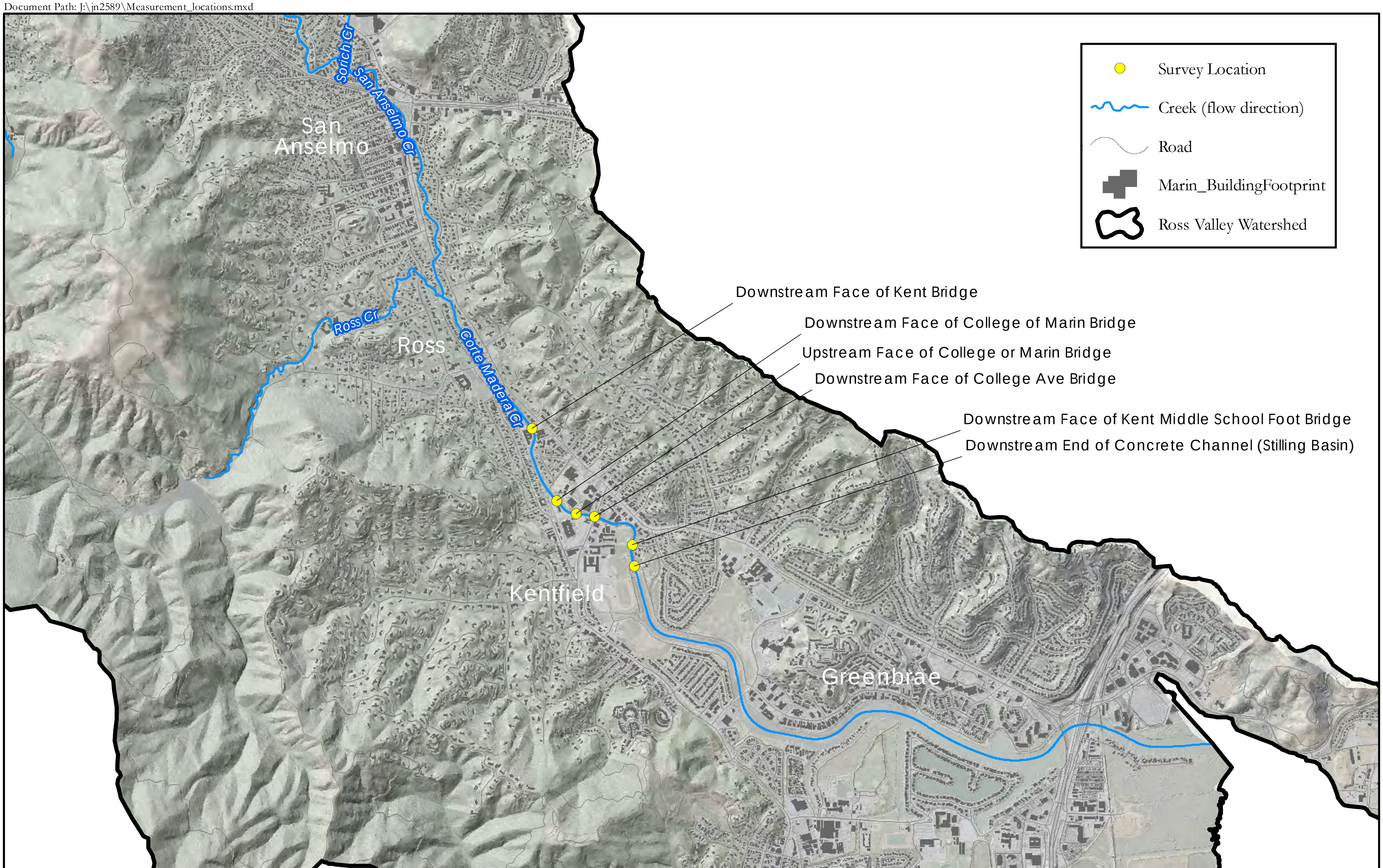
Fluvial sediment processes are an important component of fluvial function because sediment flow creates channel and floodplain morphology as well as transporting both nutrients and pollutants. Sediment in Corte Madera Creek also affects the conveyance capacity of the channel. Sediment processes within a watershed are typically divided into three classes: sediment production (occurs in the upper watershed), sediment transport, and sediment deposition (occurs in the lowest areas of the creek). For Corte Madera Creek, sediment originates in the steeper, upper watershed areas, and is transported to Units 2, 3, and 4. Sediment deposition has historically occurred in the creek at the Lagunitas Road Bridge and farther downstream in Units 1, 2, 3, and 4, including the concrete-lined channel (Copeland, R.R. 2000). Sediment deposition was detected in the 6 feet concrete-lined channel downstream of the Kentfield Hospital Bridge (Stetson 2015). Locations and corresponded depths of sediment deposition are listed in Table 4.1-1. These measurement depths of sedimentation were incorporated where appropriate into the designs and hydraulic modeling analysis of the action alternatives.

TABLE 4.1-1 MEASUREMENTS OF SEDIMENT DEPOSITION IN THE CORTE MADERA CREEK CONCRETE-LINED CHANNEL, MAY 22, 2015

Location (Figure 4.1-1)		
Description	River Station (feet)	Depth (feet)
Downstream Face of Kentfield Hospital Bridge	359 + 47	0
Downstream Face of Science, Math, Nursing (SMN) (College of Marin New Foot Bridge)	344 + 00	0.2
Upstream Face of SS Bridge (College of Marin Foot ridge)	338 + 78	1.96
Downstream Face of College Avenue Bridge	334 + 76	2.41
Downstream Face of Kent Middle School Foot Bridge	323 + 38	2.44
Downstream End of Concrete Channel (Stilling Basin)	319 + 10	4.65

The estimated profile of sediment deposition based on the May 22, 2015, measurements (Stetson 2015) is depicted in Figure 4.1-2. Sediment deposition occurs in the lower portion of the concrete channel. On April 5, 2016, USACE and the District jointly conducted measurements of sediment depths at the locations previously measured on May 22, 2015 (USACE 2016). These measurements revealed sediment deposition similar to that previously measured.

Document Path: J:\jn2589\Measurement_locations.mxd



STETSON ENGINEERS INC.

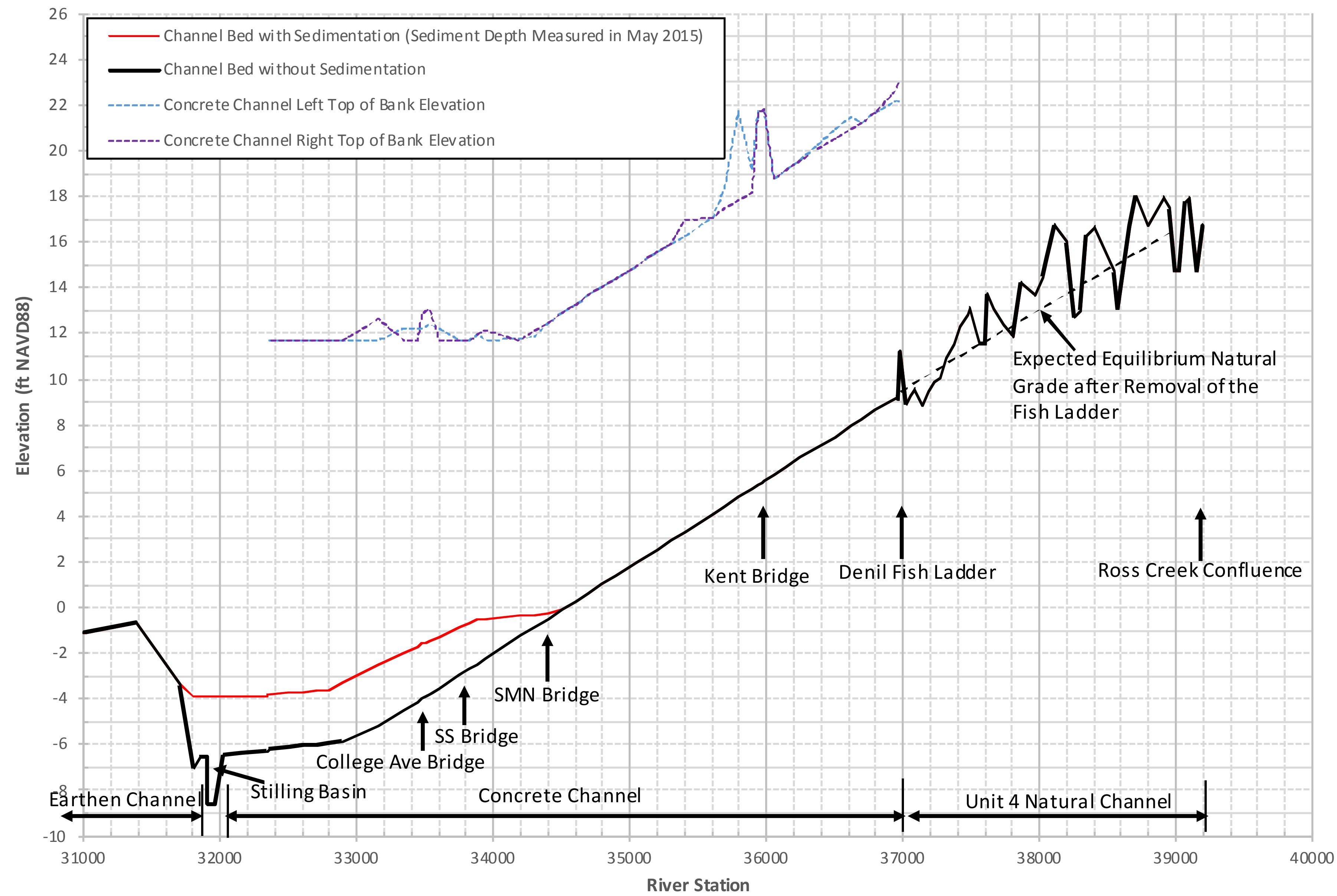
MAY 22, 2015
SEDIMENT MEASUREMENT LOCATIONS
ROSS VALLEY, CA

0 0.25 0.5 Miles

N

FIGURE 4.1-1

Figure 4.1-2 Channel Bed Profile



Sediment yield from the upper watershed is high due to land use impacts. Natural landslides and earth flows in the upper watershed areas also periodically overwhelm the creeks with large volumes of fine-grained sediment (Stetson 2000). In the description of the Corte Madera Watershed in the Integrated Regional Water Management Plan Report (Marin County 2013), two problematic subwatersheds were identified. The Sleepy Hollow Creek subwatershed is identified as contributing 26 percent of total bedload sediment inflow at the Town of Ross. The most probable sources of sediment are identified as active hillslope processes (e.g., slumps/land sliding). The San Anselmo Creek subwatershed is described as contributing 29 percent of total bedload sediment inflow to the creek within the study area (Marin County 2013).

After construction of the lower portions (Units 1, 2, and 3) of the Corte Madera Creek Flood Control Project (CMCFCP), the channel began to aggrade at rates much greater than anticipated and the District was unable to maintain the channel at its design depth. Nonetheless, the earthen channel section in Units 1 and 2 (i.e., downstream of the stilling basin) contained the 1 percent AEP flood event (i.e., 100-year flood event) that occurred in December 2005 without overbank flow. In an attempt to restore the original channel design depth, Units 1 and 2 were dredged in 1986, and the stilling basin was dredged again in 1998. Unit 4 below Sir Francis Drake Boulevard, upstream of the concrete-lined channel, is also aggradational (Stetson 2000). Because of its high costs, temporary benefits, and undesirable environmental consequences, periodic dredging is not a favorable method for maintaining the channel in Unit 4 (Stetson 2009).

Rainfall and Runoff

Marin County is characterized as having a temperate Mediterranean climate, with heavy rain in the winter and warm, arid summers. Eighty-three percent of the precipitation occurs during the months of November through March with less than 1 percent occurring from June through September (USACE 1966; USACE 2000a). Coastal fog is most common in late summer, when it provides a minor source of precipitation. Mean annual precipitation for the county averages from 30 to 61 inches per year (Fischer, *et al.* 1996); and for the watershed 40.75 inches per year (PWA 2009a). Snowfall is rare within the watershed and has no significant effect on flood peaks.

The upper parts of the watershed are hilly and mostly wooded (USACE 2000a). The lower ridges and valley areas of the watershed are highly developed suburban residential and commercial areas. Development in the communities of Fairfax, San Anselmo, Ross, Kentfield, Larkspur, and Greenbrae has increased the area of impervious surfaces within the watershed, decreasing the amount of rainfall that can infiltrate into the soil. These changes result in more runoff and higher peak flows than those which would occur under natural conditions (Royston 1977, in USACE 2010).

Major fluvial runoff events occur during the rainy winter and spring seasons. Floods attributable to Corte Madera Creek are flashy and of short duration. Flashy runoff patterns in the Ross Valley result from intense rainfall, the shape and steepness of the upper watershed surrounding the valley, and the lack of significant detention and infiltration in the urbanized valley. Tributaries rise rapidly so that flooding begins a few hours after the occurrence of heavy rainfall (FEMA 2009a, in USACE 2010). Flood peaks occur generally within 3 to 5 hours after periods of intense rainfall and recede within 24 hours after the end of such storms (USACE 1966). Historical accounts indicate that major storms occurred in 1951, 1960, 1966, 1982–1983, 1986, and 2005 (USACE 1966; FEMA 2009a, in USACE 2010; Stetson 2009, 2011, 2007, in USACE 2010). During the summer months and dry years, there is little rainfall-runoff inflow to Corte Madera Creek.

The USACE has prepared several studies to assess the hydrologic conditions for the project, beginning with those described in Design Memorandum No. 1 (USACE 1966). The standard project flood (SPF)[1] discharges were estimated to be 7,500 cubic feet per second (cfs) for Corte Madera Creek within the study area, based on a 3-day storm that occurred in Hollister, California in December 1955 (USACE 1966; 1988). The SPF estimate did not provide for upstream storage and assumed that the Corte Madera Creek channel and tributaries were fully improved upstream to Fairfax.

The District maintains a rainfall gage in Kentfield. Rainfall data from this gage are available from a web database (https://marin.onerain.com/site.php?site_id=1555&site=0fc267e5-331e-48fc-8a35-8512b95e4737). Stage data at the Corte Madera Creek Ross Gage (Site ID: 5255) is published by the District.

Interior Drainage: The municipal storm drainage system for the Town of Ross and unincorporated area Kentfield collect overland flow in storm drains. The runoff is piped under roads or in right-of-ways and outfalls into Corte Madera Creek. More than 10 existing outfalls are located within Units 2, 3, and 4 (Figure 4.16-1). The pipe outfalls range from 18 to 72 inches in diameter and enter from both sides of the channel.

According to the USACE Design Memorandum No. 1 (USACE 1966), two hydrologic criteria were adopted in the design of local runoff for outfall structures and possible ponding areas: (1) the 100-year storm of 6 hours duration occurs over the interior areas when the main channel is at a 2-year stage; and (2) the coincident storm causing the 1 percent AEP flood in Corte Madera Creek occurs over the interior areas. Sheetflow flooding is caused by inadequate channel capacity and poor drainage in areas close to the stream (FEMA 2009a, in USACE 2010).

Channel Morphology and Conveyance: Corte Madera Creek from Sir Francis Drake Boulevard to the Denil fish ladder (i.e., Unit 4) is primarily a natural channel with vegetated banks and a gravel bed. Structural elements include the bridge abutments at Lagunitas Road Bridge and retaining walls along much of Unit 4. The longitudinal slope of the channel is fairly consistent. The vertical drop from Sir Francis Drake Boulevard to the concrete-lined channel is 11.3 feet. The horizontal distance for this change is 4,050 feet, resulting in a slope of 0.28 percent. The land immediately adjacent to Corte Madera Creek generally appears flat but there is topographical variation that becomes important during flood stage (Royston 1977, in USACE 2010).

From the confluence with Ross Creek downstream to the Lagunitas Road Bridge, the channel cross section is fairly consistent. The channel is deeply incised 12 to 15 feet below the banks. The channel bottom is about 20 to 25 feet across. Banks along this section of Corte Madera Creek range from 5:1 (horizontal: vertical) slope to vertical where concrete retaining walls are built (PWA 2009b). The channel bed is characterized by 30- to 150-foot-long and 15- to 20-foot-wide lateral scour pool/riffle sequences with depths ranging from 0.5 to 1.5 feet average depth. Scour pools contain large woody debris, root wads, and substrate composed of small gravel, sand, and silt. The area has abundant shade (A.A. Rich 2000). The Lagunitas Road Bridge was replaced in 2010 with a higher soffit that has not changed the channel geomorphology.

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[1] The standard project flood is defined by USACE as that flood produced by the standard project storm which is the most critical storm on record within a region meteorologically homogeneous with the basin under study, or the most critical storm on record in adjacent regions that can be reliably transposed to the subject basin, occurring at a time when conditions for runoff are favorable.

Downstream of the Lagunitas Road Bridge to the Denil fish ladder, the channel remains incised though the depth from the bank to channel bed begins to decrease (10 to 12 feet). The creek banks vary in steepness from a steep 2:1 vegetated slope to vertical retaining walls. The channel bed tapers from approximately 30 feet in width at the bridge to 15 feet at the downstream end of Unit 4. The channel bed is characterized by long (80 to 100 feet), shallow (from a few inches to about 1.5 feet average depth) alternating lateral scour pool and riffle sequences; riffles were very narrow (3 to 6 feet wide) and shallow. The low streamflows, riprap, and condition of the wooden retaining walls resulted in fairly stagnant pool areas. Riffle areas were extremely shallow. Substrate in the pool areas consisted of sand, silt, and organic detritus; in the riffles, small gravel was the predominant substrate (A.A. Rich 2000).

The creek channel, within and upstream of Unit 4, has considerable vegetation, primarily on the natural banks. This vegetation provides protection to the underlying soil against erosion from water flowing in the creek. In addition, many homeowners have placed rock, timber, concrete and other materials on the creek banks to protect against scour and erosion (Royston 1977, in USACE 2010); however, banks in Unit 4 are actively eroding along approximately 7,200 linear feet of bank. Royston (1977, in USACE 2010) estimated that roughly 20 percent of the total length of bank would be subject to 1 foot of erosion per year.

In 1989 and 2000, soil conditions within Corte Madera Creek were evaluated (Copeland 1989, 2000). Streambed soils were found to be shallow with limited absorbing capacity. The basic purpose of the field survey was to determine where erosion problems might develop and to visually determine the types of soil exposed in the banks and in the creek bottom. Surveys indicated that generally the banks consist of clayey sands and sandy clays of relatively low plasticity. In the creek bottom, well-graded gravels were observed (Royston 1977, in USACE 2010). Subsurface exploration near the town limits of Ross determined that the subsurface materials consist predominately of clays, sandy clays, and clayey sands. In general, the materials were firm or stiff except for the soft clay (Bay Mud) along the eastern portion of the study area (USACE 1966).

Sedimentation rates in Units 2 and 3 of Corte Madera Creek are high because of the combined influence of low channel slope in the concrete-lined channel and tides. Sediment from Corte Madera Creek and San Francisco Bay is conveyed on incoming tides, adding to the sediment load.

Flooding in the Ross Valley occurs when peak flows exceed the conveyance capacity of the Corte Madera Creek channel. Structures on the creeks constrain flow causing water levels to rise and breach the main channel transmitting flow into overflow paths (PWA 2000, in USACE 2010). The Denil fish ladder, in its current condition, is the primary constriction to the high-water flows that cause extensive overbank flooding along Corte Madera Creek and barrier to fish passage. Bridge constrictions and poorly designed residential streambank stabilization structures have exacerbated flooding on this naturally flood-prone system (Stetson 2006).

The USACE has conducted numerous studies focused on evaluating the performance of Units 3 and 4 since 1971 (USACE 1966, 1974a, 1974b, 1987a, 1987b, 1988, 2000a, 2000b; Stetson 2008, in USACE 2010). These studies have identified a hydraulic constraint through the transition from Unit 4 to Unit 3 created by the existing Denil fish ladder and the narrow channel condition on the east and west bank. Channel capacity in the section of Corte Madera Creek between Lagunitas Road Bridge and the concretized channel currently ranges from about 3,300 to 4,000 cfs. The left bank downstream of Lagunitas Road Bridge was overtopped during the December 15, 2016, January 10, 2017, and February 7, 2017, storm events when the observed peak discharges at the Ross gage were about 3,380, 3,690, and 3,710 cfs respectively.

Out-of-Bank and Floodplain Flow: Out-of-bank flows on San Anselmo and Corte Madera Creeks have historically led to significant flooding in the towns of San Anselmo and Ross, respectively. Previous studies have been performed to assess the location and source of out-of-bank flooding on the main branch of the watershed (PWA 2009b; Stetson 2011). The Ross Valley Capital Improvement Plan (CIP) study (Stetson 2011) estimated that, with respect to flows exceeding 2,800 cfs, backwater from the Madrone Avenue Bridge causes San Anselmo Creek to breach the right bank of the main channel at Nokomis Avenue. The diverted flow then travels as split flow through San Anselmo, and rejoins the creek corridor near its confluence with Ross Creek. Additional overflow caused by backwater buildup at the Sycamore Avenue Bridge contributes to the overflow generated at Nokomis Avenue. In the Ross Valley CIP study (Stetson 2011), it was estimated that split flow at Sycamore Avenue Bridge is likely to occur at flows exceeding 3,100 cfs at that location. Flood overflows originating near downtown San Anselmo run down San Anselmo Avenue and along Shady Lane in Ross where they join with overflow occurring upstream of Lagunitas Road Bridge. The combined floodwaters flow through Ross Commons and down Poplar Avenue in Ross and Kent Avenue in Kentfield before finally returning to the concrete-lined channel downstream of College Avenue in Kentfield.

Within Unit 4, a split flow condition has historically been exacerbated by backwater buildup at Lagunitas Road Bridge. The Lagunitas Road Bridge, as previously constructed (i.e., prior to 2010 when it was replaced with a higher bridge), was at an elevation below floodplain grade. Channel bed sedimentation added to the hydraulic constraint at the bridge (Stetson 2006). The split flow from Corte Madera Creek began approximately 300 feet upstream of the Lagunitas Road Bridge along the western bank of the channel and contributed to flooding in Ross and Kentfield. Historically, this split flow was estimated by the USACE and Stetson to occur at flows exceeding 3,200 cfs to 3,600 cfs (USACE 2000a; Stetson 2011). Based on an analysis of floodplain topography and out-of-bank flow the historical split flow appeared to rejoin the main channel approximately 1.3 miles downstream (PWA 2009b). Today, with the new Lagunitas Road replacement bridge in place since 2010, this split flow is estimated to occur at flows exceeding 3,630 cfs (Stetson 2017b). Above this flow rate the channel would be overtopped although the water surface may not reach the replacement bridge soffit. The Lagunitas Road replacement bridge was designed to convey about 5,400 cfs before the water surface reaches the bridge soffit. This bridge soffit design assumed that the discharge of 5,400 cfs is fully contained in the Unit 4 channel without overtopping by adding hypothetical floodwalls along both sides of the Unit 4 reach.

Groundwater

Groundwater and surface water are often hydraulically connected to some degree in natural streams. Surface water may infiltrate and become groundwater, or groundwater may discharge to the surface and become surface water. During the dry season, groundwater normally has cooler temperatures than the surface water flowing in the creek and, thus, groundwater discharge to the surface has a cooling effect which makes the stream more suitable for cold freshwater habitat. While the project has primarily surface water components, information on groundwater hydrology has been included in this document as necessary to determine its relationship to surface water in the creek.

The Ross Valley groundwater basin underlies the downstream portion of Corte Madera Creek before its terminus at San Francisco Bay (SFRWQCB 2017). According to DWR, the study area is not located on a groundwater basin that produces, or has potential to produce, significant amounts of groundwater (Town of Ross 2009, in USACE 2010). The groundwater basin is not a source of potable water. In the Town of Ross, local groundwater wells supply water for public and private landscape irrigation (Marin County 2005a).

Examination of soil samples from borings collected in 1965 indicates that the wet to very wet materials were encountered within 2 feet of msl. Stabilized ground water level would be near msl (USACE 1966). Additional groundwater basin characteristics were published in the Marin Countywide Plan (Marin County 2005a). The study found that the Ross Valley Groundwater basin was located at a depth of 10 to 60 feet below ground surface. The basin's storage capacity was estimated at 1,380 acre-feet and covered an area of 18 square miles. The perennial safe yield was estimated at 350 acre-feet.

Tidal Influences

Tidal conditions in San Francisco Bay affect the study area in Corte Madera Creek, but only to the southern limit of the Town of Ross, which is within Unit 3 (Royston 1977, in USACE 2010). Tidal effects extend into the existing concrete-lined channel. Average tidal fluctuations in the concrete-lined channel range from 0.06 feet relative to the North American Vertical Datum of 1988 (NAVD88) at mean-lower-low-water (MLLW) to 5.90 feet NAVD88 at mean-higher-high-water. The 1 percent AEP tide elevation is estimated to be 9.0 feet NAVD88 in the FEMA 2009 Flood Insurance Study. However, the FEMA 2017 Flood Insurance Study shows the 1 percent AEP tide elevation to be 9.7 feet NAVD88. An extreme high tide of 8.88 feet NAVD88 was measured (during the January 27, 1983, coastal flood event) at the San Francisco Bay tidal gage station (NOAA #9414290) over a period of record of more than 160 years dating back to 1855.

4.1.2.2 Flood Hazards

The threat of flooding is a significant problem in the study area. Several existing flood management-focused documents (e.g., PWA 2000, in USACE 2010, 2009b; USACE 2000a, 2000b; Stetson 2006, 2009, 2011, 2007 and 2008, in USACE 2010) have addressed flooding conditions in the study area. Historical flooding from Corte Madera Creek was primarily due to the relatively small capacity of the creek channel within Unit 4, the historical constriction of flow from the insufficient opening under the old Lagunitas Road Bridge, and backwater created from the transition into the concrete-lined Unit 3 channel. Historically, flows greater than about 3,200 cfs to 3,600 cfs overtopped Sylvan Lane upstream of the old Lagunitas Road Bridge. Today, with the new Lagunitas Road replacement bridge in place since 2010, the channel hydraulic capacity is estimated to be about 3,630 cfs (Stetson 2017b) at the most constrictive location of the channel. Above this flow rate the channel would be overtopped although the water surface may not reach the bridge soffit. The Lagunitas Road replacement bridge was designed to convey about 5,400 cfs before the water surface reaches the bridge soffit. . This bridge soffit design assumed that the discharge of 5,400 cfs is fully contained in the Unit 4 channel without overtopping by adding hypothetical floodwalls along both sides of the Unit 4 reach.

Flood History

Corte Madera Creek has flooded numerous times over the past 70 years. Floods causing major damage occurred in 1951, 1955, 1960, and 1966 (pre-project), and 1982–1983, 1986, and 2005 (post-project) (USACE 1966; FEMA 2009a, in USACE 2010; Stetson 2009, 2011, 2007, in USACE 2010). Before the initiation of the federal project (CMCFCP), in 1969, the most severe flood for which measurements were obtained occurred in December 1955 (FEMA 2009a, in USACE 2010). This flood had an estimated maximum discharge of about 5,500 cfs at the U.S. Geological Survey (USGS) Ross gauging station (Ross Gage). The peak discharge of 5,500 cfs for the water year 1956 flood was estimated by interpolation based on the FEMA's flood frequency curve and FEMA's estimate of 1956 flood as a 4 percent AEP flood (FEMA 2017). The USGS database shows that the water year 1956 flood had a peak discharge of 3,620 cfs at the Ross gage, which, in Stetson's judgment, did not account for out-of-channel flow. Since the federal project was built, more severe floods occurred in 1982 and 2005. The January 3 to 5, 1982 storm produced the largest recorded flood-flow at the Ross Gage. The runoff resulted from a 32-hour rainstorm that became stationary and produced a continuous downpour that averaged about ¾ inch per hour for 6 hours. Most of the rain gages overflowed during the storm, so reliable statistics were unavailable, though part of the basin had more than 15 inches of rainfall. The storm produced a peak flow at the Ross gage estimated at 7,200 cfs with an estimated recurrence interval greater than 100 years (USACE 2000a, 2000b). The flood inundated all of the low areas of the watershed, causing considerable damage in San Anselmo, Ross, Kentfield, and Larkspur. The December 31, 2005, storm produced the second largest recorded flood flow. Stetson (2007, 2011) estimated the December 31, 2005 flood to be about 6,800 cfs at the Ross Gage, which included in-channel flow and out-of-channel flow.

In 1953, the District Zone 9 was created and in 1969 the USACE began construction of the flood control project that included Units 1, 2, and 3. Construction at the downstream end created a trapezoidal earthen channel and, further upstream, a concrete-lined channel part way through the Town of Ross. In 1982, up to 5 feet of flood water caused considerable damage in San Anselmo, Ross, Kentfield, and Larkspur. On January 1, 2006, flooding caused over $70 million in damage when the creek overtopped the banks and destroyed property in San Anselmo and nearby communities (District 2000; Friends 2004; FEMA 2009a, in USACE 2010). In response to the urgency created by this flood, the County of Marin authorized the development of an environmentally sound flood control program to respond to the concerns of business owners and residents in Ross Valley.

Flood Frequency Analysis

Following development of the SPF, several flood frequency analysis methods were used to study Corte Madera Creek stream flow data collected at the Ross Gage. A 1999 flood frequency analysis, conducted by the USACE, relied on USGS streamflow measurements associated with the original 1951 rating curve (Stetson 2006). Over the subsequent four decades of monitoring the channel had aggraded nearly 4 feet (Stetson 2007, in USACE 2010). The USGS did not update the rating curve until 1987 to account for the cross-sectional change at the gage. These bed level changes were reported to have affected the accuracy of the historical measurements taken at the Ross Gage and the reliability of the USACE's 1999 flood frequency analysis and flood frequency curve (Stetson 2006). The study published an updated stage-discharge rating curve (low-flow range) for the gage based on field measurements. The rating curve for the Ross Gage was used with peak stage measurements at the gage to determine annual peak flow discharges after 1993. Using this data, a flood frequency analysis was conducted using the 1987 version of HEC-WRC[2] program (Dawdy 2006, in USACE 2010). The 2006 analysis relied on 55 years of data (including the historic USGS data). The computed analysis results are presented in Table 4.1-2.

The USACE performed statistical analyses using HEC-SSP[3] to develop relationships between the magnitude of flood flow and probability of occurrence in any given year (USACE 2008). The updated USACE analysis included 57 years of data and relied on the published USGS historical peak flow values.

[2] The HEC-WRC program has included several updates since its inception in 1978. The program is currently called HEC-flood frequency analysis which reflects techniques described in the revised, "Guidelines for Determining Flood Flow Frequency," Bulletin 17B, 1982.

[3] HEC-SSP is software developed by USACE to perform statistical analyses of hydrologic data. The current version of HEC-SSP can perform flood flow frequency analysis based on Bulletin 17B. The program can perform generalized frequency analysis on flow data and a volume-duration frequency analysis on high and low flows.

The minor differences between the results of the 2006 and 2008 analyses shown in Table 4.1-3 reflect datasets, model selection (Firth 2010), and computed versus expected probability used in each study.

More recent flood frequency analysis was performed using HEC-flood frequency analysis, as described in Technical Memorandum No. 1 of the 2011 Ross Valley CIP study (Stetson 2011), using historical annual peak discharges at the Ross gage shown in Table 4.1-3 and Figure 4.1-3. Table 4.1-2 presents the flood frequency analysis results each of the published flood frequency analysis studies, as well as the published FEMA values, where available. The peak discharge estimates at the Ross Gage under existing conditions in the Stetson 2011 CIP Study were adopted for this EIS/EIR analysis[4].

TABLE 4.1-2 COMPARISON OF PEAK FLOOD DISCHARGES

Recurrence Interval	Dawdy, 2006	USACE, 2008	Stetson CIP 2011	FEMA Flood Insurance Study 2009	FEMA Flood Insurance Study 2014	FEMA Flood Insurance Study 2017
	(CFS)	(CFS)	(CFS)	(CFS)		
2-year	2,130	2,106	2,130	—	—	—
5-year	3,630	3,620	3,490	—	—	—
10-year	4,520	4,555	4,370	4,060	3,871	4,060
20-year	5,280	5,368	5,180	—	—	
50-year	6,120	6,295	6,180	6,200	6,022	6,200
100-year	6,650	6,903	6,890	6,900	7,049	6,900
200-year	7,120	7,442	7,560	—	—	—
SPF	—	7,500a	—	—	—	—
500-year	7,630	8,063	8,400	8,400	9,334	8,400
All peak flood discharges were calculated based on historical discharges at the Ross Gage. SPF SOURCE: USACE 1966						

Notes:

1. Results from the Stetson 2011 CIP Study were adopted for this EIS/EIR analysis because they were recent and comprehensive.
2. All analyses except the FEMA 2014 Flood Insurance Study used the Log-Pearson III Method to derive the peak flow estimates. The FEMA 2014 Flood Insurance Study used a calibrated HEC-HMS model to simulate the peak flows for selected 24-hour design storms associated with the 10-, 2-, 1-, and 0.2-percent-annual-chance rainfall events (which are 6.03 inches, 8.09 inches, 9.0 inches, and 11.02 inches, respectively, in the HEC-HMS model; PWA 2009a).
3. Given that long-term historical annual peak flow records are available for the Ross Gage, use of the Log-Pearson III flood frequency analysis method based on historical annual peak flows is more reliable than 2014 FEMA's use of HEC-HMS hydrologic modeling based on selected 24-hour design storms. Rainfall-runoff modeling methods are normally used only for ungaged streams, not for gaged streams with long-term historical records of annual peak flows (FEMA 2009b).
4. The FEMA 2017 (effective) Flood Insurance Study directly used the results from the FEMA 2009 Flood Insurance Study. The peak flow estimates documented in the FEMA 2017 (effective) Flood Insurance Study are very close to those estimated by the Stetson 2011 CIP Study.

[4]The Stetson 2011 CIP Study used the available historical annual peak discharges up to 2010. At this time no attempt was made to update the FFA using the data collected since 2010. This way the EIS/EIR used the same flood frequency data as the County-wide flood management programs. It would be expected that the flood frequency would have little change even if the data collected since 2010 were used. This is because that no major floods have occurred since 2010.

TABLE 4.1-3 ANNUAL PEAK DISCHARGES AT THE ROSS GAGE, CORTE MADERA CREEK					
Water Year	Peak Flow (cfs)	Water Year	Peak Flow (cfs)	Water Year	Peak Flow (cfs)
1952	3,300	1972	908	1992	1,790
1953	3,280	1973	2,690	1993	3,350
1954	1,940	1974	1,950	1994	NR
1955	648	1975	2,640	1995	NR
1956	5,500	1976	330	1996	NR*
1957	652	1977	144	1997	2,270
1958	3,130	1978	2,180	1998	3,310
1959	1,870	1979	1,430	1999	1,356
1960	2,610	1980	2,910	2000	1,726
1961	519	1981	1,190	2001	NR
1962	2,690	1982	7,200	2002	1,726
1963	2,460	1983	3,480	2003	3,390
1964	1,040	1984	2,300	2004	3,454
1965	1,400	1985	2,600	2005	3,290
1966	2,880	1986	4,150	2006	6,834
1967	3,120	1987	2,330	2007	690
1968	1,700	1988	975	2008	3,402
1969	1,870	1989	1,350	2009	1,829
1970	3,290	1990	588	2010	2,375
1971	2,640	1991	1,650		

Notes:

1. The USGS term "water year" is defined as the 12-month period October 1, for any given year through September 30, of the following year.
2. The annual peak discharges for the period 1952 – 1997 except 1956 were obtained from the USGS database (USGS #11460000). The peak discharge of 5,500 cfs for water year 1956 was estimated by interpolation based on the FEMA's flood frequency curve and FEMA's estimate of 1956 flood as a 4 percent AEP flood (FEMA 2017). The USGS database shows that the water year 1956 flood had a peak discharge of 3,620 cfs, which, in Stetson's judgment, did not account for out-of-channel flow.
3. The post-1997 annual peak discharges were estimated using the county recorded annual peak stages at the Ross streamflow gage converted to NGVD29 and the updated stage-discharge rating curve by Stetson (Stetson, 2007). For the period of 1998-2003, convert the gage height to NGVD29 by adding 7.04 feet. For post-2003, convert the gage height to NGVD29 by adding 4.97 feet (Stetson, 2006).
4. There were no peak flow records available for water years 1994, 1995, and 2001.
5. The county has stage records at the Ross streamflow gage for water year 1996, but Stetson judges them unreliable because the peak stage reading was unreasonably high at 27.60 feet, which was even 5 feet higher than the peak stage during the December 31, 2005, flood.
6. The flood frequency analysis results from the Stetson 2011 CIP Study were adopted for this EIS/EIR analysis. The Stetson 2011 CIP Study used the available historical annual peak discharges up to 2010. At this time no attempt was made to update the flood frequency analysis using the data collected since 2010. This way the EIS/EIR used the same flood frequency data as the county-wide flood management programs. It would be expected that the flood frequency would have little change even if the data collected since 2010 were used. This is because that no major floods have occurred since 2010.

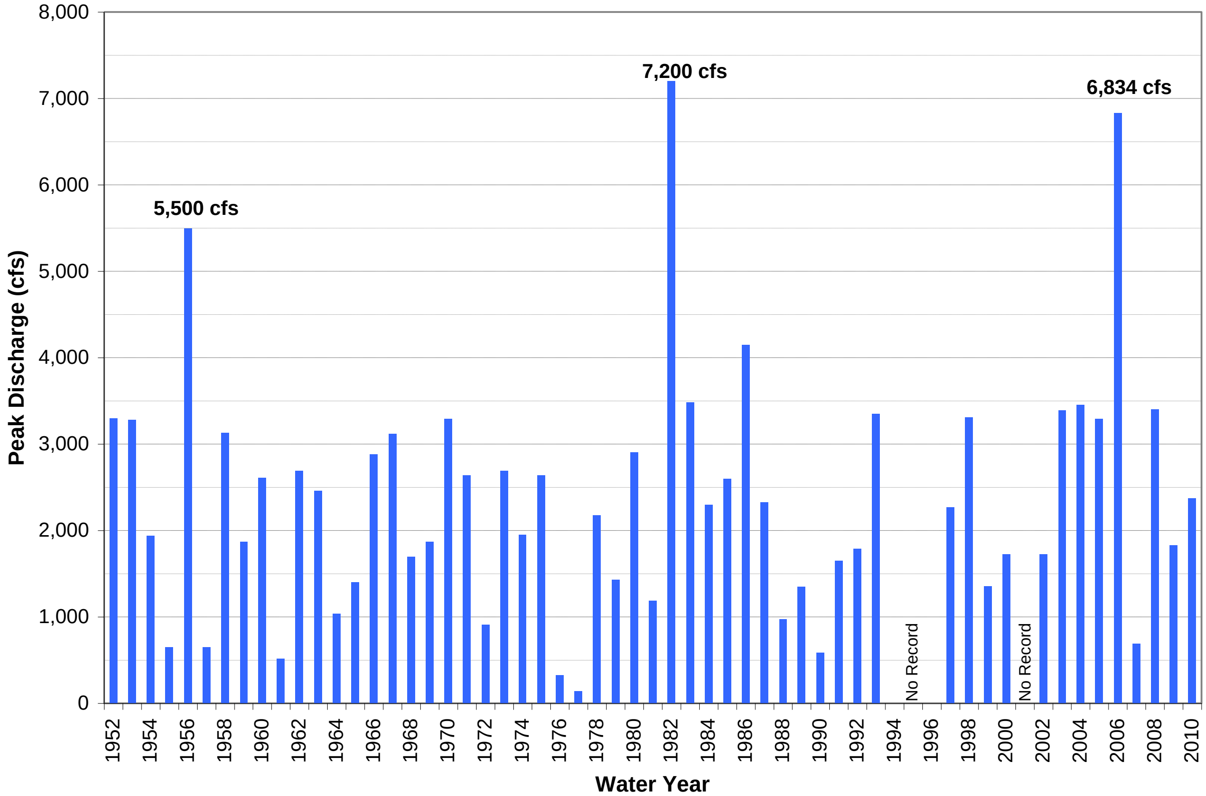


Figure 4.1-3 Historical Annual Peak Discharges.
Recorded at the Flood Zone 9 Streamflow Gage in Ross, Corte Madera Creek.

A 1977 report estimated the 1 percent AEP flood flows entering the study area to be 3,700 cfs from San Anselmo Creek, 900 cfs from Ross Creek, and a combined overland flow of 2,300 cfs for a total of 6,900 cfs (Royston 1977, in USACE 2010). The USACE estimated that approximately 4,700 cfs remained in-channel and 2,500 cfs flowed out-of-channel during the 1982 flood (USACE 2000a). This channel flow estimate corresponds to an approximate 10-year peak flood discharge. The design flow identified for the Project would coincide with the capacity improvement of 5,400 cfs at Lagunitas Road Bridge, which, as previously stated, was completed as part of a separate project. This peak flow rate corresponds to a 4-5 percent AEP based on information presented in Table 4.1-2.

The current (effective) Marin County Flood Insurance Study and countywide Flood Insurance Rate Map were issued on August 15, 2017 (FEMA 2017). Peak discharge data were published for Corte Madera Creek in the effective Flood Insurance Study (FEMA 2017). A summary of the FEMA discharge data for Corte Madera Creek within the study area is included in Table 4.1-3.

Tidal Processes

Tidal Characteristics: Tidal characteristics in the study area as presented are based on data from the Corte Madera Creek tide gage, which was established in May 1977 and removed in December 1978[5]. Mean tide conditions are from the National Ocean Service (National Ocean Service 1983). The 10- and 100-year estimated high tides, which have a respective 10 percent and 1 percent probability of occurring in any given year, are from the FEMA 2017 effective Flood Insurance Study (FEMA 2017). These tidal benchmarks are shown in Table 4.1-4. The 1983 tidal benchmark data provided in Table 4.1-4 are slightly different than the original 1966 design data used to determine the elevation of the design flood. This difference primarily results from subsequent updates to tidal benchmarks after each new national tidal datum epoch (NTDE)[6]. The hydraulic modeling analysis for this EIS/EIR used the tidal benchmark data from the Point San Quentin tide gage, NOAA #9414873 (Appendix A). This tide gage is located approximately two miles from the project area. The mean higher high water and the mean tide level at the Point San Quentin tide gage are 5.95 feet and 3.24 feet NAVD88, respectively, which are about 0.15-0.20 feet higher than those at the Corte Madera Creek tide gage.

TABLE 4.1-4 TIDAL BENCHMARKS

Corte Madera Creek	Datum			Affected Extent of Concrete Channel by Tide
	MLLW (feet)	NGVD29 (feet)	NAVD88 (feet)	
Estimated 1% AEP High Tide (FEMA 2017)	9.75	7.01	9.70	A little above Denil fish ladder
Estimated 10% AEP High Tide (FEMA 2017)	8.45	5.71	8.40	350 feet below Denil fish ladder
Mean Higher High Water	5.80	3.06	5.75	Near Kentfield Hospital Bridge
Mean High Water	5.21	2.47	5.16	150 feet below Kentfield Hospital Bridge
Mean Tide Level	3.14	0.40	3.09	700 feet below Kentfield Hospital Bridge
National Geodetic Vertical Datum, 1929 (NGVD29)	2.74	0.00	2.69	800 feet below Kentfield Hospital Bridge
Mean Low Water	1.07	-1.67	1.02	400 feet above SMN Bridge
Mean Lower Low Water	0.00	-2.74	-0.05	100 feet above SMN Bridge

Notes:
1. Sources: National Ocean Service 1983; NOAA 2010, in USACE 2010; FEMA 2017.
2. Average tide levels are for the Corte Madera Creek tidal gage (NOAA #941 4874).
3. For comparison - Richmond gage mean higher high water = 6.06 NAVD88 or 3.37 NGVD29 (NOAA #9414863).
4. The affected extent by tide was determined by comparing the tide level with the channel bed profile (Figure 4.1-2 for the channel bed profile).

According to the General Design Memorandum No. 1 (USACE 1966), the design tidal boundary or starting water surface elevation is 3.0 feet NGVD29 for all design conditions (USACE 2000a). Generally,

[5] The Corte Madera Creek tide gage was established on the northern shore of the creek, east of US 101 and south of Sir Francis Drake Boulevard.

[6] The specific 19-year period adopted by the National Ocean Service as the official time segment over which tide observations are taken and reduced to obtain mean values (e.g., mean lower low water, etc.) for tidal datum. It is necessary for standardization because of periodic and apparent secular trends in sea level. The present NTDE is 1983 through 2001.

the selection of the tidal boundary condition will affect predicted water surface elevations for some distance upstream. The project channel is designed for the peak discharge resulting from the SPF coincident with mean higher high water and a smaller discharge of one-fourth the SPF, coincident with the highest estimated tide (elevation 5.8 feet msl) in San Francisco Bay. If the SPF occurs coincident with the highest estimated tide, the channel would carry the flood without overflow but with encroachment into the channel freeboard (USACE 1966).

Flooding within the lower portions of the study area (Units 2 and 3) is driven primarily by high tides in San Francisco Bay and concurrent high flows in Corte Madera Creek. Extreme high tides in San Francisco Bay result from the combined effects of astronomical high tides and other factors including winds, barometric pressure, ocean temperatures, and fresh water runoff. Figure 4.1-4 shows areas mapped within the 1 percent AEP and 0.2 percent AEP floodplain on the effective FEMA Flood Insurance Rate Map (FEMA 2017). According to analysis conducted for FEMA, flooding downstream of the stilling basin is controlled by extreme high tide events (FEMA 2017). Flooding upstream of the stilling basin is controlled by extreme rainfall-runoff events on Corte Madera Creek.

Table 4.1-5 presents the statistics of tidal elevations published in the USACE's Tidal Flood Risk Analysis Summary Report for the South San Francisco Bay Shoreline Study (USACE 2014), the FEMA 2009 Flood Insurance Study, the 2014 Flood Insurance Study, and the 2017 effective Flood Insurance Study (FEMA 2009a, in USACE 2010; FEMA 2014; FEMA 2017). The statistics of tidal elevations published in the USACE 2014 study were used in the hydraulic modeling analysis for this EIS/EIR (Appendix A).

TABLE 4.1-5 TIDAL ELEVATIONS

Mouth of Corte Madera Creek	USACE 2014 Study		FEMA 2009 and 2014 Flood Insurance Study		FEMA 2017 Flood Insurance Study	
	NGVD29 (feet)	NAVD88 (feet)	NGVD29 (feet)	NAVD88 (feet)	NGVD29 (feet)	NAVD88 (feet)
10-Year High Tide	5.55	8.24	5.81	8.50	5.71	8.40
50-Year High Tide	5.95	8.64	6.21	8.90	6.61	9.30
100-Year High Tide	6.10	8.79	6.31	9.00	7.01	9.70
500-Year High Tide	6.42	9.11	6.61	9.30	8.21	10.90

NAVD88 = NGVD29 + 2.69 feet (InfoTech 2007, in USACE 2010)

Sea-Level Change: Tidal flooding in the San Francisco Bay area is expected to gradually increase in the future as a result of relative sea-level change. Relative sea-level change is the change of land surface elevation in relation to sea level, and includes the combined effects of local subsidence or uplift and global sea-level change. Information about local subsidence/uplift in the vicinity of the study area is limited. The closest sites for which local rates of change for land surface elevation have been estimated are Point Orient, approximately 5 miles to the east across the bay, and Sausalito, approximately 6 miles to the south; local rates at these sites are -0.024 inch per year, and +0.048 inch per year, respectively (BCDC 1987). Given this information, local rates of change in land surface elevation are not considered significant.

Climate change simulations project a substantial rate of global sea-level change over the next century due to the thermal expansion as the oceans warm and the acceleration of runoff from melting land-based snow and ice. Significant uncertainty remains with respect to the magnitude of the potential change in sea level due to uncertainty stemming from the choice of future emission scenarios used in climate change models, incomplete understanding of oceanic and atmospheric response to these emissions, and the potential for stochastic events not related to burning of fossil fuels (e.g., volcanic activity) to affect climate processes.

The Intergovernmental Panel on Climate Change (IPCC) (IPCC 2007, in USACE 2010), State of California (Cayan *et al*. 2008), and National Research Council (NRC 2012) have projected rates of sea-level change in the San Francisco Bay area. The State of California Sea-Level Rise Guidance/2018 Update (California Natural Resources Agency 2017) provides a science-based methodology for state and local governments to analyze and assess the risks associated with sea-level rise and incorporate sea-level rise into their planning, permitting, and investment decisions. The Marin Shoreline Sea Level Rise Vulnerability Assessment/Bay Waterfront Adaptation & Vulnerability Evaluation (BayWAVE) (Marin County 2017) provides context and estimates of the physical and fiscal impacts across the County's bayside shoreline over the coming decades. It includes sea level rise scenarios ranging from 10 inches in the near-term (15 years) to 20 inches in the medium-term (mid-century) and to 60 inches in the long-term (end of century).

The USACE Engineering and Construction Bulletin (ECB) No. 2018-14 (USACE 2018) provides guidance for incorporating climate change impacts to inland hydrology in civil works studies, designs, and projects. The objective of this ECB is to enhance USACE climate preparedness and resilience by incorporating relevant information about observed and expected climate change impacts in hydrologic analyses for planned, new, and existing USACE projects. The USACE Engineering Circular EC 1165-2-211 Water Resource Policies and Authorities: Incorporating Sea-Level Change Considerations in Civil Works Programs, issued in July 2009, provides guidance for estimating the range of potential sea-level change and for incorporating direct and indirect physical effects of projected future sea-level change (USACE 2009) into project planning and design. Planning studies and engineering designs should evaluate alternatives against a range of local sea-level change projections which are defined by low, intermediate, and high rates of local sea-level change. The USACE-projected intermediate sea level change of about 0.83 feet, or about 10 inches, over the next 50 years (2017-2067) was incorporated in this EIS/EIR analysis (Appendix A).

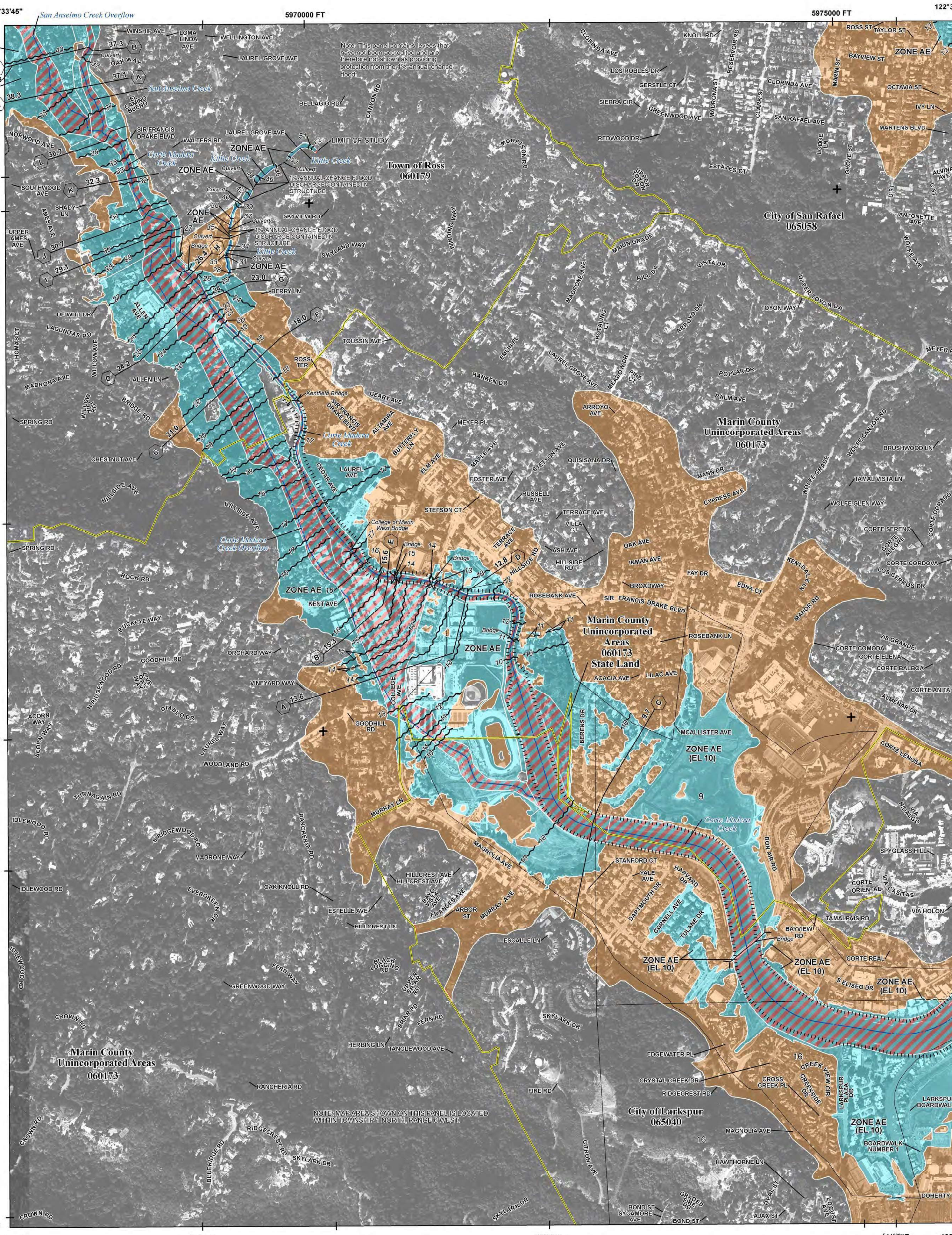
Base Flood Floodplain

The National Flood Insurance Act of 1968 and the Flood Disaster Prevention Act of 1973 established the National Flood Insurance Program to provide insurance coverage to property owners within flood hazard areas. The FEMA administers the National Flood Insurance Program and prepares FISs and associated Flood Insurance Rate Maps to assist communities in local land use planning and flood control decision-making. Marin County entered into the National Flood Insurance Program in 1982, the date the original Flood Insurance Rate Map was published for the incorporated areas of the county (Marin County 2007). To qualify for the National Flood Insurance Program, Marin County adopted local floodplain development policies and now requires flood control measures for new construction and redevelopment projects within their jurisdiction.

On a national level, the 1 percent AEP flood (statistically, the flood with a 1 percent chance of occurring during any given year), termed the base flood by FEMA, represents the level of flood hazard mapped by FEMA and is the level of protection that most flood control projects are designed to achieve. The flood zone may represent flooding from fluvial, coastal, or combined fluvial-coastal flood processes. Projects, such as the one proposed, would provide flood benefit by simply improving channel conveyance capacity and improving the level of flood protection above the existing 5-year level; as estimated by the 2011 Ross Valley CIP study (Stetson 2011).

As it is currently mapped by FEMA (FEMA 2017), the Corte Madera Creek 1 percent AEP floodplain varies from approximately 100 feet wide near its junction with Sleepy Hollow Creek, 1.25 miles west of the study area, to approximately 1,250 feet wide at Lagunitas Road (Figure 4.1-4), to approximately 4,000 feet wide where the creek enters San Francisco Bay. Development, including roads, houses, schools, and commercial and industrial complexes, has encroached upon this natural floodplain. Numerous homes and commercial properties lie within the 1 percent AEP floodplain. All of these properties would have floodwater within their property limits during a 1 percent AEP flood event (Royston 1977, in USACE 2010).

FEMA Effective Flood Insurance Rate Map**:** Effective Flood Insurance Rate Maps typically delineate the 1 percent AEP and 0.2 percent AEP flood hazard event areas. The effective Flood Insurance Rate Map for the study area was delineated based on a detailed hydraulic modeling analysis. The flood hazard delineations in the effective Flood Insurance Rate Maps (2017) show the project vicinity mapped in Zone AE (Figure 4.1-4).



FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT HTTP://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99* With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes *Zone X*
OTHER AREAS	NO SCREEN Areas of Minimal Flood Hazard *Zone X*
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert or Storm Sewer
	Accredited or Provisionally Accredited Levee, Dike or Floodwall
	Non-accredited Levee, Dike or Floodwall
	(E) 18.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
	(8) Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
OTHER FEATURES	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Base map information shown on this FIRM was derived from Coastal California LiDAR and Digital Imagery dated 2011. USDA NAIP 2012 imagery is used in areas not covered by the Coastal California imagery.

Figure 4.1-4

SCALE

Map Projection:
Universal Transverse Mercator Zone 10N; North American Datum 1983;
Western Hemisphere; Vertical Datum: North American Vertical Datum of 1988

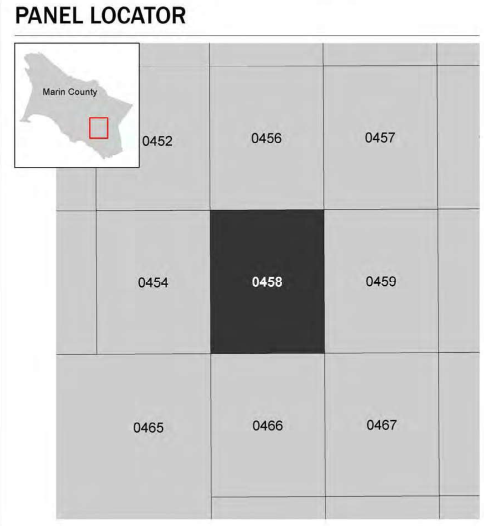
N

1 inch = 500ft 1:6,000

0 250 500 750 1,000 2,000 Feet

0 125 250 500 Meters

PANEL LOCATOR



FEMA

National Flood Insurance Program

NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

MARIN COUNTY, CALIFORNIA
and Incorporated Areas

PANEL 458 OF 531

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
LARKSPUR, CITY OF	065040	0458	F
MARIN COUNTY	060173	0458	F
ROSS, TOWN OF	060179	0458	F
SAN RAFAEL, CITY OF	065058	0458	F

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4.1.3 Environmental Consequences

This section describes the environmental consequences of the proposed project relating to hydrology and hydraulics. It describes the methods used to determine the effects of the project and lists the thresholds used to conclude whether an effect would be significant. The effects that would result from implementation of the project, findings with or without mitigation, and applicable mitigation measures are presented for each alternative.

4.1.3.1 Avoidance and Minimization Measures

The following AMM would be implemented as part of the Project design and would avoid or minimize adverse effects associated with flooding.

- **AMM-HYD-1: Flood Warnings** – Install public warning signs and sirens to improve public awareness and response to inundation emergencies (e.g., flooding). This action will enhance safety for people using and working in the area.

4.1.3.2 Methodology for Impact Analysis and Significance Thresholds

The effects of the proposed project on hydrology and hydraulics would be on groundwater and surface water flooding. In regard to groundwater, the effects of some action alternatives that would remove portions of the concrete lining of the channel would increase groundwater discharge into the channel. The method of analysis of these effects on groundwater was qualitative in nature and relied on applying general principals of groundwater flow.

In regard to surface water flooding, the modeling objective was to design risk management features for the 4 percent AEP flood event that would reduce overflow from the channel into the floodplain or redirect flood flows to minimize flooding that impacts residents, businesses, and other facilities. The method of analysis of project effects on flooding was quantitative and relied on computer modeling.

Detailed hydraulic modeling was performed by USACE to assess the project effects with regard to flooding. The USACE software, the Hydrologic Engineering Center's River Analysis System (HEC-RAS) version 5.0.3, with combined 1D and 2D (one-dimensional and 2-dimensional) unsteady-flow hydraulic modeling capabilities, was used. A combined 1D/2D unsteady-flow model application for the Corte Madera Creek watershed was jointly developed by Stetson and USACE[7] in 2017 (Stetson 2017a). The model starts at the San Francisco Bay and extends about 10 miles upstream along the mainstream and tributaries into the upper watershed above Fairfax. The model geometry incorporates sedimentation depths measured in May 2015 at the lower portion of the concrete channel (see Section 4.1.2.1 for the

[7] USACE developed the downstream portion of the model which starts immediately downstream of the Ross Creek confluence with Corte Madera Creek and extends downstream to the bay encompassing the Corte Madera Creek Flood Control Project. Stetson developed the upstream portion of the model, which extends to the Fairfax area, and then merged the two model portions to arrive at a single comprehensive Ross Valley 1D/2D unsteady-flow hydraulic model covering the entire Corte Madera Creek mainstem and major tributaries. Stetson then calibrated/verified the merged model

measured sedimentation depths)[8]. The model was calibrated to the December 15, 2016, bankfull event (an approximate 20 percent AEP or 5-year flood) and the December 31, 2005, flood event (an approximate 1 percent AEP or 100-year flood), and verified to the January 4, 1982, flood event (an approximate 0.6 percent AEP or 150-year flood). The model was peer reviewed by USACE in 2017.

All action alternatives except Alternative J were designed to provide a flood protection for 4 percent AEP flood events for the entire study reach, plus additional assurance provided by floodwalls. Alternative J was designed to provide a flood protection for 4 percent AEP flood events within and upstream of the Frederick S. Allen Park (Allen Park) Riparian Corridor, but downstream of the Allen Park Riparian Corridor was not. To assess the residual flooding (i.e., flooding that would occur during floods greater than the design flood), each alternative was then analyzed for the 2 percent and 1 percent AEP flood events. For the existing and the future without project (FWOP) conditions, the hydraulic modeling analysis was also performed for these flood events (Appendix A). Residual flooding of the action alternatives was assessed using the FWOP condition as the baseline. The modeled downstream tidal boundary condition initially used the tide with the same return interval as the modeled flood event. For example, the 2 percent AEP tide was used in modeling the 2 percent AEP flood and the 1 percent AEP tide was used in modeling the 1 percent AEP flood. This downstream tidal boundary assumes that extreme flood flows occur coincidently with extreme tides, which is overly conservative and incorrect. Hydraulic modeling analysis was redone with the correct downstream boundary condition for existing conditions, the FWOP condition, and Alternatives F and J using the MHHW as the downstream boundary condition. The USACE-projected “intermediate” sea level rise of about 0.83 feet, or about 10 inches, over the next 50 years (2017-2067) was used in modeling of the FWOP condition and the FWOP with alternatives conditions.

Effects on hydrologic conditions may be considered significant if implementation of an alternative would result in any of the following conditions:

- **Impact HYD-1:** Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).
- **Impact HYD-2:** Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site.
- **Impact HYD-3:** Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site.

[8] The lower portion of the concrete channel had deposited sediment. The channel geometry of the model incorporated the 2015 sediment depth measured along the lower portion of the concrete channel as the bottom of the channel, rather than using the as-built designs of the clean concrete channel. Using the 2015 measured sediment depth has no relation to the calibration to the specific events. Actually the sediment depth that occurred during the specific event was likely mobilized but not measured. Notes: Due to modifications in recent years of a few hydraulic structures along Corte Madera Creek, including replacement of Lagunitas Bridge in 2010, modification of the Ross Fish Ladder in 2006, and the replacement of the Creekside Marsh culvert near Bon Air road in 2016, two geometry files were developed for model calibration; “2005 geometry” and “2017 geometry.” Both geometries share exactly the same calibrated/verified hydraulic parameters, and differ only with regard to the geometries of these three structures. For the design and analyses of alternatives, only the “2017 geometry” file was used.

- **Impact HYD-4:** Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
- **Impact HYD-5:** Place a structure within a 100-year flood hazard area which could impede or redirect flood flows.
- **Impact HYD-6:** Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam.

4.1.3.3 Effects and Mitigation

No Action Alternative

The no action alternative represents the foreseeable future condition if neither the Project nor one of the action alternatives are approved. It is also referred to as the future without project (FWOP) condition. The county identified the following projects as the likely foreseeable projects within the timeframe of the Unit 4 project:

- Sunnyside Nursery Site Detention Basin;
- Building Bridge #2 Removal (632-636 San Anselmo Avenue, San Anselmo);
- Azalea Avenue Bridge Replacement;
- Madrone Avenue Bridge Replacement;
- Nokomis Avenue Bridge Replacement;
- Sycamore Avenue/Center Boulevard Bridge Replacement;
- Bridge Avenue Bridge Replacement; and
- Winship Avenue Bridge Replacement.

These foreseeable projects under the no action alternative are all located upstream of Unit 4 (see Figure 1 of Attachment 2 to Appendix A) and are mostly bridge replacement projects. These projects would have no effect on groundwater in the Unit 4 Project area. By attenuating flood flows through detention basins and by increasing in-channel discharge through bridge replacements, the combined effects of these foreseeable projects could result in minor change in the magnitude, timing, and paths of flow entering the Unit 4 Project area. With regard to Impact HYD-6, although the no action alternative would still expose people or structures to a significant risk of loss, injury, or death involving flooding, however, compared to existing conditions, the foreseeable projects under the no action alternative would be expected to have a less than significant impact on flooding in the Unit 4 study area. In summary the no action alternative would have ***no impact*** to hydrology and hydraulics, and no mitigation of any kind would be required.

Action Alternatives Evaluation

All action alternatives except Alternative J are designed to contain the 4 percent AEP flood. Alternative J is designed to provide a flood protection for 4 percent AEP flood events within and upstream of the Allen Park Riparian Corridor, but downstream of the Allen Park Riparian Corridor is not. Refer to Appendix A for detailed results of the potential effects on flooding.

- **Impact HYD-1**: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).

Alternative A would not construct any flood risk management (FRM) features or remove concrete channel lining that would alter existing groundwater movement. Impact HYD-1 would be ***less than significant*** for Alternative A.

Alternative B would remove the concrete-lining of the channel for College of Marin widening in portions of Unit 3 (around the College of Marin) and Unit 2 (around Kent Middle School). Alternatives F and G would remove the concrete-lining for College of Marin widening and at Allen Park Riparian Corridor. Alternative J would remove the concrete-lining at Allen Park Riparian Corridor. These changes would increase groundwater inflow into the channel by removing the concrete lining which impedes groundwater discharge into the creek. The increased groundwater discharge would contribute to the baseflow during the dry season and have a cooling effect on surface flow, which would be beneficial to habitat. The removal of the concrete channel would restore natural groundwater movement to the channel. Because of the high water table and the small affected area adjacent to the channel, Alternatives B, F, G, and J would not deplete the aquifer or lower the groundwater table. Impact HDY-1 would be ***less than significant*** for Alternatives B, F, G, and J.

- **Impact HYD-2:** Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site.

Alternative A would not substantially alter the existing drainage patterns of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on or off site. Containing more flood flows in the Unit 4 natural channel reach by floodwalls and removal of the Denil fish ladder may increase flow velocity and, thus, erosion and sediment transport potential. However, an equilibrium natural grade along the Unit 4 natural channel reach that has similar grade as the concrete channel would be expected after removal of the fish ladder (Figure 4.1-2). Further erosion and siltation would be expected to be minimal after an equilibrium natural grade is established. Alternative A would have floodwalls with 15 feet vegetation cleared area on both sides that would be planted with grass to reduce post-construction erosion and sedimentation.

As discussed in Section 4.1.2.1, the lower portion of the concrete channel (downstream of the College of Marin SMN Bridge) has deposited sediment under existing conditions. Containing more flood flows in the concrete channel by floodwalls may increase the flow velocity and, thus, sediment transport potential. This would be beneficial to the transport of the deposited sediment.

In summary, the impacts of Alternative A on erosion and sediment transport would be expected to be ***less than significant*.**

Alternative B would have similar floodwalls as Alternative A along the Unit 4 reach and along the concrete channel upstream of the College of Marin. The main difference between the two alternatives is that Alternative B would remove and widen portions of Unit 3 (around the College of Marin) and Unit 2 (around Kent Middle School) and replace with features that replicate a natural tidal creek. Widening the channel may reduce the flow velocity while containing more flows by floodwalls, which may increase flow velocity. The net effect on flow velocity and sediment transport potential along the widened channel reach are expected to be insignificant. Alternative B would not substantially alter the existing drainage patterns of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on or off site.

In addition to the same channel widening as Alternative B in portions of Unit 3 and Unit 2, Alternative F would include an underground bypass culvert to convey high flows from the upstream portion of Unit 4 downstream to the Allen Park Riparian Corridor. Under low flow conditions, Alternative F would not bypass any flows and, thus, would not substantially alter the existing drainage patterns of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on or off site. Under high flow conditions, a portion of the flow would be diverted to the culvert and bypass the Unit 4 natural channel reach. The flow reduction may decrease flow velocity and, thus, increase siltation potential. However, the decreased flow velocity would be small (less than 0.3 fps) along the Unit 4 natural channel reach and its impact on siltation would be ***less than significant.*** Construction of the Allen Park Riparian Corridor under Alternative F would reduce the flow velocity within the Corridor. However, hydraulic modeling shows that the resulting flow velocity would still be high enough to prevent sedimentation within the Corridor.

Alternative G would have similar floodwalls as Alternative A along the Unit 4 reach, the same channel widening as Alternative B in portions of Unit 3 and Unit 2, and the same Allen Park Riparian Corridor as Alternative F. Based on the analysis results of Alternatives A, B, and F, Alternative G would not substantially alter the existing drainage patterns of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on or off site.

Alternative J would have the same underground bypass culvert and the same Allen Park Riparian Corridor as Alternative F. Downstream of the Allen Park Riparian Corridor, Alternative J would construct floodwalls near the Granton Park neighborhood and adjacent to College Avenue. These floodwalls would not substantially alter the existing drainage patterns of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on or off site.

- **Impact HYD-3**: Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site.

  All action alternatives are designed for flood reduction and would not contribute runoff water in excess of current baseline conditions and would not exceed the capacity of existing or planned stormwater drainage systems and, therefore, would have ***no impact***.

- **Impact HYD-4**: Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.

All action alternatives are designed for flood reduction and would not create or contribute runoff water that would exceed the capacity or planned stormwater drainage system and, therefore, would have ***no impact.***

- **Impact HYD-5**: Place a structure within a 100-year flood hazard area which could impede or redirect flood flows.

All action alternatives would include the placement of floodwalls within a 1 percent AEP special flood hazard area. These structures would prevent or reduce creek flood flows into the floodplain but may impede flood flows of the interior drainage systems. With appropriate improvement designs of the interior drainage systems in the final design, the impacts of these floodwalls would be ***beneficial*** or have ***no impact.***

Construction of the Allen Park Riparian Corridor under Alternatives F, G, and J would require relocation or reconstruction of the storm drain outfalls on both side of the creek that discharge to the concrete channel below the Denil fish ladder (see the photo below). The relocation or reconstruction of the storm drain outfalls will be designed conjunctively with improvement designs of the interior drainage systems in the final design.

Construction and operation of the interior drainage systems could result in significant impacts, including impacts to biological resources, water quality, air quality, and noise. The extent and nature of these impacts cannot be determined at this time, since the interior drainage systems, which may include new pump stations, conveyance pipes, and outfalls, have not yet been specified or designed. General impacts of construction and operation of these facilities are discussed in impact WQ-3 in Section 4.2, Water Quality.

Photo 4.1-A. View of the storm drain outfall downstream of the Denil fish ladder

- **Impact HYD-6**: Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam.

Action Alternatives A, B, F, and G are designed to contain the 4 percent AEP flood, as demonstrated in Figures 8, 10, 12, and 14 of Attachment 2 to Appendix A which show that the 4 percent AEP flood inundation would be completely within the channel for these four action alternatives without floodplain inundation. Action Alternative J is designed to provide a flood protection for 4 percent AEP flood events within and upstream of the Allen Park Riparian Corridor, but downstream of the Allen Park Riparian Corridor is not. This is demonstrated in Figure 16 of Attachment 2 to Appendix A which shows that the 4 percent AEP inundation of Alternative J would not be completely within the channel downstream of the Allen Park Riparian Corridor.

Alternative A, would have a beneficial effect by reducing the exposure of people or structures to a significant risk of loss, injury, or death involving flooding in the study area (refer to Figure 13 of Attachment 2 to Appendix A which shows significant reduction in 1 percent AEP floodplain inundation extent [by about 94 acres] and depth, compared to the FWOP condition). Impact HYD-6 would be ***less than significant***.

Alternative B would have a beneficial effect by reducing the exposure of people or structures to a significant risk of loss, injury, or death involving flooding in the study area (refer to Figure 11 of Attachment 2 to Appendix A which shows significant reduction in 1 percent AEP floodplain inundation extent [by about 93 acres] and depth, compared to the FWOP condition). Note that Alternative B would increase the 1 percent AEP floodplain inundation depth on the area and properties that lie inside/interior to the setback floodwall near Sylvan Lane; however, these properties would be purchased and the residents relocated to mitigate the impact. Impact HYD-6 would be ***less than significant***.

Alternative F would have a beneficial effect by reducing the exposure of people or structures to a significant risk of loss, injury, or death involving flooding in the study area (refer to Figure 13 of Attachment 2 to Appendix A which shows significant reduction in 1 percent AEP floodplain inundation extent [by about 65 acres] and depth, compared to the FWOP condition). Impact HYD-6 would be ***less than significant.***

Alternative G would have a beneficial effect by reducing the exposure of people or structures to a significant risk of loss, injury, or death involving flooding in the study area (refer to Figure 15 of Attachment 2 to Appendix A which shows significant reduction in 1 percent AEP floodplain inundation extent [by about 82 acres] and depth, compared to the FWOP condition). Impact HYD-6 would be ***less than significant.***

Alternative J would have a beneficial effect by reducing the exposure of people or structures to a significant risk of loss, injury, or death involving flooding in the study area (refer to Figure 17 of Attachment 2 to Appendix A which shows some reduction in 1 percent AEP floodplain inundation extent [by about 32 acres] and depth, compared to the FWOP condition). Impact HYD-6 would be ***less than significant.***

The main reason that Alternative F shows less reduction in the 1 percent AEP inundation extent than Alternatives A, B, and G is because Alternative F does not have floodwalls with 3 feet of assurance along the Unit 4 reach. It makes sense that Alternative J would have the least reduction in the 1 percent inundation extent. This is because Alternative J does not have floodwalls with 3 feet of assurance along the Unit 4 reach and along the right side of the creek reach downstream of the Allan Park Riparian Corridor.

It should be noted that constructing floodwalls on the left bank only and not the right bank under Alternative J would not induce more flooding and damages on the right bank floodplain. Under existing conditions, this right bank floodplain would be flooded due to the overland floodwater escaped from the Unit 4 reach. With the underground bypass culvert in Alternative J for diverting a portion of floodwater from the Unit 4 reach to below the fish ladder and, thus, reducing the overland floodwater, the modeling result shows that the flooding in this right bank floodplain would be reduced, not increased (refer to Figures 16 and 17 of Attachment 2 to Appendix A which shows reduced flooding in this right bank floodplain).

Table 4.1-6 summarizes the hydrology impacts of the action alternatives.

TABLE 4.1-6 HYDROLOGY IMPACT CONCLUSIONS					
Effect	**AMMs**	**Applicable Alternatives**	**Significance**	**Mitigation**	**Significance after Mitigation**
HYD-1: Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level which would not support existing land uses or planned uses for which permits have been granted).	--	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
HYD-2: Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, in a manner that would result in substantial erosion or siltation on- or off-site.	--	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
HYD-3: Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner that would result in flooding on- or off-site.	--	All	NI	--	--
HYD-4: Create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.	--	All	NI	--	--
HYD-5: Place a structure within a 1% AEP flood hazard area which could impede or redirect flood flows.	--	All	NI	--	--
HYD-6: Expose people or structures to a significant risk of loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam.	AMM-HYD-1	All Action Alternatives	B	--	--
	--	No Action	NI	--	--

AMM = avoidance and minimization measure
LTS = less than significant
NI = No Impact
B = Beneficial

4.1.3.4 Cumulative Effects

The foreseeable projects under the no action alternative are all located upstream of the Unit 4 Project area. As shown in Figures 5a, 6a, and 7a of Attachment 2 to Appendix A, the existing condition and FWOP condition (i.e., no action alternative) would have almost the same floodplain inundation extent and depth in the Ross/Kentfield area. The increased water surface elevation for the FWOP condition for the downstream Kentfield area (Figures 5b, 6b, and 7b of Attachment 2 to Appendix A) is the result of the higher future tide used in the modeling; a sea level rise of 10 inches was used in the modeling of FWOP. In other words, with the no action alternative, the hydrology and flooding conditions within the study area would continue as existing conditions.

All action alternatives would reduce flooding impacts and have no significant impacts, so do not have the capability of combining with other projects in an adverse manner with respect to cumulative hydrologic and flooding impacts. As discussed above, other cumulative projects, most notably those watershed-wide foreseeable projects which are all located upstream of the Unit 4 Project study area, would not have any adverse cumulative impact on hydrology and flooding of the study area. The Sunnyside flood diversion and storage basin in the San Anselmo Flood Risk Reduction Project would reduce in-channel flow in the Unit 4 project area for a 10-year or smaller flood event (which is beneficial to the Corte Madera Creek flood risk reduction) but would have little effect for larger flood events due to the limited storage capacity of the flood diversion and storage basin (about 33 acre-feet). Nevertheless, these effects were accounted for in the hydraulic modeling of the action alternatives since the modeling analysis used the watershed-wide hydraulic model. Similarly, the effects of all the foreseeable bridge replacement projects were also accounted for in the hydraulic modeling of the action alternatives although they would have little effect on in-channel flows in the Unit 4 project area.

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4.2 Water Quality

This section describes the existing surface and groundwater quality within the study area. This section also describes the regulatory setting for water quality and the effects on water quality that would result from the no action alternative and Alternatives A, B, F, G, and J and any mitigation measures that would reduce significant effects. This section was developed based on field observations, recent water quality data from DWR, the SFRWQCB and Marin County, and studies undertaken by Friends of Corte Madera Creek Watershed.

4.2.1 Regulatory Setting

This section describes regulatory information that applies to water quality.

4.2.1.1 Federal

Clean Water Act (33 United States Code [USC] § 1251 *et seq*.)

Sections 303(d), 401, 402, and 404 apply to water quality considerations. A detailed discussion of the how the Clean Water Act applies to the project and how the project complies with these sections of the Act, please see Chapter 9.

4.2.1.2 State

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act of 1969 applies to water quality considerations. A detailed discussion of the how this Act applies to the project and how the project complies with the Act, please see Chapter 9.

2007 San Francisco Bay RWQCB Basin Plan

The study area is located within the jurisdiction of the SFRWQCB (Region 2). The SFRWQCB has the authority to implement water quality protection standards through the issuance of permits for discharges to waters at locations within its jurisdiction. The 2007 SFRWQCB Basin Plan (Basin Plan) describes the water quality control measures that contribute to the protection of the beneficial uses of the San Francisco Bay watershed. The Basin Plan identifies beneficial uses for each segment of the San Francisco Bay and its tributaries, water quality objectives for the reasonable protection of the uses, and an implementation plan for achieving these objectives. As the Project would involve modifications within the channel of Corte Madera Creek, the guidance provided by the Basin Plan and enforced by the SFRWQCB would be applicable to the Project.

4.2.1.3 Local

Marin Countywide Plan

The Marin Countywide Plan is made up of several elements that shape the manner in which development, including flood control projects, occur within the county. These elements include: Natural Systems and Agriculture, Socioeconomics (which includes public safety), Community Development, Noise, and Built Environment. As the Project is located within unincorporated portions of the county, the policies of the countywide plan that are germane to the Project include, but are not limited to:

- **Policy WR-1.3: Improve Infiltration.** Enhance water infiltration throughout watersheds to decrease accelerated runoff rates and enhance groundwater recharge. Whenever possible, maintain or increase a site's predevelopment infiltration to reduce downstream erosion and flooding.

Marin County Code

The Marin County Code establishes standards for development in areas subject to flooding, grading and erosion control, protection of trees and riparian vegetation, management of parks and recreation facilities, and noise. The following sections of the Marin County Code are considered applicable to the Project:

- **Title 19: Buildings:** Chapter 19.06 of the Marin County Code contains requirements to ensure that proper grading and erosion control procedures are implemented to protect the public health and welfare and to avoid the siltation of watercourses.

Marin County Stormwater Pollution Prevention Program

The Marin County Stormwater Pollution Prevention Program, formed in 1993, is a joint entity of cities, towns, and unincorporated areas in Marin County constituted to prevent stormwater pollution, protect and enhance water quality in creeks and wetlands, preserve beneficial uses of local waterways, and comply with state and federal regulation governing water quality. Marin County Stormwater Pollution Prevention Program is composed of unincorporated Marin County, the cities of Belvedere, Larkspur, Mill Valley, Novato, San Rafael, and Sausalito and the towns of Corte Madera, Fairfax, Ross, San Anselmo, and Tiburon. The county's local stormwater program is responsible for implementing Marin County Stormwater Pollution Prevention Program. The local stormwater program is administered by the Department of Public Works District staff in cooperation with the Community Development Agency, Environmental Health Services, and Parks and Open Space.

Marin County Stormwater Pollution Prevention Program participates in benthic invertebrate monitoring, as an indicator of stream health in the watersheds of east Marin County and participates in periodic monitoring of water quality to help establish TMDLs. Marin County Stormwater Pollution Prevention Program provides information to interested parties, including residents and developers, to documents such as the Start-at-the-Source Design Guidance Manual to help improve Marin County water quality, stream channel stability, and aquatic habitats. Marin County Stormwater Pollution Prevention Program's Stormwater Quality Manual for Development Projects in Marin County is a valuable guidance for applicants to apply low impact development approach in their project design and prepare submittals that demonstrate their project complies with the NPDES permit requirements.

While Marin County Stormwater Pollution Prevention Program participates in some water quality monitoring and community outreach, they do not enforce implementation of its policies. However, the county and cities are members of Marin County Stormwater Pollution Prevention Program that utilize BMPs within their programs and implement the requirements for nonpoint source pollution control[9] and NPDES Phase II permit requirements. County permits for construction projects also require as conditions of approval that erosion control measures are identified on the engineering plans and implemented

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[9] Marin County Code addresses nonpoint source pollution under Title 24, Development Standards. Section 24.04.625, Erosion and Sediment Control, ensures that BMPs are incorporated into project construction, and when required by the Marin County Community Development Agency, a SWPPP be prepared to address interim (i.e. during construction) and post construction erosion control measures. Section 24.04.627, Surface Runoff Pollution Control Plans, addresses nonpoint source pollution by presenting permanent BMPs that implement Start-at-the-Source techniques aimed at improving stormwater water quality. Permanent BMPs may include but are not limited to, site and drainage design features that route runoff from roofs and paved surfaces to landscaped areas, engineered bioretention facilities, roofs over areas where vehicles are washed or repaired, and facilities for cleaning equipment such as mats used in restaurant kitchens. The Marin County Stormwater Pollution Prevention Program's Stormwater Quality Manual for Development Projects in Marin County contains specific guidance applicable to the project category.

based on the Association of Bay Area Governments Manual of Standards for Erosion & Sediment Control Measures.

4.2.2 Affected Environment

4.2.2.1 Surface Water Quality

Beneficial uses of Corte Madera Creek identified in the SFRWQCB Basin Plan are as follows: cold and warm freshwater habitat for aquatic life, wildlife habitat, preservation of rare and endangered species, and noncontact recreation. Potential beneficial uses are fish migration, fish spawning, and contact recreation (RWQCB 2017). The creek is not used as a potable water supply.

Corte Madera Creek has a number of tributaries that flow from open space headwater areas through highly urbanized areas to San Francisco Bay. The creek experiences a variety of water quality problems related to nonpoint-source pollution from urban runoff (4.1 miles of storm sewers), septic systems, road and bank erosion; specific concerns include pesticides, bacteria, particulates (sediment), and nutrients (Town of Ross 2009, CCA 2002, in USACE 2010). The SFRWQCB provides information on sediment, pathogens, and diazinon as pollutants of concern. Pathogens of concern are Enterococcus (in Corte Madera Creek), and E. coli (in the tributaries) (Friends 2006, in USACE 2010). Nutrient loading from runoff and sewage contribute to growth of algae and other aquatic plants in portions of Corte Madera Creek, particularly areas that are unshaded by riparian vegetation (Town of Ross 2009, in USACE 2010). Erosion originating primarily from headwater areas and, to a lesser extent, creek banks in the towns, result in increased siltation in the creeks (Stetson 2000), which can be harmful to salmonids.

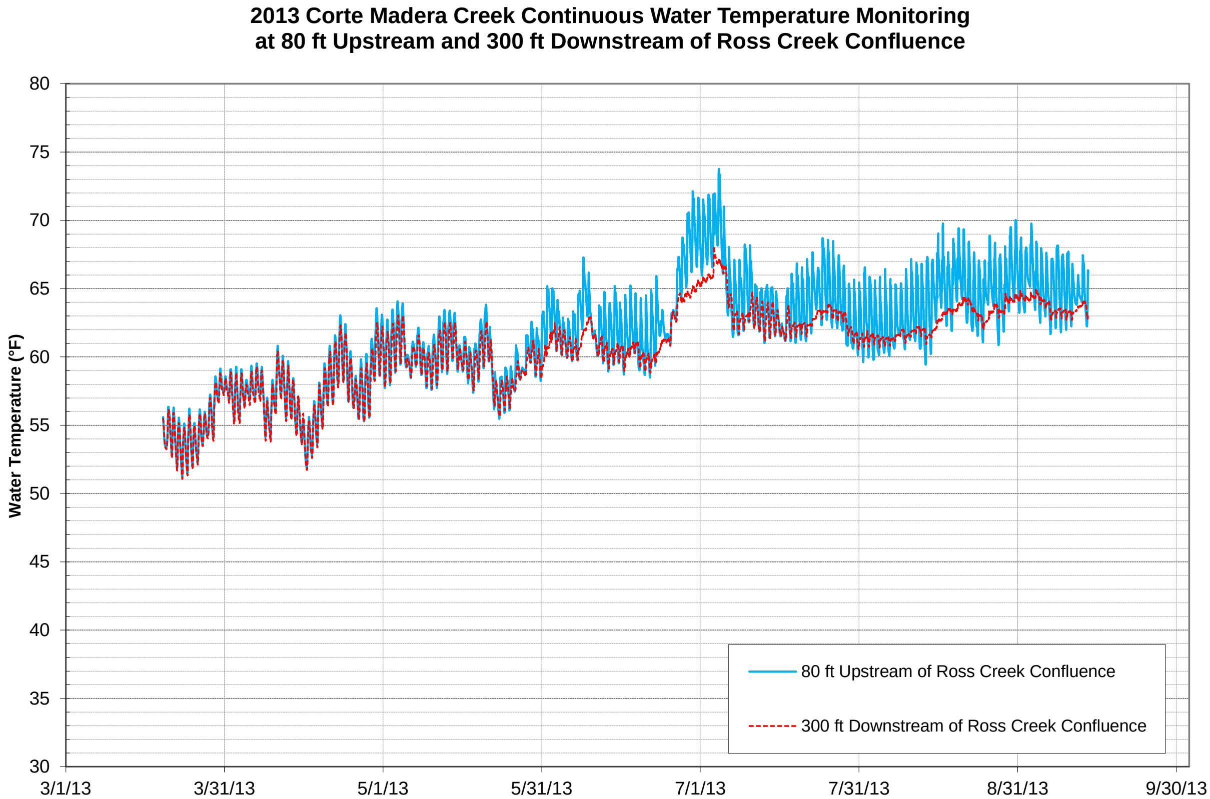
Both Corte Madera Creek and San Francisco Bay are identified by the CWA Section 303(d) List as impaired waterbodies. Corte Madera Creek is impaired for the pesticide diazinon, although this listing may be related to the overall impairment of the San Francisco Bay rather than specific measurements for diazinon within Corte Madera Creek. The SFRWQCB 2005 plan amendment cites earlier data showing no detectable diazinon (less than 30 nanograms/liter) in water samples from Corte Madera Creek. A TMDL has been approved in the Basin Plan for all urban creeks to address the impairment (SFRWQCB 2017). An attainment strategy to achieve the TMDL has identified the sources of diazinon loading in the watershed and specified actions to address them; public participation has been important in setting effective and achievable TMDLs and attainment strategies (Marin County 2005a, 2007) and will continue to be central to improving water quality.

High coliform bacteria counts have been detected during the winter months in various segments of the creek (Marshall *et al*. 1994, as cited in A.A. Rich 2000). Friends of Corte Madera Creek (2006) found elevated levels of both E. coli and Enterococcus at several stations within Corte Madera Creek. In the summer of 2005, Enterococcus counts (Most Probable Number/100 milliliter [mL]) ranged from 51 to 100 most probable number /100 mL throughout Corte Madera Creek downstream of Ross Town Hall. At the downstream end of the concrete channel, the Enterococcus count was 81 most probable number /100 mL. In summer of 2006, Enterococcus counts ranged from 29 to 92 most probable number /100 mL. At the downstream end of the concrete channel, the Enterococcus count was 29 most probable number /100 mL. Counts of E. Coli in Corte Madera Creek behind Ross Town Hall were elevated in winter months relative to summer months in 2004 (320 most probable number /100 mL winter vs. 66 most probable number /100 mL summer) and 2005 (450 most probable number /100 mL winter vs. 60 most probable number /100 mL summer). Although the results were highly variable, these counts periodically exceeded federal contact recreational criteria (saltwater concentrations of Enterococcus < 35 most probable number /100 mL, freshwater concentrations of E. coli < 126 most probable number /100 mL).

High water temperatures have been attributed to urbanization of the watershed, specifically the reduction of shaded stream surface area, although less so within Unit 4, due to loss of riparian vegetation and increased channel width (Friends 2008a, in USACE 2010). Measured water temperatures in the study area are high beginning in late May and extending through September, ranging from 65 to 75 degrees Fahrenheit (°F) (A.A. Rich 2000), with higher temperatures being recorded within the concrete-lined sections of Corte Madera Creek. In 2008, temperatures at the Bridge Avenue Pool were measured between 62 and 70°F in June and August (Friends 2008a, in USACE 2010). Also, in 2008, temperatures in Ross Creek upstream of its confluence with Corte Madera Creek were recorded between 62 and 67°F during March and May (Friends 2008b, in USACE 2010). These temperatures are stressful for migrating salmonids, but thermal refugia may be available to fish either due to the presence of pockets with limited mixing, combined with daily temperature fluctuations, or the presence of deeper pools in areas of the creek which are not concrete-lined (A.A. Rich 2000). Elevated water temperatures may also exacerbate existing problems with algae and aquatic plant growth (Town of Ross 2009, in USACE 2010).

Continuous water temperatures in Corte Madera Creek near the Ross Creek confluence at two different locations were collected in 2013 by the Friends of Corte Madera Creek: one at about 80 feet upstream of the Ross Creek confluence and the other at about 300 feet downstream of the Ross Creek confluence (Figure 4.2-1). The collected water temperatures at the downstream location were generally about 3 - 6°F cooler than the upstream location in the summer months (June-September; see the graph below), suggesting there was a cooling effect between the two locations. The cooling effect would not result from Ross Creek surface inflow because there was no flow at the downstream end of Ross Creek in the summertime of 2013. The cooling effect may have resulted from Ross Creek subsurface inflow (Stetson 2014).

Figure 4.2-1



4.2.2.2 Groundwater Quality

The DWR Bulletin 118 (California Groundwater) presents the results of groundwater basin evaluations in California. The most recent Bulletin 118 update was published in 2003 and identifies the 1,770-acre Ross Valley Groundwater Basin (Basin 2-28) within the San Francisco Bay Hydrologic Region. The Ross Valley groundwater basin is a small, coastal basin located in the cities of Corte Madera and Larkspur. It is bounded on the east by San Francisco Bay and the north by Corte Madera Creek (DWR, 2004). Existing beneficial uses for the Ross Valley Groundwater Basin are municipal/domestic and agricultural water supply, and potential beneficial uses are industrial service water supply (without water quality limitations) and industrial process water supply (with water quality limitations) (RWQCB 2017); however, groundwater in Ross Valley is used only for landscape irrigation (Marin County 2005).

In general, groundwater quality throughout most of the San Francisco Bay Hydrologic Region is suitable for most urban and agricultural uses with only local impairments. Although the region's primary constituents of concern are high total dissolved solids, nitrate, boron, and organic compounds, the Ross Valley Basin does not have enough available data to provide either an estimate of the basin's groundwater budget or groundwater extraction from the basin (DWR 2003).

In addition to rainfall infiltration as a source of groundwater recharge, the lower portion of Corte Madera Creek may also recharge groundwater reservoirs (Marin County 2005a). Information on the Ross Valley groundwater basin is limited, but given its proximity to the Bay, seawater intrusion may influence groundwater quality (DWR 2004).

4.2.3 Environmental Consequences

This section describes the environmental consequences relating to water quality conditions for the Project. It describes the methods used to determine the effects of the Project and lists the thresholds used to conclude whether an effect would be significant. The effects that would result from implementation of the Project, findings with or without mitigation, and applicable mitigation measures are presented for each alternative.

4.2.3.1 Avoidance and Minimization Measures

The Project is required to comply with all NPDES Permit requirements for the construction period. Under the NPDES program, it is required to submit a Notice of Intent with the SWRCB Division of Water Quality. The Notice of Intent includes general information on the types of construction activities that will occur on the site. It will also be required to prepare a SWPPP that includes a description of appropriate BMPs to minimize the discharge of pollutants from the site and a habitat restoration plan. BMPs appropriate for construction activities can be organized into four major categories:

1. **Erosion Control:** Measures that prevent erosion and keep soil particles from entering stormwater, lessening the eroded sediment that must be trapped, both during and at completion of construction.
2. **Sediment Control:** Feasible methods of trapping eroded sediments so as to prevent a net increase in sediment load in stormwater discharges from the site.
3. **Site Management:** Methods to manage the construction site and construction activities in a manner that prevents pollutants from entering stormwater, drainage systems or receiving waters.
4. **Materials and Waste Management:** Methods to manage construction materials and waste that prevent their entry into stormwater, drainage systems or receiving waters.

The SWPPP must fully comply with SFRWQCB requirements and contain specific BMPs to be implemented during construction to reduce erosion and sedimentation to the maximum extent practical. The following AMM design features, which are associated with all of the action alternatives, would avoid or reduce adverse environmental impacts from the Project:

- **AMM-WQ-1: Staging Area** – Establish staging areas for activities such as fueling, equipment storage, and fill storage.
- **AMM-WQ-2: Fuel Management Plan –** Develop and incorporate a Fuel Management Plan.
- **AMM-WQ-3: Turbidity Management Plan –** Implement a Water Quality and Turbidity Management Plan; plan will include stormwater management.
- **AMM-WQ-4: Construction Timing –** Conduct construction activities during the dry season to minimize turbidity and water quality degradation.
- **AMM-WQ-5: Hazardous Spill Plan –** Develop and incorporate a Hazardous Spill Plan.
- **AMM-WQ-6: In-Stream Sediment Control –** Use coffer dams and/or silt curtains to the extent feasible during construction.
- **AMM-WQ-7: Minimize In-water Construction –** In-water construction activities will be minimized to the extent practical.
- **AMM-WQ-8: Turbidity Control –** The use of BMPs for turbidity control shall be employed during all in-water work conducted in the creek, where appropriate.
- **AMM-WQ-9: Stormwater Runoff Control –** No debris, soil, silt, sand, cement, concrete, or washings thereof, or other construction-related materials or wastes, oil, or petroleum products, or other

organic or earthen material shall be allowed to enter into or be placed where it may be washed from the construction sites by rainfall or runoff.

- **AMM-WQ-10: Stormwater Management Plan –** A Stormwater Management Plan will be developed to ensure that, during rain events, construction activities do not increase the levels of erosion and sedimentation. This plan will include the use of erosion-control materials and erosion-control measures to minimize any impacts that may occur due to increased mobilization of sediments.
- **AMM-WQ-11: Prepare SWPPP –** Erosion will be controlled based on the SWPPP to be prepared for the project. Implementing the SWPPP measures will minimize soil erosion and related sedimentation.
- **AMM-WQ-12: Clear Area Sediment Control on Both Sides of Floodwalls** – Grass will be planted in the 15 feet clear area on both sides of floodwalls to prevent post-construction erosion and sedimentation.

The following AMMs from other resource areas would avoid or reduce adverse environmental impacts from the Project:

- **AMM-BIO-2: Seasonal Restrictions -** Implement wet-season restrictions on construction for wildlife protection. Construction activities in or adjacent to the channel of Corte Madera Creek shall be conducted during the dry season (June 15 through October 15).
- **AMM-BIO-4: Minimize Footprint -** The amount of disturbance within the project area shall be reduced to the absolute minimum necessary to accomplish the proposed project. Topsoil from the creek banks shall be removed, stockpiled, covered, and encircled with silt fencing to prevent loss or movement of the soil into Corte Madera Creek. All disturbed soils shall undergo erosion control treatment prior to the rainy season and after construction is terminated. Treatment typically includes temporary seeding with native species and sterile straw mulch. All topsoil shall be replaced in a manner as close as possible to pre-disturbance conditions. All construction-related holes in the ground will be covered to prevent entrapment of California red-legged frog or foothill yellow-legged frog.
- **AMM-BIO-9: Cleaning of Equipment and Vehicles -** Equipment will be cleaned of any sediment or vegetation before transfer and use between sites to prevent spreading pathogens or exotic/invasive species. Vehicle and equipment washing will occur on-site as needed. No runoff from vehicle or equipment washing will be permitted to enter waters of the state without adequate treatment.
- **AMM-BIO-10: Project Site Maintenance -** Project sites will be maintained trash-free, and food refuse will be contained in secure bins and removed daily.
- **AMM-GEO-2: Reuse of Soils** - Reuse of earth materials will reduce the amount of import material, stockpile, and landfill material, which will minimize soil effects.

The BMPs identified in the SWPPP shall also include soil stabilization techniques such as: hydroseeding and short-term biodegradable erosion control blankets; silt fences or some kind of inlet protection at downstream storm drain inlets; post-construction inspection of all drainage facilities for accumulated sediment; and post-construction clearing of all drainage structures of debris and sediment. Finally, the USACE and sponsor will be required to submit a Notice of Termination (NOT) when site soils are stable and permanent erosion and sediment control is in place.

4.2.3.2 Methodology for Impact Analysis and Significance Thresholds

The Project could affect water quality would by increasing surface water temperature introducing construction-related non-point source pollution. In regard to surface water temperature, the method of analysis of Project effects was qualitative in nature and relied on applying general principals of mixing and shading effects.

Significance Thresholds

The Project could pose a significant impact to water quality if implementation of an alternative would result in any of the following conditions:

- **Impact WQ-1:** Violate any water quality standards or WDRs or otherwise substantially degrade water quality.
- **Impact WQ-2:** Provide substantial additional sources of polluted runoff.
- **Impact WQ-3:** Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.

4.2.3.3 Effects and Mitigation

No Action Alternative

With the no action alternative, surface water quality within Corte Madera Creek would continue as existing conditions. Groundwater would see no change compared with existing conditions.

The no action alternative would avoid construction impacts associated with the action alternatives, including temporary impacts on soil features from construction activities, and have ***no impact*** to water quality.

Action Alternatives

The following sections discuss the potential effects of the action alternatives on water quality.

- **Impact WQ-1**: Violate any water quality standards or WDRs or otherwise substantially degrade water quality.

During construction of all action alternatives, vegetative cover that stabilizes the soil would be removed by grading and earthmoving activities. Stormwater could mobilize and transport exposed soil to nearby drainage ways. Other pollutants, which may be bound to soil particles (e.g., oils and pesticides), could be transported as well. Construction equipment and materials could also contaminate soil that would later spread should there be rainfall or another runoff generating source. Under Section 402 of the Clean Water Act, the Project must comply with the National Pollutant Discharge Elimination System (NPDES) General Permit for Stormwater Discharges Associated with Construction Activity (NPDES General Construction Permit; Order No. 2009-0009-DWQ) during the construction period, because the Project would disturb more than one acre of ground. The Construction General Permit characterizes construction activities by the level of risk to water quality. This is determined using a combination of the sediment risk of the Project and the receiving water quality risk. Projects can be characterized as Risk Level 1, Risk Level 2, or Risk Level 3, with Risk Level 1 representing the lowest risk to receiving water quality. The minimum BMPs and monitoring that must be implemented during construction are based on the risk level. For Risk Level 1 sites, the Construction General Permit specifies minimum BMPs to be implemented that address good housekeeping practices (including those for managing hazardous materials used during construction); non-stormwater management, erosion, and sediment control; and run-on and runoff control. For construction activities characterized as higher risk levels, the minimum requirements identified for Risk Level 1 apply, as do other more stringent requirements. The BMPs as listed in listed in Section 4.2.3.1 *Avoidance and Minimization Measures* are designed to minimize or prevent pollutants from coming into contact with stormwater and to keep eroded and/or stormwater pollutants from moving off-site into receiving waters. These BMPs would avoid or minimize stormwater and water quality effects caused by construction site runoff. Compliance with the Construction General Permit, including preparation and implementation of the SWPPP and associated BMPs as well as inspection and reporting, would effectively reduce degradation of surface water quality to a less-than-significant level. Adherence to these requirements would also effectively reduce potential impacts associated with spills or leaks of hazardous materials and stormwater quality during construction and thus impacts would be ***less than significant.***

Alternatives A, B, and G would remove up to 1.34 acres of riparian woodland with substantial native trees and canopy in Unit 4. All alternatives would remove tree canopy along newly constructed floodwalls downstream of the fish ladder. These activities would reduce shading, which would potentially result in warmer water temperature. USACE guidelines require a vegetation free zone of 15 feet on both sides of floodwalls. Low growing vegetation, such as grass, that would not interfere with maintenance or integrity of the floodwalls is permitted. The loss of existing shade would be permanent. Stream segments with reduced shade would likely result in increased water temperature and other aquatic plants.

Alternative A would not remove any portion of the concrete-lining of the channel except for a small amount that could occur with removal of the fish ladder. Compared to other action alternatives, Alternative A would likely have the greatest impact to water temperature because of the loss of shade, primarily in Unit 4, and none of the benefits from increased groundwater infiltration from removal of the concrete channel. The impact to water temperature in Unit 4 and farther downstream to the SMN Bridge would be ***significant***. Downstream of the SMN Bridge, water temperature would be dominated by the tidal water temperature. As shown in Table 4.1-4, the MLLW of tide extends to the SMN Bridge.

Alternative B would remove the concrete-lining of the channel for College of Marin widening in portions of Unit 3. These changes would increase groundwater discharge into the channel by removing the concrete lining which impedes groundwater discharge into the creek. During the dry season, groundwater normally has cooler temperatures than surface water that could cool stream temperatures. However, since the MLLW of tide extends to the SMN Bridge (Table 4.1-4), this cooling effect could be overshadowed by the tidal water temperature. Similar to Alternative A, Alternative B could result in a ***significant*** impact to water temperature in Unit 4 and farther downstream to the SMN Bridge.

As stated previously, Impact WQ-1 would be significant for Alternatives A and B because of removal of riparian trees that shade the creek and because concrete channels would not be removed, which at least partially compensate for reduced shading by increasing inflow of cooler groundwater into the channel. USACE regulations, prohibit planting of trees within 15 feet of floodwalls and levees without a study that demonstrates no unacceptable safety risk from vegetation growth are present. Due to the absence of an analysis at the time this EIS/EIS was developed, planting of shade trees within the 15 foot setback from the floodwalls cannot be identified as a mitigation measure for Alternatives A and B. Another mitigation measure to be considered would be the release of cold water from Phoenix Lake reservoir into Ross Creek, a tributary to Corte Madera Creek, during periods of high stream water temperature. Phoenix Lake is owned and operated by the Marin Municipal Water District, and its operations therefore are outside the control of the District; hence, the feasibility of this measure cannot be assured. No other mitigation measures are available. Therefore, for Alternatives A and B, Impact WQ-1 would be ***significant and unavoidable***.

Alternative F would remove the concrete-lining of the channel for College of Marin widening in portions of Unit 3 and the upstream portion of the concrete channel for construction of the Allen Park Riparian Corridor. These changes would increase groundwater discharge into the channel by removing the concrete lining. During the dry season, groundwater normally has cooler temperatures than surface water. In Alternative F, existing vegetation in Unit 4 that provides substantial shade to the creek would remain intact. Alternative F would be expected to have a ***less than significant*** impact on water quality.

Alternative G would remove the concrete-lining of the channel for College of Marin widening in portions of Unit 3 and the upstream portion of the concrete channel for construction of the Allen Park Riparian Corridor. These changes would increase groundwater discharge into the channel by removing the concrete lining. During the dry season, groundwater normally has cooler temperatures than surface water. However, Alternative G would also be expected to raise water temperature in Unit 4 due to loss of existing shade. Downstream of Unit 4, the combined effect of the loss of shade in Unit 4 and the cooler groundwater discharge in the Allen Park Riparian Corridor would be expected to result in a ***less than significant*** impact to water temperature.

Alternative J would remove the concrete-lining of the upstream portion of the concrete channel for construction of the Allen Park Riparian Corridor. These changes would increase groundwater discharge into the channel by removing the concrete lining. During the dry season, groundwater normally has cooler temperatures than surface water. In Alternative J, existing vegetation in Unit 4 that provides substantial shade to the creek would remain intact. Alternative J would be expected to have a ***less than significant*** impact and, in fact, could improve water quality from reduced water temperature.

- **Impact WQ-2**: Provide substantial additional sources of polluted runoff.

As discussed under Impact WQ-1, with implementation of the AMMs and compliance with the General Construction Permit, activities associated with project construction would not provide substantial additional sources of polluted runoff. Following construction, the floodwalls in all action alternatives would contain more floodwater in the channel and less floodwater in the floodplain. This redistribution of floodwater would not create additional sources of polluted runoff. The underground bypass culverts in Alternatives F and J are designed to convey flood flow from the upstream portion of Unit 4 downstream to the Allen Park Riparian Corridor, downstream from the Denil fish ladder. This rerouting of flood flow would not provide substantial additional sources of polluted runoff. Impact WQ-2 would be ***less than significant*** for all action alternatives.

- **Impact WQ-3**: Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects

All action alternatives would include the placement of floodwalls within a 1 percent AEP special flood hazard area. These floodwalls would prevent or reduce creek flood flows into the floodplain but may impede flood flows of the existing interior drainage systems, resulting in the need for additional facilities to relieve flooding behind the floodwalls. Such facilities may include up to several new pump stations and related drainage facilities, including sumps, drains, and outfalls, to convey accumulated stormwater and flood flows back into the creek channel during and immediately after large rain events. Detailed location and configuration of such facilities will not be determined until the PED phase of the project. Generally, however, the action alternatives that include less extensive floodwalls (Alternatives J and F) would require fewer pump stations than those that include more extensive floodwalls (Alternatives A, B, and G). Generally, pump stations would be located on County property or other public property, in close proximity to the stream channel. Pump stations typically require 2-5,000 square feet for the station. Pump stations would likely be fenced for security, with the fence enclosing a pump shed, likely consisting of permanent 1-story structure on a concrete pad, typically covering about 400-800 square feet, and a separate or attached storage shed. A sump would be installed beneath the pump shed, with surface drains leading into the sump and drain pipes leading from the pumps, through the floodwalls, leading to outfalls into the creek channel. Where a connection to the electrical grid is available, the main pump or pumps would operate on electricity from the grid. Because electrical service is often interrupted during floods, back-up diesel-powered pumps would be kept on site or brought to the site when necessary. Above-ground diesel fuel tanks may therefore be placed at some or all of the pump stations. Placing the pump stations close to the stream channel would minimize the size of the pumps and amount of drainage piping necessary, and would also minimize disturbance of surrounding areas during construction.

Construction of pump stations and related drainage facilities would be likely to result in disturbance of soil and vegetation, potentially including small sections of streambanks and associated riparian vegetation. Because pump stations would be located close to the stream, disturbance of built structures, including roadways and other infrastructure, would be minimal. Changes to land use would be minor, and restricted to the area of the pump station only, though locations would be sought that are already designated for facilities of this kind. Construction of pump stations could cause significant impacts to biological resources (e.g. through removal of riparian vegetation); water quality (e.g., through release of pollutants during and after construction); and noise and air quality, which may be adversely affected during construction. Disruptions to traffic during construction would likely be minor and less than significant, because of the small area and size of structures. Pump station operation could also result in significant noise and air quality impacts, particularly from operation of diesel-powered pumps during and after floods, as well as from testing of diesel pumps where they are permanently installed. Many of these effects could likely be avoided by application of AMMs specified in Section 3.9.4, or mitigated to less than significant through application of commonly specified mitigation measures, such as adherence to local noise ordinances during construction. Until the design of the Project progresses further, however, neither the extent of impacts nor the ability to avoid or mitigate them can be known. Therefore, this impact has the potential to remain ***significant and unavoidable*** for all action alternatives.

All action alternatives except Alternative J would install three underground bypass culverts around the College Avenue Bridge to increase hydraulic capacity at the bridge. These culverts would convey the same source of water as the existing bridge and would result in ***less than significant*** impacts on water quality.

Alternatives F and J would construct a bypass culvert beneath Sir Francis Drake Boulevard adjacent to Unit 4 that would re-enter the channel at the Allen Park Riparian Corridor in Unit 3. This bypass culvert would be designed to divert a portion of flood water and would have ***less than significant*** impacts on water quality because the bypass would not create additional sources of polluted runoff. During low flow conditions, no flows would be diverted to the bypass culvert and the flow and water quality in Unit 4 would be the same as existing conditions and not be affected by the culvert.

Construction of the Allen Park Riparian Corridor under Alternatives F, G, and J could require relocation of the sanitary sewer line that crosses underneath the Denil fish ladder and extends along the left bank of Corte Madera Creek on the landward side of the concrete wall. The length of demolished sewer line would be approximately 1,115 feet and the added sewer line would be approximately 1,031 feet. The new sewer line would include a new inverted syphon beneath the creek that connects with the sewer line from Sir Francis Drake Boulevard and a second inverted syphon to re-connect with the existing trunk line downstream near College of Marin. The current sewer line is within an existing right-of-way and the new location would be located on public property. It would be expected that the sewer line relocation would have ***less than significant*** impacts on water quality with implementation of BMPs during relocation, in particular the BMPs for preventing sewer spills.

Table 4.2-1 summarizes the impacts to water quality.

TABLE 4.2-1 WATER QUALITY IMPACT CONCLUSIONS

Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
WQ-1: Violate any water quality standards or waste discharge requirements or otherwise substantially degrade water quality	AMM-WQ-1 AMM-WQ-2 AMM-WQ-3 AMM-WQ-4 AMM-WQ-5 AMM-WQ-6 AMM-WQ-7 AMM-WQ-8 AMM-WQ-9 AMM-WQ-10 AMMWQ-12 AMM-WQ-12 AMM-BIO-2 AMM-BIO-4 AMM-BIO-9 AMM-BIO-10 AMM-GEO-2	A, B	S	None Available	SU
		F, G, J	LTS	--	--
		No Action	NI	--	--
WQ-2: Provide substantial additional sources of polluted runoff.	--	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
WQ-3: Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects	AMM-WQ-1 AMM-WQ-2 AMM-WQ-3 AMM-WQ-4 AMM-WQ-5 AMM-WQ-6 AMM-WQ-7 AMM-WQ-8 AMM-WQ-9 AMM-WQ-10 AMMWQ-12 AMM-WQ-12 AMM-BIO-2 AMM-BIO-4 AMM-BIO-9 AMM-BIO-10 AMM-GEO-2	All Action Alternatives	S	Not Yet Determined	SU
		No Action	NI	--	--

AMM = avoidance and minimization measure
LTS = less than significant
NI = no impact
S = significant
SU = significant and unavoidable

4.2.3.4 Cumulative Effects

The cumulative setting for effects on water quality are those receiving waters within the Unit 4 Project study area and downstream. As discussed earlier, all action alternatives have the potential to degrade water quality as a result of construction-related soil erosion and accidental discharges of hazardous materials into the receiving waters (Impact WQ-1). If the Project's construction occurs during the same timeframe as the Sir Francis Drake Boulevard Rehabilitation project or other cumulative projects listed in Table 4-2, receiving water quality could be degraded due to increased turbidity and/or inadvertent increase of construction materials in receiving waters resulting in cumulative impacts. However, because all projects would be required to comply with NPDES General Construction Permit requirements for developing and implementing appropriate BMPs related to grading and excavation, stormwater management, bank protection, vegetation management and removal, and sediment removal and storage, the construction-related cumulative impacts on water quality would be minimized and would be less than significant.

As discussed earlier, Alternatives A, B, and G would be expected to raise water temperature in Unit 4 due to loss of shade from existing riparian vegetation. Cumulative projects, such as development of FDS basins under Ross Valley Flood Protection and Watershed Program and the San Anselmo Flood Risk Reduction Project, would also result in disturbance of riparian vegetation that could reduce shading and increase stream temperatures. These effects would, however, be temporary, as riparian vegetation would be replaced and would eventually regain its role in shading the stream. Because these changes would occur over several years, they would tend not to combine in a cumulative manner with the water quality impacts of the project, and therefore, no significant cumulative impact on water temperature is anticipated.

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4.3 Geology

This section describes regional geology and seismic hazards and identifies site-specific geologic, soils, and related geotechnical issues within the study area. Information is also presented on paleontological resources. Data used to prepare this section were taken from various sources, including the USACE Project Design Memorandums Nos. 1 and 2 (USACE 1966, 1967), the 1987 Final SEIS for the Unit 4 project (USACE 1987c), the Geomorphic Assessment for the Corte Madera Creek Watershed (Stetson 2000), the Marin Countywide Plan background studies (Marin County 2005c), and the Draft EIR and supporting technical studies for the Lagunitas Road Bridge Replacement Project (URS 2009, in USACE 2010). Geotechnical information in the study area is included in Appendix P.

4.3.1 Regulatory Setting

Federal, state, and local agencies enforce regulations regarding geology, soils, and seismicity. The agencies, their enabling legislation, and their roles in establishing and implementing policies related to geology are presented below.

4.3.1.1 Federal

Federal laws that apply to geologic resources are discussed below. Chapter 9 provides details of the applicable laws.

- Clean Water Act – Section 402
- Earthquake Hazards Reduction Act

4.3.1.2 State

State laws that apply to geologic resources are discussed below. Chapter 9 provides details of the applicable laws.

- Seismic Hazards Mapping Act
- Alquist-Priolo Earthquake Fault Zoning Act

4.3.1.3 Local Regulations

Marin County Code

The Marin County Code establishes standards for development in areas subject to flooding, grading and erosion control, protection of trees and riparian vegetation, management of parks and recreation facilities, and noise. The following section of the Marin County Code is considered applicable to the Project:

Chapter 19.06 of the Marin County Code contains requirements to ensure that proper grading and erosion control procedures are implemented to protect the public health and welfare and to avoid the siltation of watercourses.

4.3.2 Affected Environment

4.3.2.1 Regional Geology

Marin County is located in the central portion of the Coast Ranges geomorphic province. This province extends about 600 miles along the western edge of California and is bounded on the south by the Transverse Ranges, on the north by the Klamath Mountains, and on the east by the Great Valley. The Coast Ranges geomorphic province is dominated by northwest/southeast-trending ridges and valleys.

The Coast Ranges province, as well as the rest of the state, has been dominated by tectonic activity associated with the boundary between the Pacific and North American plates. The currently active boundary between these two plates is manifested at the surface by the northwest/southeast-trending San Andreas Fault zone, which separates the Point Reyes Peninsula in western Marin County from the eastern portion of Marin County. The bedrock east of the San Andreas Fault Zone consists of Mesozoic rocks unconformably overlain by Tertiary (Miocene and younger) deposits. These rocks represent a complex history that includes late Mesozoic to early Cenozoic subduction and accretion, uplift and faulting, and faulting that continues to the present time. The Mesozoic rocks consist of the Great Valley complex and the Franciscan complex. The Great Valley complex consists of accreted and deformed remnants of Jurassic oceanic crust and a thick sequence of turbidites (disturbed deep ocean sediments). The Franciscan complex rocks were probably Jurassic oceanic crust and Jurassic to Cretaceous pelagic deposits (marine sediments) overlain by Upper Jurassic to Upper Cretaceous turbidites. During the Late Cretaceous time, the Franciscan complex was subducted beneath the Coast Ranges, which resulted in the deformed and sheared rocks that are present. During late Miocene time, the regional tectonic regime changed and became dominated by the transform boundary of the San Andreas Fault system and deposition of sediments on the older complexes (Marin County 2005b).

As a result of this geologic activity, the region is characterized by narrow valleys flanked by steep-sided, almost parallel ridges, trending northwest and approximately parallel to the Pacific Ocean coastline. Most ridges are below 5,000 feet and many are below 3,000 feet. The most prominent feature within the Corte Madera Creek watershed is Mount Tamalpais (2,604 feet) (USACE 1987c).

The watershed's western boundary is a steep, forested ridge. Numerous creeks that drain steep upland areas onto relatively steep and laterally confined alluvial valley flats combine as San Anselmo Creek in Ross Valley at San Anselmo. San Anselmo Creek then flows southeast through Ross Valley along the Cretaceous sandstone ridge running southeast along the eastern edge of the basin (Stetson 2000). San Anselmo Creek flows into Corte Madera Creek west of Greenbrae at the confluence with Ross Creek. Ross Valley can be loosely characterized as a long, narrow, alluvial-filled trench carved by Corte Madera Creek (USACE 1966).

General Stratigraphy

The general stratigraphy of the study area consists of three geologic units: the Franciscan Formation, Bay Mud, and valley fill/alluvium.

Franciscan Formation: Bedrock underlying the Corte Madera Creek drainage is part of the Jurassic-Cretaceous Franciscan Formation. The formation in this area consists primarily of hard sandstone (greywacke) with minor amounts of shale and chert and occasional serpentinite and greenstone. These rocks have been folded into a series of complex anticlines and synclines during the latest episode of crustal deformation during mid-Pleistocene time, and were subsequently or contemporaneously highly fractured and faulted. In general, the trend of these geologic structures is northwestward. Present physical and topographical expression in the Corte Madera Creek basin is aligned along and controlled by this trend (USACE 1966).

Near the upstream end of the Project, at the Lagunitas Road Bridge, borehole logs indicate the shallowest depth to bedrock is approximately 35 to 40 feet below ground surface (URS 2009, in USACE 2010). The depth to bedrock is approximately 40 feet below ground surface near Kentfield and increases in depth towards the Bay (Stetson 2000). Sandstone bedrock has been reported near Station 317+00 at 63 feet below msl (USACE 1967). The potential for the Project to encounter Franciscan Formation bedrock is low because the contemplated FRM measures (refer to Chapter 2) would not extend to such depths (USACE 1967).

Bay Mud: The watershed continues to experience ongoing tectonic uplift and faulting. Following the Pleistocene-Holocene transition (about 10,000 to 12,000 years ago), rising sea level and continuing tectonic uplift caused lower portions of eroding v-shaped upland valleys in Marin County watersheds to fill with sediment, creating u-shaped valleys (Stetson 2000). San Francisco Bay waters encroached upon and drowned the lower 2.5 miles of the ancestral Ross valley. The deposition of soft marine sediments formed the present-day tidal marshlands and mudflats (USACE 1966). Holocene sea level rise probably influenced valley filling and flattened the valley slope in the alluvial channel network approximately below the City of San Anselmo (Stetson 2000).

The marine sediments are referred to as the “Bay Mud” formation, which attains a maximum thickness of approximately 125 feet in the center of the valley near U.S. Highway 101. Typically, Bay Mud consists of silts and clays that are very soft to soft, wet, sticky, and structurally weak (USACE 1966). The thickness of the Bay Mud ranges from 10 to 15 feet thick downstream of the study area (Station 315+00), and thins rapidly to Station 323+00. Upstream from Station 323+00, Bay Mud is reportedly absent and valley fill overlies bedrock. The geologic contact between Bay Mud and underlying valley fill materials is irregular and reflects the meandering nature of Corte Madera Creek in the past (USACE 1967). Bay Mud presence cannot be ruled out near the downstream Project limit.

Valley Fill/Alluvium: Upstream of the marshland, the valley fill is composed of various mixtures of alluvial soils and slope-wash from the adjoining hills. The valley fill consists of interbedded sand and gravel, firm to stiff silt and clay, and lesser lenses of soft clay. The valley fill materials are generally stiff to dense and comparatively competent foundation materials (USACE 1966, 1967).

Faults and Seismicity

The study area is approximately 9 miles equidistant between two active faults (the San Andreas and Hayward faults). The CGS has delineated earthquake fault zones in Marin County, per requirements of the Alquist-Priolo Earthquake Fault Zoning Act; however, only the San Andreas Fault Zone is considered to be active (having ruptured in the Holocene) and well defined within Marin County boundaries and is, therefore, zoned under the Alquist-Priolo Earthquake Fault Zoning Act (Marin County 2005b). Historically, ground surface displacements closely follow the trace of geologically young faults. The study area is not within an Alquist-Priolo Earthquake Fault Zone, and the site is not near any known active faults. The potential for surface rupture at the study area associated with fault movement (Town of Ross 2009, in USACE 2010).

Although no faults cross the study area, the area is seismically active (USACE 1966, 1967). Other faults in the region capable of producing earthquakes that could affect the study area include the Calaveras, San Gregorio, Concord-Green Valley, Greenville, and Mount Diablo faults (Marin County 2005b).

The Working Group on California Earthquake Probabilities concluded there is a 62 percent probability of at least one magnitude 6.7 or greater earthquake before 2032 within the San Francisco Bay area. This earthquake is likely to occur on one of the seven major fault systems in the bay area. It was determined that the Hayward-Rodgers Creek, San Andreas, and Calaveras fault systems have the highest probabilities of generating a magnitude 6.7 or greater earthquake before 2032. The San Andreas (21 percent probability) and the Hayward-Rodgers Creek (27 percent probability) fault systems could have the greatest impacts on Marin County because of their proximity to population centers within Marin County and the fact that they have the highest probability of rupture in the San Francisco Bay region. It was also found that an estimated probability of 80 percent exists for a magnitude 6.0 to 6.7 earthquake event in the San Francisco Bay region before 2032(Marin County 2005b).

4.3.2.2 Site Conditions

Topography

Elevation in the study area varies from -12 feet NGVD29 in the bed of Corte Madera Creek to approximately 25 feet above sea level on paved surfaces. The longitudinal slope of the channel is fairly consistent. The vertical drop from Sir Francis Drake Boulevard to the concrete-lined channel is 11.3 feet. The horizontal distance for this change is 4,050 feet, resulting in a slope of 0.28 percent. Although the land immediately adjacent to Corte Madera Creek generally appears flat, there is topographical variation that becomes important during flood events, which is described in greater detail in Section 4.1 – Hydrology.

Soil Types

The study area is mapped by the Natural Resources Conservation Service (NRCS) in the Marin Soil Survey as Xerorthents-Urban Land Complex 0-9 percent slopes (unit 204) and Tocaloma-Mcmullin-Urban Land Complex, 30 to 50 percent slopes (unit 182). Unit 204 is a deep, nearly level to sloping soil complex found on valley floors and tidal flats. Xerorthents consist of cut or fill areas (areas affected by urban construction) and vary greatly in depth and drainage. Urban lands consist of areas covered by roads, driveways, houses, parking lots, and other structures. Urban land soils have been altered to the extent that their original characteristics are no longer present. The soils are well drained, have varying water capacities, and are prone to very rapid runoff. Caving potential is low (NRCS 2009). Unit 182 composition is 40 percent Tocaloma and similar soils, 20 percent Mcmullin and similar soils, 20 percent urban land, and 12 percent minor components and is well drained with medium to high runoff. The predominant soil is Xerorthents-Urban Land Complex 0-9 percent that ranges from 98 percent for Alternative A to 95 percent for Alternative F.

Subsurface Materials

Soil testing shows that the subsurface materials within the study area are primarily clays and sandy clays with some silts, sands, and some gravels. The materials are generally firm or stiff (USACE 1966).

4.3.2.3 Geologic Hazards

Seismic Conditions

The San Andreas and Hayward faults are designated with Maximum Credible Earthquake magnitudes of 8.0 and 7.5, respectively, by the California Seismic Hazard Map. The closest mapped fault to the study area is the San Andreas Fault. The area is located within the 0.4 g peak bedrock acceleration contour (URS 2009, in USACE 2010). The study area is in an area subject to severe to violent perceived ground shaking and expected damage to structures is moderate heavy to heavy from a San Andreas Fault earthquake; and very strong to severe perceived ground shaking and expected damage to structures is moderate to moderate heavy from a North Hayward-Rogers Creek Fault earthquake (Marin County 2005b, Exhibit 10 and 11). A site-specific geotechnical study that meets USACE specifications would be required during the design phase of the Project.

Liquefaction, Settlement, and Lateral Spreading

Strong ground shaking caused by large earthquakes can induce ground displacement and/or failure such as liquefaction, compaction settlement, and slope movement. A site's susceptibility to these hazards relates to the site topography, soil conditions, and depth to groundwater. The soil most susceptible to liquefaction is loose, cohesionless soil below the water table and within about 50 feet of the ground surface. Liquefaction can result in loss of foundation support and settlement of overlying structures, ground subsidence and translation due to lateral spreading, and differential settlement of affected deposits. Lateral spreading occurs when a soil layer liquefies at depth and causes horizontal movement or displacement of the overburden mass on sloping ground or toward a free face such as a stream bank or excavation, or toward an open body of water.

Results of the geotechnical study for the Lagunitas Road Bridge Replacement Project indicated the potential for liquefaction in the study area, but the potentially liquefiable layers occur at a depth greater than the bottom of the channel. At that depth, seismically induced settlements at the top of the potentially liquefiable layers could be up to 4 to 5 inches. The study also concluded that because the potentially liquefiable layers occur at a depth greater than that of the bottom of the channel and not within the sloping ground, potential hazard from lateral spreading would be low (Treadwell & Rollo, 2006, Town of Ross 2009, in USACE 2010).

Results summarized from the bridge replacement work are intended to describe potential conditions that could be encountered during design and construction of the Project. A site-specific geotechnical study that meets USACE specifications would be required during the study phase of the Project.

Landslides

Typically, landslides and other slope stability hazards are activated in response to an increase in subsurface and surficial water content, earthquake shaking, the addition of load on a slope, or the removal of downslope support. The study area lies upon relatively flat ground, with the exception of the west and east headwalls on the banks of Corte Madera Creek. A study of the Marin County region by the USGS indicates that no landslides have been mapped within the proximity of the study area. During a geotechnical exploration program for the Lagunitas Road Bridge Replacement Project, no evidence of landsliding that might directly affect the study area was observed (Town of Ross 2009, in USACE 2010). Bank instability or localized sloughing has been reported by residents in Unit 4; however, these are small scale events resulting from the incised channel, instability from development along the creek, and the flashiness of the watershed.

4.3.2.4 Paleontological Resources

A search of the University of California Museum of Paleontology (UCMP) collections database indicated one invertebrate fossil has been recovered from the Franciscan Formation (bedrock) in Corte Madera (UCMP 2018). This is not within the study area, and Franciscan bedrock is not expected to be encountered during project construction.

Based on a review of readily available published documents, there were no other reported fossil occurrences in the study area. However, Late Pleistocene and Holocene fossils have been recovered from marine sediments (Bay Mud) elsewhere in the San Francisco Bay area. For example, near the Bay Bridge San Francisco anchorage, remains of petrified wood, marine mollusks and mammals, bony fishes, amphibians, reptiles, birds, a diversity of extinct land mammals such as ground sloths, mammoth, mastodon, deer, horse, camel, and bison, and microfossils such as radiolaria, foraminifera, diatoms, pollen, and spores have been found in older Bay Mud. Fossil mollusk shells were reported in cores of Holocene younger Bay Mud from depths of approximately 20 and 25 feet near Candlestick Point in San Francisco (City and County of San Francisco 2011).

The potential for encountering fossils in Bay Mud in the study area would be limited for a number of reasons. Within the study area, the limits of potentially disturbed soils as a result of the Project are located between Station 318+00 in Unit 2 and at Station 393+00. Upstream from Station 323+00, Bay Mud is reportedly absent, and valley fill overlies bedrock. In the vicinity of the Lagunitas Road Bridge

Replacement Project, which includes the study area, the sandy, lean clay and sandy gravel are not likely to contain unique paleontological resources (Town of Ross 2009, in USACE 2010).

4.3.3 Environmental Consequences

4.3.3.1 Avoidance and Minimization Measures

The following AMMs would be implemented as part of the Project design and would avoid or minimize adverse effects associated with geology.

- **AMM-GEO-1: Floodwall Design -** New floodwalls will be designed and constructed to reduce or otherwise account for potential geologic hazards such as ground shaking, liquefaction, settlement, and lateral spreading. Geotechnical investigations will be completed to support project design to ensure that potential geologic hazards will not cause the project to fail. Before construction begins, for all project phases, a final geotechnical subsurface investigation report for the proposed project shall be submitted to Marin County. The final geotechnical engineering report shall be prepared according to the current California Building Code standards. The geotechnical investigation shall include subsurface testing of soil and groundwater conditions for both on-site and off-site project elements and shall determine appropriate foundation designs. All recommendations contained in the final geotechnical engineering report shall be implemented by the USACE and sponsor for all project phases.
- **AMM-GEO-2: Reuse of Soils** - Reuse of earth materials will reduce the amount of import material, stockpile, and landfill material, which will minimize soil effects.
- **AMM-GEO-3: Grading and Erosion Control Plan** - A grading and erosion control plan will be prepared by a California Registered Civil Engineer. The grading and erosion control plan shall be submitted to Marin County before issuance of grading permits for all new development on the project site and all supporting elements. The plan shall be consistent with the state's NPDES permit requirements and shall include the site-specific grading associated with development for all project phases.
- **AMM-GEO-4: Stop Work after Seismic Activity-** In the event of an earthquake or tsunami warning, the contractor will stop all work until it is determined that conditions are safe to commence work. This action will enhance safety for people working in the area.

In addition, the following AMMs for hydrology and water quality are applicable to geological resources:

- **AMM-HYD-1**: **Flood Warnings**: Install public warning signs and sirens to improve public awareness and response to inundation emergencies (e.g. flooding). This action will enhance safety for people using and working in the area.
- **AMM-WAT-12: Prepare SWPPP:** Erosion will be controlled based on the SWPPP to be prepared for the project. Implementing the SWPPP measures will minimize soil erosion and related sedimentation.

4.3.3.2 Methodology for Impact Analysis and Significance Thresholds

Geology and Soils

Existing conditions, potential geologic hazards, and potential mineral resources were evaluated from review of available published literature such as geologic reports and geologic maps, soil survey data and maps, and review of seismic hazard maps that include the Project area.

For the purpose of this analysis, the following applicable thresholds of significance have been used to determine whether implementing the proposed project would result in a significant impact. These thresholds of significance are based on Appendix G of the CEQA Guidelines. A geology and soils impact is considered significant if implementation of the proposed project would do any of the following:

- **Impact GEO-1:** Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving any of the following.
    - Rupture of a known earthquake fault as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issued by the state geologist for the area or based on other substantial evidence of a known active fault
    - Strong seismic ground shaking
    - Seismic-related ground failure, including liquefaction
    - Landslides
- **Impact GEO-2:** Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse
- **Impact GEO-3:** Result in substantial soil erosion or the loss of topsoil
- **Impact GEO-4:** Be located on expansive soil, as defined in Table 18-1-B of the UBC (1994), creating substantial risks to life or property
- **Impact GEO-5:** Inundation by seiche, tsunami, or mudflow.

Minerals

Evaluation of mineral resources included review of CGS Mineral Resource Zone maps and review of the Marin County General Plan. Project impacts would be considered significant if they:

- Result in the loss of availability of a known mineral resource that would be of value to the region and residents of the state.
- Result in the loss of availability of a locally-important mineral resource recovery site delineated on a local general plan, specific plan, or other land use plan.

No mineral resources are known to be present in the Project area, and no mining activity occurs in the Project area; therefore, mineral resource impacts were not further evaluated herein.

Paleontological Resources

Evaluation of paleontological resources included a search of the UCMP collections database that indicated one invertebrate fossil has been recovered from the Franciscan Formation (bedrock) in Corte Madera (UCMP 2018). This is not within the study area, and as previously noted, Franciscan bedrock is not expected to be encountered during project construction. No paleontologically important rock unit is known to be present with the study area, and this impact was not further evaluated.

4.3.3.3 Effects and Mitigation

No Action Alternative

With the no action alternative, geology and soils within Corte Madera Creek would remain as existing. There would be no direct or indirect effects to soil and geology. There would be ***no impact*** to geology and soils.

Action Alternatives

The Project may contribute to impacts described in this section.

- **Impact GEO-1:** Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving any of the following.
    - Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issues by the state geologist for the area or based on other substantial evidence of a known fault
    - Strong seismic ground shaking
    - Seismic-related ground failure, including liquefaction
    - Landslides

The study area is subject to severe to violent perceived ground shaking and expected damage to structures is moderately heavy to heavy from a San Andreas Fault earthquake; and very strong to severe perceived ground shaking and expected damage to structures is moderate to moderately heavy from a North Hayward-Rodgers Creek Fault earthquake (Marin County 2005b, Exhibits 10 and 11). A site-specific geotechnical study that meets USACE specifications would be required during the design phase of the Project. Implementation of AMM GEO-1 would require that the design recommendations of a geotechnical engineer, in accordance with the 2016 or subsequently adopted California Building Code, be incorporated into all project features to reduce potential damage from a seismic event.

Shaking associated with an earthquake on either fault could cause moderate to heavy damage to built features of the study area, including the proposed Project. Impact GEO-1 could be ***significant*** and require mitigation for all action alternatives.

- **Mitigation GEO-1: Geotechnical Oversight**- All earthwork and floodwall installation shall be monitored by a licensed geotechnical or soils engineer retained by the USACE and sponsor of all project phases and all off-site elements. The geotechnical or soils engineer shall provide oversight during excavation, placement of fill, construction of floodwalls, and disposal of materials removed from and deposited on the project site to ensure that the design is implemented as intended to minimize significant impacts.

Level of Significance after Mitigation

This impact would be reduced to ***less than significant*** with mitigation for all action alternatives. The impact is minimized through proper design and qualified oversight of construction to ensure proper implementation of the design.

- **Impact GEO-2:** Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse.

The Project area is located mostly within flat lands with surrounding slopes identified as containing few if any landslides and is downstream from a few areas identified as areas from which debris flows can be expected during future storms (Marin County 2005b). A USGS study of the Marin County region indicated that no landslides have been mapped within the proximity of the study area. During a geotechnical exploration program for the Lagunitas Road Bridge Replacement Project, no evidence of landsliding that might directly affect the study area was observed (Town of Ross 2009, in USACE 2010). None of the alternatives would increase risk of landslides.

The Project would have ***no impact*** for all action alternatives.

- **Impact GEO-3:** Result in substantial soil erosion or the loss of topsoil

Project construction would include soil-disturbing activities, including soil removal, excavation of floodwall sites, grading, access improvements, and revegetation. This would result in the temporary disturbance of soil and expose disturbed areas to winter storm events. In addition, soil disturbance during summer could result in soil loss from wind erosion. Construction activity would be conducted consistent with WDRs prescribed for compliance with the state's Porter-Cologne Water Quality Control Act and BMPs outlined in the SWPPP (AMM-WAT-12) (see Section 4.2). Applying these measures would ensure that soil erosion and the loss of topsoil during Project construction are minimized, resulting in a ***less than significant*** impact for all action alternatives.

In conformance with the SWPPP, Grading and Erosion Control Plan, and construction standards, erosion control methods would be implemented to prevent loss of soil at all work areas. After construction, all areas would be left in a condition to facilitate natural revegetation, appropriate drainage, and prevent erosion. Excavated material would not be stockpiled or deposited near or on streambanks. Soil would be re-used onsite to the greatest degree feasible to reduce the amount of import material (AMM-GEO-2: Reuse of Soils).

Soils in staging areas or otherwise affected during construction would be returned to preconstruction conditions upon completion of the work. Land would be restored as nearly as practicable to the original conditions. Areas around structure footings would be reseeded with native plants, as appropriate to the location and in consultation with the landowner. Temporary access would be restored and revegetated.

Alternatives A, B, and G would likely result in more soil erosion than Alternatives F and J because of floodwall construction in Unit 4 along Corte Madera Creek. Each of the alternatives could directly or indirectly result in accelerated soil erosion. Implementation of AMMs would result in a ***less than significant*** impact for all action alternatives***.***

- **Impact GEO-4:** Be located on expansive soil, as defined in Table 18-1-B of the UBC (1994), creating substantial risks to life or property.

Project actions would occur on two soil types, Tocaloma-McMullin-Urban Land Complex and Xerorthents-Urban land complex (Figure 4.3-1). The Tocaloma-McMullin complex has low extensibility, or expansion potential. The extensibility rating for the Xerorthents-Urban land complex was not available from the NRCS web soil survey. However, the soil expansion potential is anticipated to be low because the soil complex is fill and heavily developed. USACE design standards and the California Uniform Building Code require a geotechnical investigation for all alternatives. Per these regulatory requirements, if expansive soils are found, a geotechnical study and report will be required. The report will include recommendations for remediating expansive soils, which may include, for example, removal of these soils and replacement with engineered fill. With adherence to these existing regulatory requirements, all action alternatives would have a ***less than significant*** impact with respect to expansive soils.

- **Impact GEO-5:** Inundation by seiche, tsunami, or mudflow.

The Project area around the College of Marin and extending downstream is mapped as a tsunami inundation zone (CGS 2015). Landslides are considered unlikely in the Project area. People working on the Project would be subject to these risks, but this risk is not isolated to the study area. The impacts of tsunami, seiche, or mudflows would not be increased by the Project. The Project could be affected by tsunami, seiche, or mudflows, but this potential impact is not unique to the study area or a result of the Project. The Project would not increase, or in any way affect the risk of tsunami, seiche, or mudflows and there would be ***no impact***.

Table 4.3-1 summarizes the impacts to geology***.***

TABLE 4.3-1 GEOLOGY IMPACT CONCLUSIONS

Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
GEO-1: Expose people or structures to potential substantial adverse effects, including the risk of loss, injury, or death involving: Rupture of a known earthquake fault, as delineated on the most recent Alquist-Priolo Earthquake Fault Zoning Map issues by the state geologist for the area or based on other substantial evidence of a known fault; Strong seismic ground shaking; Seismic-related ground failure, including liquefaction; Landslides.	AMM-GEO-1	All Action Alternatives	S	M-GEO-1	LTS
		No Action	NI	--	--
GEO-2: Be located on a geologic unit or soil that is unstable, or that would become unstable as a result of the project, and potentially result in on- or off-site landslide, lateral spreading, subsidence, liquefaction, or collapse	--	All	NI	--	--
GEO-3: Result in substantial soil erosion or the loss of topsoil	AMM-GEO-2 AMM-GEO-3	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
GEO-4: Be located on expansive soil, as defined in Table 18-1-B of the UBC (1994), creating substantial risks to life or property	AMM-GEO-1	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
GEO-5: Inundation by seiche, tsunami, or mudflow	--	All	NI	--	--

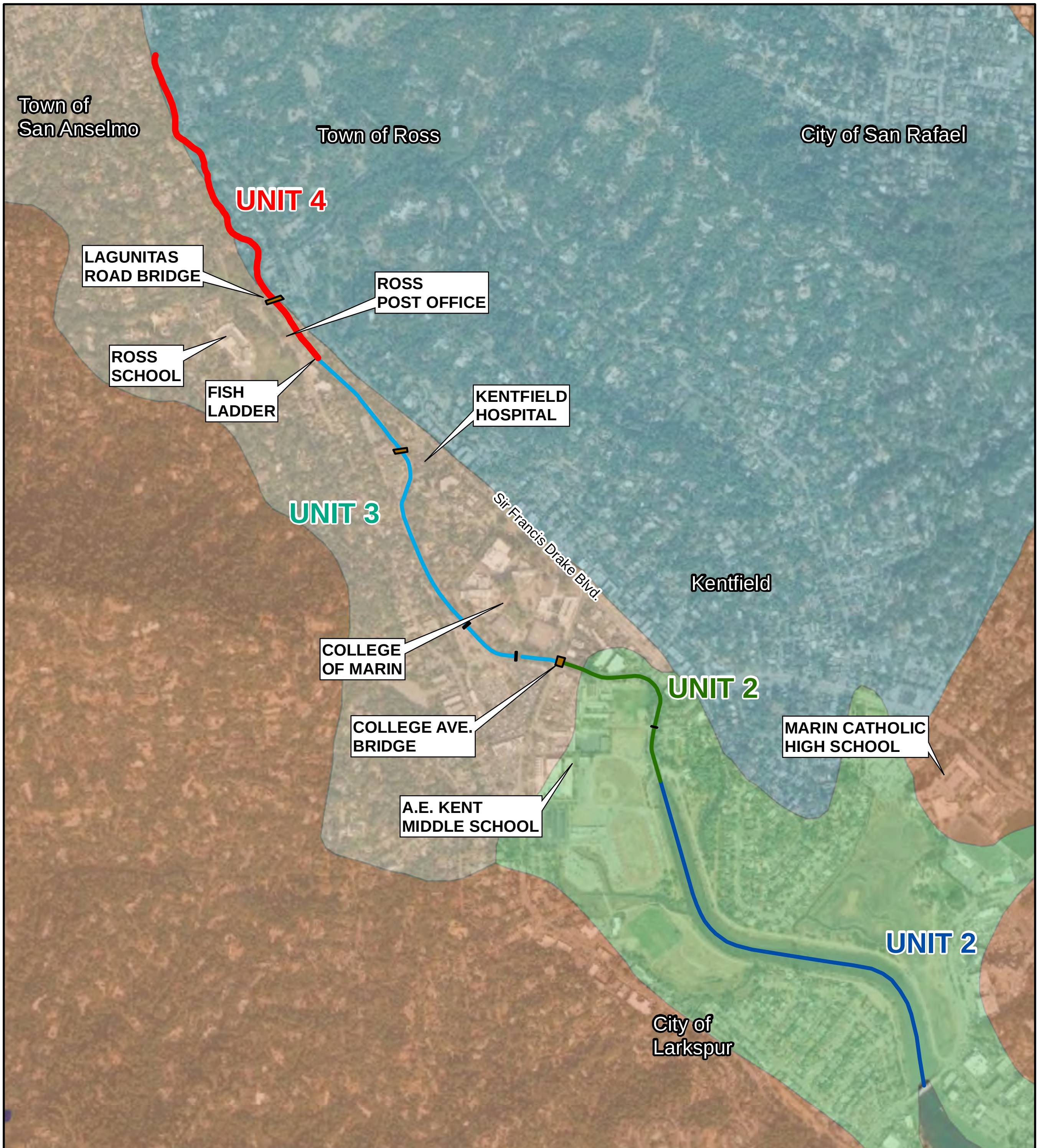
AMM = avoidance and minimization measure
LTS = less than significant
NI =no impact
S = significant

4.3.3.4 Cumulative Impacts

The San Francisco Bay area is a seismically active region with a wide range of geologic and soil conditions that can vary greatly within a short distance. Accordingly, geologic, soils, and seismic impacts tend to be site-specific and depend on the local geology and soil conditions. For these reasons, the geographic scope for potential cumulative geologic and seismic impacts consists of the project area and immediately adjacent areas. In general, to have a cumulative impact, two or more projects would have to spatially overlap and occur at the same time. Some of the projects listed in Table 4-2 would occur within the same timeframe as the project; however, only Sir Francis Drake Boulevard Rehabilitation would spatially overlap with the project location.

Similar to the geographic limitations discussed above, it should be noted that geologic, seismic, and soils impacts are also generally time-specific, and could only be cumulative if two or more events occurred at the same time and in the same location. If Sir Francis Drake Boulevard Rehabilitation is constructed at the same time as this project, erosion effects could be cumulatively significant if appropriate measures are not taken. However, the state Construction General Permit, along with County and City storm water management programs, would require each individual project with a construction footprint over 1 acre to prepare and implement a SWPPP that would describe BMPs to control runoff and prevent erosion. Through compliance with the Construction General Permit, the potential for erosion impacts would be reduced to less than significant levels. The Construction General Permit was developed to address cumulative conditions arising from construction throughout the state, and is intended to maintain cumulative effects of projects subject to this requirement below levels that would be considered significant. For example, two adjacent construction sites would each be required to implement BMPs to reduce and control the release of sediment and/or other pollutants in any runoff leaving their respective sites, including from erosion. Therefore, the combined cumulative effect of the project's incremental effect and the effects of other projects is not significant.

Many parts of the Bay Area are at risk of personal or property damage related to seismic shaking, seiche or tsunami, or liquefaction. People working on the project would be subject to these risks, but this risk is not isolated to the study area. The study area (as with all development projects in the region) must comply with design standards developed to minimize risk from damage from seismic events. With these standards in place (AMM-GEO-4), the potential contribution to seismic hazard impacts associated with the project would be less than cumulatively considerable.



Corte Madera Creek - Flood Control Units

- UNIT 4 Natural Channel
- UNIT 3 Concrete-Lined Channel
- UNIT 2 Concrete-Lined Channel
- UNIT 2 Natural Channel

Rock Types*

- Alluvium
- Artificial fill over Bay mud
- Greenstone
- Melange
- Sandstone and Shale

*MarinMap2 Open Data Download (MapServer)

0 0.1 0.2 Miles

Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Figure 4.3-1 Geology

Date: 10/4/2018 Datum: NAD 83

Burleson Consulting, Inc.

4.4 Air Quality

This section describes existing ambient air quality and climatological conditions relevant to the Corte Madera Creek region, located in the San Francisco Bay Area Air Basin (SFBAAB). Data used to prepare this section were obtained from various sources, including the Bay Area Air Quality Management District (BAAQMD), Western Regional Climate Center, and the California Air Resources Board (ARB).

4.4.1 Regulatory Setting

This section discusses regulatory information that applies to air quality resources. Additional regulatory information appears in Chapter 9 Environmental Compliance.

4.4.1.1 Federal

The project must comply with the federal Clean Air Act. Chapter 9 provides a discussion of the clean air act and how the project complies with the act.

4.4.1.2 State

The project must comply with the California Clean Air Act as well as the Bay Area Air Quality Management District's CEQA Guidelines, discussed in detail in Chapter 9

4.4.1.3 Local

Marin Countywide Plan

The following policies of the Marin Countywide Plan are applicable to air quality regulation:

- **Policy AIR-1.1: Coordinate Planning and Evaluation Efforts**. Coordinate air quality planning efforts with local, regional, and state agencies, and evaluate the air quality impacts of proposed plans and development projects;
- **Policy AIR-1.2: Meet Air Quality Standards.** Seek to attain or exceed the more stringent of federal or state Ambient Air Quality Standards for each measured pollutant;
- **Policy AIR-1.3: Require Mitigation of Air Quality Impacts**. Require projects that generate potentially significant levels of air pollutants, such as quarries, landfill operations, or large construction projects, to incorporate best available air quality mitigation in the project design.

4.4.2 Affected Environment

The study area is located within the Town of Ross and unincorporated areas of Marin County, which is within the SFBAAB, as shown in Figure 4.4-1. The SFBAAB also includes all of Alameda, Contra Costa, Napa, San Mateo, Santa Clara, and San Francisco counties, the southern half of Sonoma County, and the southwestern portion of Solano County. The SFBAAB is one of 15 air basins within California, which were so designated in an effort to identify regional and local characteristics during air quality planning endeavors.

Ambient air quality within SFBAAB is influenced by climatological conditions, topography, and the quantity and type of pollutants released in an area. The major determinants of transport and dilution of a given pollutant are wind, atmospheric stability, terrain, and sunshine for photochemical pollutants. The regional climate in SFBAAB is semi-arid and characterized by mild, dry summers and mild, moderately wet winters (about 90 percent of the annual total rainfall is received in the November–April period), moderate daytime onshore breezes, and moderate humidity. The climate is dominated by a strong, semi-permanent, subtropical high-pressure cell over the northeastern Pacific Ocean. Climate is also affected by the moderating effects of the adjacent oceanic heat reservoir. In summer, when the high-pressure cell is strongest and farthest north, fog forms in the morning, and temperatures are mild. In winter, when the high-pressure cell is weakest and farthest south, occasional rainstorms occur.

4.4.2.1 Bay Area Air Quality Management District

The BAAQMD is the primary agency responsible for comprehensive air pollution control in the SFBAAB. The BAAQMD works directly with the Association of Bay Area Governments, the Metropolitan Transportation Commission, and local governments, and cooperates actively with all federal and state government agencies. The BAAQMD inspects emissions sources, develops rules and regulations, establishes permitting requirements for stationary sources, and enforces such measures through educational programs or fines, when necessary.

The BAAQMD is directly responsible for reducing emissions from stationary (area and point) sources and for assuring that state controls on mobile sources are effectively implemented. It has responded to these requirements by preparing a series of O_3 Attainment Plans and Clean Air Plans that comply with the CAA and CCAA to accommodate growth, reduce pollutant levels in SFBAAB, meet NAAQS and CAAQS, and minimize the fiscal impact that pollution control measures have on the local economy. The O_3 Attainment Plans are prepared for the federal O_3 standard, and Clean Air Plans are prepared for the state O_3 standard. The BAAQMD Board of Directors adopted the most recent O_3 Attainment Plan in October 2001 (BAAQMD 2001), and in April 2004, the USEPA made the final finding that SFBAAB had attained the 1-hour standard.

Since then, the 1-hour O_3 standard has been replaced by an 8-hour O_3 standard and SFBAAB was designated as a marginal nonattainment area. Although certain elements of the 8-hour implementation rule are undergoing legal challenge, it is not currently anticipated that marginal areas would be required to prepare attainment demonstrations for the 8-hour O_3 standard.

Nonetheless, BAAQMD continues to work with the Metropolitan Transportation Commission and the Association of Bay Area Governments to update the Bay Area O_3 Strategy. The updated Bay Area O_3 Strategy would describe current conditions, review SFBAAB's progress in reducing O_3 levels to attain state 1-hour and 8-hour O_3 standards, and describe how SFBAAB's proposed control strategy would fulfill CCAA planning requirements for the state 1-hour O_3 standard and mitigation requirements for transport of O_3 and O_3 precursors to neighboring air basins. For example, BAAQMD has established a GHG operational emissions threshold of 1,100 metric tons (MT) of CO_2 equivalents (CO_2e) per year for nonstationary sources (BAAQMD 2017a).

The Board of Directors adopted the current regional Clean Air Plan in April 2017 to update the 2010 version. The Clean Air Plan identifies the control measures that would be implemented to reduce major sources of pollutants. The Clean Air Plan focuses on O_3, PM, toxic air contaminants, and GHGs, as they are the primary concerns for SFBAAB. Previous planning efforts have substantially decreased the population's exposure to unhealthful levels of pollutants, even while substantial population growth has occurred within SFBAAB (BAAQMD 2017a).

4.4.2.2 Regional Air Pollutants

Air pollutant emissions within SFBAAB are generated from stationary, mobile, and natural sources. Stationary sources can be divided into two major subcategories: point sources and area sources. Point sources occur at a specific location and are usually associated with manufacturing and industry. Examples are boilers or combustion equipment that produce electricity or generate heat. Area sources are widely distributed and produce many small emissions. Examples of area sources include residential and commercial water heaters, painting operations, portable generators, lawn mowers, agricultural operations, landfills, and consumer products such as barbeque lighter fluid and hair spray. Construction activities that create fugitive dust, such as excavation and grading, also contribute to area source emissions. Mobile sources refer to emissions from on- and off-road motor vehicles, including tailpipe and evaporative emissions. On-road sources may be legally operated on roadways and highways. Off-road sources include aircraft, trains, and construction equipment. Mobile sources account for the majority of air pollutant emissions within SFBAAB. Air pollutants can also be generated by the natural environment such as during wildfires and when fine dust particles become suspended in the air during high winds.

To protect the public health and welfare, federal and state governments have identified criteria air pollutants and a host of air toxics, and have established NAAQS and CAAQS through the CAA and CCAA. The air pollutants for which federal and state standards have been promulgated and which are most relevant to air quality planning and regulation in air basins include O_3, CO, suspended PM, SO_2, NO_2, and Pb. NAAQS and CAAQS for these pollutants are presented in Table 4.4-1.

TABLE 4.4-1 CALIFORNIA AND NATIONAL AMBIENT AIR QUALITY STANDARDS AND DESIGNATION

Pollutant	Averaging Time	California Standards		National Standards[a]		
		Standard	Attainment Status	Primary[b]	Secondary[c]	Attainment Status
O_3	8-hour	0.07 ppm	Nonattainment	0.07 ppm	—	Nonattainment
	1-hour	0.09 ppm	Nonattainment	— [d]	—	—
CO	8-hour	9 ppm	Attainment	9 ppm	—	Attainment
	1-hour	20 ppm	Attainment	35 ppm	—	Attainment
NO_2	Annual	0.03 ppm	—	0.053 ppm	Same as primary	Attainment
	1-hour	0.18 ppm	Attainment	100 ppb	—	Attainment
SO_2	Annual	—	—	0.03 ppm	—	Attainment
	24-hour	0.04 ppm	Attainment	0.14 ppm	—	Attainment
	3-hour	—	—	—	0.5 ppm (1,300 µg/m^3)[e]	—
	1-hour	0.25 ppm	Attainment	75 ppb	—	Attainment
PM_{10}	Annual	20 µg/m^3	Nonattainment	—	Same as primary	—
	24-hour	50 µg/m^3	Nonattainment	150 µg/m^3	Same as primary	Unclassified
$PM_{2.5}$	Annual	12 µg/m^3	Nonattainment	12 µg/m^3	15 µg/m^3	Unclassified/ Attainment
	24-hour	—	—	35 µg/m^3	—	Nonattainment
Pb	Calendar Quarter	—	—	1.5 µg/m^3	Same as primary	Attainment
	Rolling 3-Month Average	—	—	0.15 µg/m^3	Same as primary	Attainment
	30-day Average	1.5 µg/m^3	—	—	—	—

Notes:

a. Standards, other than for O_3 and those based on annual averages, are not to be exceeded more than once a year. The O_3 standard is attained when the expected number of days per calendar year with maximum hourly average concentrations above the standard is equal to or less than one.

b. Primary Standards are the levels of air quality necessary, with an adequate margin of safety to protect the public health. Each state must attain the primary standards no later than 3 years after that state's implementation plan is approved by the USEPA.

c. Secondary Standards are the levels of air quality necessary to protect the public welfare from any known or anticipated adverse effects of a pollutant.
d. The national one-hour O_3 standard was revoked by USEPA on June 15, 2005.
e. The concentration is expressed first in the units in which the standard was promulgated. Equivalent units are given in parenthesis.

Abbreviations:
CO = carbon monoxide
NO_2 = nitrogen dioxide
O_3 = ozone
Pb = lead
$PM_{2.5}$ = particulate matter less than 2.5 microns in diameter
PM_{10} = particulate matter less than 10 microns in diameter
ppb = parts per billion by volume of air
ppm = parts per million by volume of air
SO_2 = sulfur dioxide
$\mu g/m^3$ = micrograms per cubic meter
SOURCE: BAAQMD 2017b

Criteria pollutants and TACs subject to federal and state standards are described below.

- **Ozone:** A gas that is formed when volatile organic compounds, which can also be referred to as reactive organic gases (ROG), and nitrogen oxides (NO_X), both byproducts of internal combustion engine exhaust, undergo slow photochemical reactions in the presence of sunlight. Meteorological conditions that are needed to produce high concentrations of O_3 are direct sunshine, early morning stagnation in source areas, high ground surface temperatures, strong and low morning inversions, greatly restricted vertical mixing during the day, and daytime subsidence that strengthens the inversion layer. O_3 concentrations are generally highest during the summer months when direct sunlight, light wind, and warm temperature conditions prevail.
- **Carbon Monoxide:** A colorless, odorless gas produced by the incomplete combustion of fuels. CO concentrations tend to be highest during winter mornings, with little to no wind, when surface-based inversions trap the pollutant at ground levels. Because CO is emitted directly from internal combustion engines, unlike O_3, and motor vehicles operating at slow speeds are the primary source of CO in the SFBAAB, the highest ambient CO concentrations are generally found near congested transportation corridors and intersections.
- **Particulate Matter:** Extremely small, suspended particles or droplets 10 microns (PM_{10}) and 2.5 microns ($PM_{2.5}$) or smaller in aerodynamic diameter. Some sources of PM, such as pollen and wind-blown dust, are naturally occurring. However, in populated areas, most PM is caused by road dust, diesel soot, combustion products, abrasion of tires and brakes, and construction activities.
- **Sulfur Dioxide:** A colorless, extremely irritating gas or liquid that enters the atmosphere as a pollutant, mainly as a result of burning high sulfur-content fuel oils and coal, and from chemical processes at chemical plants and refineries.
- **Nitrogen Dioxide:** One of a group of highly reactive gases known as oxides of nitrogen or NO_X, used as the indicator for the larger group of NO_X. NO_2 primarily gets in the air from the burning of fuel. NO_2 forms from emissions from cars, trucks and buses, power plants, and off-road equipment.
- **Toxic Air Contaminants:** A diverse group of air pollutants that can affect human health, but for which ambient air quality standards have not been established. This is not because they are fundamentally different from the pollutants discussed above, but because their effects tend to be local rather than regional. The ARB has designated nearly 200 compounds as TACs. Additionally, the ARB has implemented control measures for a number of compounds that pose high risks and show

potential for effective control. The majority of the estimated health risks from TACs can be attributed to a relatively few compounds, the most important being diesel particulate matter.

4.4.2.3 Health Effects of Air Pollutants

Ozone

Individuals exercising outdoors, children, and people with preexisting lung disease, such as asthma and chronic pulmonary lung disease, are considered to be most susceptible to O_3 effects. Short-term exposure (lasting for a few hours) to O_3 can result in breathing pattern changes, reduction of breathing capacity, increased susceptibility to infections, inflammation of lung tissue, and some immunological changes. Elevated O_3 levels are associated with increased school absences. In recent years, a correlation between elevated ambient O_3 levels and increases in daily hospital admission rates, as well as mortality, has also been reported. An increased risk for asthma has been found in children who participate in multiple sports and live in communities with high O_3 levels. O_3 exposure while exercising is known to increase the severity of the responses described above.

Carbon Monoxide

Individuals with a deficient blood supply to the heart are the most susceptible to the adverse effects of CO exposure. The effects observed include earlier onset of chest pain with exercise and electrocardiograph changes indicative of worsening oxygen supply to the heart. Inhaled CO has no direct toxic effect on the lungs, but exerts its effect on tissues by interfering with oxygen transport and competing with oxygen to combine with hemoglobin present in the blood to form carboxyhemoglobin. Hence, conditions with an increased demand for oxygen supply can be adversely affected by exposure to CO. Individuals most at risk include fetuses, patients with diseases involving the heart and blood vessels, and patients with chronic hypoxemia (oxygen deficiency) as seen at high altitudes.

Particulate Matter

The elderly, people with pre-existing respiratory or cardiovascular disease, and children appear to be more susceptible to the effects of high levels of PM_{10} and $PM_{2.5}$. A consistent correlation between elevated ambient fine PM (PM_{10} and $PM_{2.5}$) levels and an increase in mortality rates, respiratory infections, number and severity of asthma attacks and the number of hospital admissions has been observed in different parts of the United States and various areas around the world. In recent years, some studies have reported an association between long-term exposure to air pollution dominated by fine particles and increased mortality, reduction in life span, and an increased mortality from lung cancer.

Daily fluctuations in $PM_{2.5}$ concentration levels have been related to hospital admissions for acute respiratory conditions in children, to school and kindergarten absences, to a decrease in respiratory lung volumes in normal children, and to increased medication use in children and adults with asthma. Recent studies show lung function growth in children is reduced with long-term exposure to PM.

Sulfur Dioxide

A few minutes of exposure to low levels of SO_2 can result in airway constriction in some asthmatics, all of whom are sensitive to its effects. In asthmatics, increase in resistance to air flow, as well as reduction in breathing capacity leading to severe breathing difficulties, are observed after acute exposure to SO_2. In contrast, healthy individuals do not exhibit similar acute responses even after exposure to higher concentrations of SO_2.

Nitrogen Dioxide

Population-based studies suggest that an increase in acute respiratory illness, including infections and respiratory symptoms in children (not infants), is associated with long-term exposure to NO_2 at levels found in homes with gas stoves. Increase in resistance to air flow and airway contraction is observed after short-term exposure to NO_2 in healthy subjects. Larger decreases in lung functions are observed in individuals with asthma or chronic obstructive pulmonary disease (e.g., chronic bronchitis, emphysema) than in healthy individuals, indicating a greater susceptibility of these subgroups.

Odors

Typically, odors are regarded as an annoyance rather than a health hazard; however, manifestations of a person's reaction to foul odors can range from psychological (e.g., irritation, anger, or anxiety) to physiological (e.g., circulatory and respiratory effects, nausea, vomiting, and headache). The ability to detect odors varies considerably among the population and overall is quite subjective. An unfamiliar odor is more easily detected and more likely to cause complaints than a familiar one because of the phenomenon known as odor fatigue, in which a person can become desensitized to almost any odor so that recognition occurs only with an alteration in the intensity.

Quality and intensity are two properties of any odor. The quality of an odor indicates the nature of the smell experience. Intensity refers to the strength of the odor. Odor intensity depends on the odorant concentration in the air. When an odorous sample is progressively diluted, the odorant concentration decreases, and the odor intensity weakens and eventually becomes so low that detection or recognition is difficult. At some point during dilution, the concentration of the odorant falls below a detection threshold by the average human.

Toxic Air Contaminants

TACs include a diverse group of air pollutants that can adversely affect human health. They have not had ambient air quality standards established for a variety of reasons (e.g., insufficient dose-response data, association with particular workplace exposure rather than general environmental exposure, etc.). Health effects of TACs can result from either acute or chronic exposure. Many types of cancer are associated with chronic toxic air contaminants exposures; however, toxic air contaminants exposures can also cause other adverse health effects. Consequently, the BAAQMD has established both cancer and non-cancer health risk thresholds for toxic air contaminants emissions.

Significant sources of TACs in the environment include: commercial operations, such as gasoline stations, dry cleaners, and buildings with boilers and/or emergency generators; and transportation activities, particularly diesel-powered vehicles, including trains, buses, and trucks. The ARB has determined that the 10 compounds which pose the greatest known health risk in California, based primarily on ambient air quality data, are benzene, 1,3-butadiene, acetaldehyde, carbon tetrachloride, hexavalent chromium, para-dichlorobenzene, formaldehyde, methylene chloride, perchloroethylene, and diesel particulate matter (described further below).

Diesel Particulate Matter

Diesel particulate matter is generated when an engine burns diesel fuel and consists of a mixture of gases and fine particles (also known as soot) that can penetrate deeply into the lungs, where they can contribute to a range of health problems. In 1998, ARB identified PM from diesel-powered engines as a toxic air contaminants based on its potential to cause cancer and other adverse health effects. Diesel exhaust is a complex mixture that includes hundreds of individual constituents and as a mixture, is identified as a known carcinogen (ARB 2018). However, under California regulatory guidelines, diesel particulate matter is used as a surrogate measure of exposure for the mixture of chemicals that make up diesel exhaust as a whole.

Compared to other air toxics that ARB has identified and controlled, diesel particulate matter poses the greatest health risk and is estimated to be responsible for about 79 percent of the total ambient air toxic risk from 10 identified TACs, which pose the greatest ambient risk. On a statewide basis, the average potential excess cancer risk associated with these emissions is over 500 potential cases per million. With respect to SFBAAB, ARB estimated the background diesel particulate matter health risk in SFBAAB in 2000 to be approximately 500 cancer cases per million people, which reflects a drop of approximately 36 percent from estimates for 1990 (ARB 2016).

4.4.2.4 Local Air Quality

Measurements of ambient concentrations of criteria pollutants are used by the USEPA and ARB to assess and classify the air quality of each air basin, county, or, in some cases, a specific developed area. The classification is determined by comparing monitoring data with NAAQS and CAAQS presented in Table 4.4-1. If a pollutant concentration in an area is lower than the standard, the area is classified as being in “attainment.” If the pollutant exceeds the standard, the area is in marginal, moderate, serious, severe, or extreme “nonattainment,” depending on the magnitude of the air quality standard exceedance. If insufficient data is available to determine whether the standard is exceeded in an area, the area is designated “unclassified.”

At the federal level, SFBAAB is designated as a nonattainment area for O_3 and 24-hour $PM_{2.5}$, meaning that federal ambient air quality standards are not expected to be met for several years. At the state level, the SFBAAB is designated as a nonattainment area for O_3, $PM_{2.5}$, and PM_{10}. The SFBAAB is in attainment for both the NAAQS and CAAQS for SO_2, CO, and NO_2 (BAAQMD 2017b).

The closest monitoring station to the study area is the San Rafael monitoring station. Table 4.4-2 shows data measured at this monitoring station and the Vallejo monitoring station when unavailable from San Rafael (between 2010 and 2016). During this period at this station, state and federal O_3 standards were not exceeded. The state 24-hour PM_{10} standard was exceeded three times, while the federal 24-hour PM_{10} standard was not exceeded. The federal 24-hour standard for $PM_{2.5}$ standard was exceeded 13 times; however, annual average was below both the state and federal standards.

The BAAQMD reports that combining ARB estimates of the population-weighted average ambient air concentration of diesel particulate matter in SFBAAB for 2003 with the cancer potency factor adopted by the California Environmental Protection Agency’s (California Environmental Protection Agency) Office of Environmental Health Hazard Assessment results in an approximate cancer risk associated with exposure to diesel particulate matter of about 500 to 700 in one million excess cancer risks (BAAQMD 2007). Most of the diesel particulate matter risks are from exposure to exhaust from diesel trucks where the emission sources are relatively close to receptors at businesses and residences near freeways.

TABLE 4.4-2 SUMMARY OF LOCAL AMBIENT AIR QUALITY IN THE STUDY AREA

Air Pollutants[a]	Year							
	2010	2011	2012	2013	2014	2015	2016	2017
O_3								
Maximum 1-hour concentration measured (ppm)	0.083	0.092	0.076	0.081	0.088	0.081	0.088	0.088
Days exceeding state 0.09 ppm 1-hour standard	0	0	0	0	0	0	0	0
Maximum 8-hour concentration measured[b] (ppm)	0.069	0.070	0.057	0.069	0.068	0.070	0.067	0.063
Days exceeding state 0.07 or federal 0.075 ppm 8-hour standard	0	0	0	0	0	0	0	0
PM_{10}								
Annual average concentration measured (µg/m^3)	16.7	16.5	13.2	15.7	14.1	16.1	13.8	17.7
Maximum 24-hour concentration measured (µg/m^3)	51	54	37	54	41	42	27	94
Days exceeding federal 150 µg/m^3 24-hour standard	0	0	0	0	0	0	0	0
Days exceeding state 50 µg/m^3 24-hour standard	1	1	0	1	0	0	0	2
$PM_{2.5}$[c]								
Annual average concentration measured (µg/m^3)	10.7	9.9	8	10.8	10.8	8.6	6.4	9.7
Maximum 24-hour concentration measured (µg/m^3)	46.5	42.2	26.5	44.9	38.1	36.3	15.6	74.7
Days exceeding federal 35 µg/m^3 24-hour standard[d]	4	1	0	2	1	2	0	8
CO								
Maximum 8-hour concentration measured (ppm)	1.1	1.0	1.1	1.1	1.1	0.9	1.0	1.6
Days exceeding federal and state 9.0 ppm 8-hour standard	0	0	0	0	0	0	0	0
NO_2[e]								
Annual average concentration measured (ppm)	0.012	0.012	0.011	0.012	0.011	0.011	0.009	10
Maximum 1-hour concentration measured (ppm)	0.057	0.053	0.052	0.050	0.062	0.044	0.046	53
Days exceeding state 0.18 ppm 1-hour standard	0	0	0	0	0	0	0	0
SO_2[c]								
Annual average concentration measured	0	0	0	0	0	-	-	-
Maximum 1-hour concentration measured[f] (ppm)	0.011	0.0074	0.0142	0.0081	0.0239	-	-	-
Maximum 24-hour concentration measured (ppm)	0.0024	0.0026	0.0025	0.0025	0.0024	-	-	-
Days exceeding federal and state standard	0	0	0	0	0	-	-	-

Notes:

a. Data was taken from the BAAQMD San Rafael monitoring station.

b. The California 8-hour O_3 standard was implemented on May 17, 2005.

c. Data was taken from the BAAQMD Vallejo monitoring station due to lack of data from the San Rafael station.
d. On December 17, 2006, the USEPA implemented a more stringent federal 24-hour $PM_{2.5}$ standard revising it from 65 µg/m^3 to 35 µg/m^3. $PM_{2.5}$ exceedance days for 2006 to 2008 reflect the new 35 µg/m^3 standard.
e. In 2010 the USEPA implemented a new 1-hour NO_2 standard of 100 ppb, and a new 1-hour SO_2 standard of 75 ppb. The previous 24-hour and annual SO_2 standards were revoked.
f. A dash (-) indicates pollutant was not monitored at this site.

Abbreviations:
CO = carbon monoxide
NO_2 = nitrogen dioxide
O_3 = ozone
$PM_{2.5}$ = particulate matter less than 2.5 microns in diameter
PM_{10} = particulate matter less than 10 microns in diameter
ppm = parts per million by volume of air
SO_2 = sulfur dioxide
µg/m^3 = micrograms per cubic meter
SOURCE: BAAQMD 2018, Annual Bay Area Air Quality Summaries

4.4.2.5 Sensitive Receptors

Sensitive receptors are those more susceptible to effects of air pollution than the population at large. While ambient air quality standards are designed to protect public health and are generally regarded as conservative for healthy adults, there is greater concern to protect adults who are ill or have long-term respiratory problems, and young children whose lungs are not fully developed. According to the ARB, sensitive receptors include children less than 14 years of age, the elderly over 65 years of age, athletes, and people with cardiovascular and chronic respiratory diseases.

Potentially sensitive land uses in and adjoining the study area include single family residences along the eastern and western edges of Corte Madera Creek, Ross Common Park, Station Park, Allen Park, Ross Elementary School, Kentfield Hospital, Kent Middle School, and the College of Marin. The average distance between the creek and nearby receptors is approximately 50 feet. However, residences on Sylvan Lane and along the creek near the east bank of the fish ladder are within 25 feet of the Project. The proximity of residences is summarized in Table 4.4-3. Ross Elementary School is 140 feet from the Project area, while the College of Marin and Kent Middle School border the creek, within 25 feet. Figures 4.4-2a through 4.4-2e present the proximity of sensitive receptors to each alternative.

TABLE 4.4-3 PROXIMITY TO RESIDENCES

Distance	Number of Residences				
	A	B	F	G	J
Less than 50 feet	64	68	70	72	43
50 to 100 feet	20	18	12	17	28
100 to 1,000 feet	684	659	656	686	583
Total within 1,000 feet	768	745	738	775	654

4.4.2.6 Land Use Planning and Air Quality

Land use patterns and density of development affect the amount of air pollutants that are generated by communities. Land uses that are segregated throughout a community increase the number and length of motor vehicle trips and associated air pollutant emissions since there are relatively few opportunities to walk, ride bicycles, and use public transportation between such uses. Compact communities often mix residential uses with commercial, business, and employment uses, thereby reducing people's dependence on motor vehicle use and reducing the length of necessary vehicle trips. Smaller, higher density uses also produce fewer air emissions on a per unit basis from the use of natural gas for space and water heating. Areas surrounding Corte Madera Creek, although suburban in nature, were developed by the mid-1960s. Since that time, new land uses have resulted principally from the redevelopment of older, underutilized properties.

4.4.3 Environmental Consequences

4.4.3.1 Avoidance and Minimization Measures

The following AMMs would be implemented as part of the Project design and would avoid or minimize adverse effects associated with air quality:

- **AMM-AIR-1: Dust Control Measures** - The contractor will implement standard dust control methods recommended by the BAAQMD, including:
    - All exposed surfaces (e.g., parking areas, staging areas, soil piles, graded areas, and unpaved access roads) shall be watered two times a day;
    - All haul trucks transporting soil, sand, or other loose material off site shall be covered;
    - All visible mud or dirt track-out 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;
    - All vehicle speeds on unpaved roads shall be limited to 15 mph;
    - 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;
    - All construction equipment shall be maintained and properly tuned in accordance with manufacturer's specifications. All equipment shall be checked by a certified mechanic and determined to be running in proper condition prior to operation.
- **AMM-AIR-2: Limit Idling Time -** Idling times shall be minimized either by shutting equipment off when not in use or reducing maximum idling time to 5 minutes (as required by the California airborne toxic control measure CCR Title 12, Section 2485). Clear signage shall be provided for construction workers at all access points.
- **AMM-AIR-3: Cleaner Construction Equipment -** All off-road diesel-powered construction equipment greater than 50 horsepower shall meet Tier-4 emission off-road emission standards, at a minimum or shall be retrofitted with a CARB certified Level 3 diesel emissions control device.
- **AMM-AIR-4: Use Electrical Power where Possible** - Use electricity from the grid rather than portable diesel-powered generators, where possible.
- **AMM-AIR-5: Air Quality Liaison -** A publicly visible sign shall be posted with a telephone number and person to contact at the lead agency regarding air quality complaints. This person shall respond and take corrective action within 48 hours. The Air District's phone number shall also be visible to ensure compliance with applicable regulations.
- **AMM-AIR-6: Haul Bay Mud -** If excavated Bay Mud material creates odor issues with the public, the Bay Mud material shall be hauled out by truck from the project site. If the material is wet, water-tight trucks shall be used. All odorous material causing odor impacts shall be removed within 24 hours of excavation.

4.4.3.2 Methodology for Impact Analysis and Significance Thresholds

The air quality analysis was based on modeling of construction-related emissions for each alternative. State-approved emissions estimating software, California Emissions Model (CalEEMod) version 2016.3.1, was used to calculate air quality emissions, detailed in Appendix B. CalEEMod calculations consider all aspects of Project construction, including emissions from worker commutes and hauling trips.

Emissions estimates were based on construction data provided in Chapter 3. Calculations were broken down by construction task, as detailed in Table 3-3. Equipment was assumed to be in operation for up to 8.5 hours per day for most equipment. The USACE provided approximate construction dates and equipment use for each phase, though these details would not be solidified until the design and construction details are finalized (Appendix B).

Operation and maintenance activities would not be expected to substantially change from current activities conducted by the District, including vegetation maintenance and sediment removal (refer to Section 3.10.5). Any change in emissions from operation and maintenance would be minor. Therefore, operation and maintenance emissions would not be expected to be significant and were not considered for this analysis.

The Project would pose a significant impact to air quality if it would:

- **Impact AIR-1:** Conflict with or obstruct implementation of the applicable air quality plan.
- **Impact AIR-2:** Violate any air quality standard or contribute substantially to an existing or projected air quality violation.
- **Impact AIR-3:** Result in a cumulative net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard.
- **Impact AIR-4:** Expose sensitive receptors to substantial pollution concentrations.
- **Impact AIR-5:** Create objectionable odors affecting a substantial number of people.

For dust emissions related to construction activities, BAAQMD CEQA Guidelines do not have quantified significance thresholds but instead rely on implementation of BMPs for fugitive dust during construction. If the required controls are implemented during a project, then short-term construction emissions are considered to be less than significant. These measures have been adopted by the Project as AMM-AIR-1. BAAQMD-recommended significance thresholds, provided in Table 4.4-4, were used for purpose of this analysis (BAAQMD 2017).

TABLE 4.4-4 BAAQMD CONSTRUCTION AIR QUALITY THRESHOLDS OF SIGNIFICANCE

Pollutant	Average Daily Emissions (lb/day)
ROG	54
NO_X	54
PM_{10} (Exhaust)	82
$PM_{2.5}$ (Exhaust)	54
PM_{10}/$PM_{2.5}$ (Fugitive Dust)	BMPs
Local CO	None
Accidental Release of Acutely Hazardous Air Pollutants	None
Odors	None

Abbreviations:
BMPs = best management practices
CO = carbon monoxide
lb/day = pounds per day
NO_x = nitrogen oxides
$PM_{2.5}$ = particulate matter less than 2.5 microns in diameter
PM_{10} = particulate matter less than 10 microns in diameter
ROG = reactive organic gases
SOURCE: BAAQMD 2017

The USEPA's General Conformity Rule, established under Section 176(c) (4) of the CAA, provides a specific process for ensuring that federal actions would conform to State Implementation Plans to achieve NAAQS. The rule sets *de minimis* thresholds for those pollutants designated nonattainment where a federal action would occur. The SFBAAB is federally designated as nonattainment for 1-hour O_3 and $PM_{2.5}$. As specified in 40 CFR § 93.153, the *de minimis* threshold is 100 tons per year for NO_x, VOCs, and $PM_{2.5}$.

Impact AIR-4 primarily applies to exposure of sensitive receptors to diesel particulate matter, which is primarily produced in the form of $PM_{2.5}$ for this Project. The BAAQMD considers an increase in ambient $PM_{2.5}$ greater than 0.3 µg/m^3 annual average significant.

4.4.3.3 Effects and Mitigation

No Action Alternative

With the no action alternative, air quality within Corte Madera Creek would remain as existing. This alternative would avoid construction impacts associated with the action alternatives, including emissions from construction equipment and grading activities. There would be ***no impact*** to air quality.

Action Alternatives

Construction

Construction for each alternative would require heavy equipment, which would produce short-term vehicle emissions and create dust. Construction activities would use equipment such as graders, excavators, concrete saws, concrete mixers, backhoes, and dump trucks to transport materials and complete excavation, grading, and installation of floodwalls. The duration of construction phases for each alternative are outlined in Appendix B. Specific tasks for each phase and associated equipment are listed in Table 3-4 and Appendix B.

Construction emissions were calculated using CalEEMod for construction tasks presented in Chapter 3. To generate a conservative estimate, most equipment was assumed to be used for 8.5 hours each workday. Pile drivers and concrete saws were assumed to be used for 6 hours each day. All assumptions are presented in Appendix B. Note that some of the demolished concrete may remain in the channel after being broken up, acting as rock bed. This would reduce haul and disposal needs, and thus reduce emissions. However, the emission calculations assumed the worst case scenario in which all concrete was hauled off-site for disposal. Daily emissions were calculated as average lb/day to appropriately compare to the BAAQMD thresholds of significance for construction. Table 4.4-5 presents the estimated emissions for each alternative.

TABLE 4.4-5 CONSTRUCTION EMISSIONS ESTIMATES								
	ROG	NO_x	CO	SO_2	PM_{10} (Fugitive)	PM_{10} (Exhaust)	$PM_{2.5}$ (Fugitive)	$PM_{2.5}$ (Exhaust)
	Thresholds of Significance							
Federal *de minimis* (tons/year)	**100**	**100**	-	-	-	-	**100**	-
BAAQMD (lb/day)	**54**	**54**	-	-	-	**82**	-	**54**
	ALT A							
Total (tons)	0.31	4.03	10.70	0.03	0.34	0.03	0.09	0.03
Daily Average[1] (lb/day)	1.17	15.42	40.92	0.10	1.30	0.13	0.35	0.13
	ALT B							
Total (tons)	0.37	4.48	13.78	0.03	0.36	0.04	0.09	0.03
Daily Average[1] (lb/day)	1.12	16.05	38.22	0.10	1.22	0.13	0.33	0.12
	ALT F							
Total (tons)	0.00	8.80	11.03	0.04	0.63	0.05	0.17	0.04
Daily Average[1] (lb/day)	0.00	29.18	36.59	0.13	2.08	0.15	0.57	0.15
	ALT G							
Total (tons)	0.31	4.65	10.30	0.03	0.41	0.03	0.11	0.03
Daily Average[1] (lb/day)	1.00	15.06	33.39	0.09	1.32	0.11	0.35	0.11
	ALT J							
Total (tons)	0.33	6.89	8.59	0.03	0.50	0.04	0.14	0.03
Daily Average[1] (lb/day)	1.11	22.85	28.49	0.10	1.65	0.12	0.45	0.11

1. When construction occurred less than a full year, working days were used to calculate daily averages, rather than full years.

Abbreviations:

BMPs = best management practices
CO = carbon monoxide
lb/day = pounds per day
N/A = not applicable
NO_x = nitrogen oxides
$PM_{2.5}$ = particulate matter less than 2.5 microns in diameter
PM_{10} = particulate matter less than 10 microns in diameter
ROG = reactive organic gases
SO_2 = sulfur dioxide
\- = no standard

Construction may contribute to the impacts described in this section. Operations and maintenance would produce minimal emissions and would not be expected to contribute to any air quality impact. Therefore, impacts discussed in this section are assumed to be temporary, not permanent.

- **Impact AIR-1**: Conflict with or obstruct implementation of the applicable air quality plan.
- **Impact AIR-2**: Violate any air quality standard or contribute substantially to an existing or projected air quality violation.

Each alternative would produce comparable emissions during construction. Emissions averaged over the Project construction period would not exceed thresholds of significance recommended by BAAQMD. Emissions would not exceed the federal *de minimis* standard of 100 tons per year each for NO_x, ROG, and $PM_{2.5}$. Fugitive dust emissions would be minimized through the implementation of AMM-AIR-1. The emissions produced from the Project would not conflict with any applicable plans or violate any air quality standard.

Impacts AIR-1 and AIR-2 would be ***less than significant.***

- **Impact AIR-3**: Result in a cumulative net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard.

The SFBAAB is designated nonattainment for O_3 and $PM_{2.5}$ federal standards and nonattainment for O_3, PM_{10}, and $PM_{2.5}$ state standards. Emissions would be limited to the period of construction, except for small amounts associated with operations and maintenance. Emissions produced during the temporary period of construction would not substantially contribute to these nonattainment pollutants.

Therefore, this impact would be ***less than significant.***

- **Impact AIR-4**: Expose sensitive receptors to substantial pollution concentrations.

Sensitive receptors would potentially be exposed to construction-related emissions of exhaust diesel $PM_{2.5}$ and diesel particulate matter. The BAAQMD recommends considering sensitive receptors within 1,000 feet of a project. This would include parks, schools, residences, and medical facilities adjacent to the study area. Sensitive receptors within 1,000 feet of construction areas for each alternative are shown in Figures 4.4-2a to 4.4-2e and quantified in Section 4.4.2.5. Because Corte Madera Creek is adjacent to residential neighborhoods and schools, many sensitive receptors would be affected by construction emissions. Air pollutants decrease with distance and would be of primary concern to the closest receptors. The linear nature of the Project would avoid exposing receptors to construction emissions for the entire duration of construction. The expected duration of construction for each unit is presented in Table 3-4. Sensitive receptors located in Unit 4 and Unit 3 would experience a longer duration of construction emissions than those in Unit 2 due to longer construction durations.

Exhaust emissions would be concentrated to the construction site, in staging areas, and along haul routes (mainly Sir Francis Drake Boulevard). Exhaust emissions would be especially noticeable for construction phases requiring more haul trips, such as bypass installation and floodwall construction. The bypass installation under Sir Francis Drake Boulevard (Alternatives F and J), and required haul trips along the same road, increases the duration of construction emissions impact to Unit 4 receptors adjacent to the road.

The average annual concentration of $PM_{2.5}$ was calculated using AERMOD and $PM_{2.5}$ emission rates determined from CalEEMod calculations. AERMOD estimates maximum 1-hour concentrations, so in order to estimate annual average concentrations for the HRA, a scaling factor of 0.1 was used (USEPA 2016a). Emissions were modeled as an elongated source area with dimensions of 600 feet by 60 feet, an area about the size of each unit. This assumption was used because construction duration for a unit is approximately one year and the model output is an annual concentration. This area also maintains the required aspect ratio of 10:1 for rectangular source areas. All assumptions are detailed in Appendix B. Table 4.4-6 presents the estimated annual average $PM_{2.5}$ concentrations at varying distances. All estimates are lower than the BAAQMD annual threshold of significance, 0.3 $\mu g/m^3$.

TABLE 4.4-6 AVERAGE ANNUAL $PM_{2.5}$ CONCENTRATIONS BY ALTERNATIVE						
Distance (meters)	Distance (feet)	A (µg/m³)	B (µg/m³)	F (µg/m³)	G (µg/m³)	J (µg/m³)
1	3	0.069	0.063	0.079	0.057	0.057
25	82	0.070	0.064	0.081	0.058	0.058
50	164	0.071	0.065	0.082	0.059	0.059
75	246	0.072	0.066	0.083	0.060	0.060
100	328	0.073	0.066	0.084	0.061	0.061
125	410	0.074	0.067	0.085	0.062	0.062
150	492	0.075	0.068	0.086	0.062	0.062
175	574	0.075	0.069	0.087	0.063	0.063
200	656	0.076	0.069	0.088	0.063	0.063
225	738	0.077	0.070	0.088	0.064	0.064
250	820	0.077	0.070	0.089	0.064	0.064
275	902	0.078	0.071	0.090	0.065	0.065
300	984	0.078	0.071	0.090	0.065	0.065
325	1066	0.057	0.052	0.066	0.048	0.048

Note: Annual averages were calculated by applying a fixed ratio of 0.10 to the maximum 1-hr concentration from AERMOD (EPA 2016).

Sensitive receptors would not be subject to $PM_{2.5}$ concentrations above the annual threshold set by BAAQMD. Furthermore, the emissions would be temporary and dispersed over a linear area, so no one receptor should experience exposure for the full duration of construction. Emissions would be further reduced by implementation of AMMs that minimize criteria pollutant emissions, including $PM_{2.5}$. Operation and maintenance emissions would be substantially lower than those from construction and thus would not exceed the threshold of significance.

This impact would be ***less than significant.***

- **Impact AIR-5**: Create objectionable odors affecting a substantial number of people.

Construction would produce odors from combustion of diesel fuel. Diesel combustion odors would be limited to the construction period and daytime hours (8 am to 5 pm), except where nighttime construction occurs, as would be the case for installation of the bypass culverts beneath Sir Francis Drake Boulevard for Alternatives F and J. Construction equipment and paving activities would not be static, and on any given day may take place at different parts of the Project site. Therefore, exposure of nearby sensitive receptors, including residents, to objectionable odors from diesel combustion would tend to be for a limited period of time. Use of low-emission, high tier diesel construction equipment, as required by AMM AIR-3, would reduce diesel combustion emissions and tends to be less odorous. AMM-AIR-2 would limit idling time, which would further limit diesel combustion odors generated by construction vehicles.

Diesel combustion odors would also be produced in the event that the backup generators for pump stations are utilized, though this would be an infrequent occurrence, occurring only following flood events. Diesel backup generators would be tested offsite to prevent odors during regular testing.

Because diesel combustion odors would be experienced for only short periods for individual receptors, and because of the use of high tier diesel equipment, which produces less odorous emissions, the impact would be less than significant.

Alternatives A, B, F, and G would require excavation of the existing creek banks and channel for floodwall construction and channel improvements. The excavation will likely be limited to the fluvial deposit layers. There is a possibility to encounter Bay Mud material, but it is anticipated the volume would be minimal. Because Bay Mud can be highly odorous, and because of the proximity of the project site to nearby sensitive receptors, including residences and schools, excavated Bay Mud could result in significant odor impacts. AMM-AIR-6 would require Bay Mud material to be hauled out by truck from the Project site and remove all odorous material causing odor impacts within 24 hours of excavation. Because the volume of material that would be hauled off-site would be small and removed within 24 hours, impacts to odor from Bay Mud would be ***less than significant***. Minimal haul trips would be needed because of the low volume of mud; thus, Bay Mud haul trips would not produce emissions to the extent to impact air quality. Alternative J would not create bay mud odors because no excavation would be required in Unit 2.

Because odors dilute with distance, they would be of concern to the closest receptors, namely residences (see Figures 4.4-2a to 4.4-2e. AMM-AIR-5 would provide an air quality liaison who would be responsible for responding to air quality complaints, including those related to odor. The liaison would take corrective action within 48 hours of receiving a complaint.

Because odor would be temporary and residents can approach the air quality liaison should odor become a problem, this impact would be ***less than significant.***

Table 4.4-7 summarizes impacts to air quality***.***

TABLE 4.4-7 AIR QUALITY IMPACT CONCLUSIONS

Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
AIR-1: Conflict with or obstruct implementation of the applicable air quality plan.	AMM-AIR-1 AMM-AIR-2 AMM-WQ-11 AMM-AIR-3 AMM-AIR-4 AMM-AIR-5	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
AIR-2: Violate any air quality standard or contribute substantially to an existing or projected air quality violation.	AMM-AIR-1 AMM-AIR-2 AMM-WQ-11 AMM-AIR-3 AMM-AIR-4	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
AIR-3: Result in a cumulative net increase of any criteria pollutant for which the project region is non-attainment under an applicable federal or state ambient air quality standard.	AMM-AIR-1 AMM-AIR-2 AMM-WQ-11 AMM-AIR-3 AMM-AIR-4	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
AIR-4: Expose sensitive receptors to substantial pollution concentrations.	AMM-AIR-1 AMM-AIR-2 AMM-WQ-11 AMM-AIR-3 AMM-AIR-4 AMM-AIR-5	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
AIR-5: Create objectionable odors affecting a substantial number of people.	AMM-AIR-2 AMM-AIR-3 AMM-AIR-4 AMM-AIR-5	All Action Alternatives	LTS	--	--
		No Action	NI	--	--

AMM = avoidance and minimization measure
LTS = less than significant
NI = no impact

4.4.3.4 Cumulative Impacts

No single project is sufficient in size to independently create regional nonattainment of ambient air quality standards. Instead, a project's individual emissions contribute to existing cumulatively significant adverse air quality impacts. For criteria air pollutants and precursors, the Project would result in a cumulatively considerable contribution to the SFBAAB's existing air quality conditions if daily average or annual emissions of operational-related criteria air pollutants or precursors would exceed any applicable threshold of significance listed in Table 4.4-8.

TABLE 4.4-8 BAAQMD CUMULATIVE OPERATIONAL THRESHOLDS OF SIGNIFICANCE

Pollutant	Maximum Annual Emissions (tons per year)	Average Daily Emissions (lb/day)
ROG	10	54
NO_X	10	54
PM_{10}	15	82
$PM_{2.5}$	10	54

As previously stated, increases in air emissions from operation and maintenance for the Project would be minimal, in comparison to emissions from existing operation and maintenance activities for existing flood control structures. Marin County would continue current stream maintenance practices on Corte Madera Creek. Activities may be slightly expanded to include maintenance of new flood control management features. Construction activities, which would be much more extensive than those of operation and maintenance, would not exceed the operational cumulative thresholds for criteria pollutants set by BAAQMD. Therefore, operation and maintenance activities would not be expected to exceed the operational cumulative thresholds either. The Project would not have a cumulatively considerable impact on criteria air pollutants.

For toxic air pollutants, a project would make a considerable contribution to a cumulative impact if emissions from other sources within a 1,000 foot radius from the fence line of a source plus the contribution from the project, exceeds 0.8 $\mu g/m^3$ of $PM_{2.5}$ The only project within 1,000 meters of the Project that is known to emit $PM_{2.5}$ is the Sanitary District No 1 Kentfield Pump, which emits 0.032 $\mu g/m^3$ $PM_{2.5}$ (BAAQMD 2012). Combined with the average annual emission during construction, the BAAQMD threshold would not be exceeded.

The Project contribution to cumulative air quality impacts would therefore be less than significant.

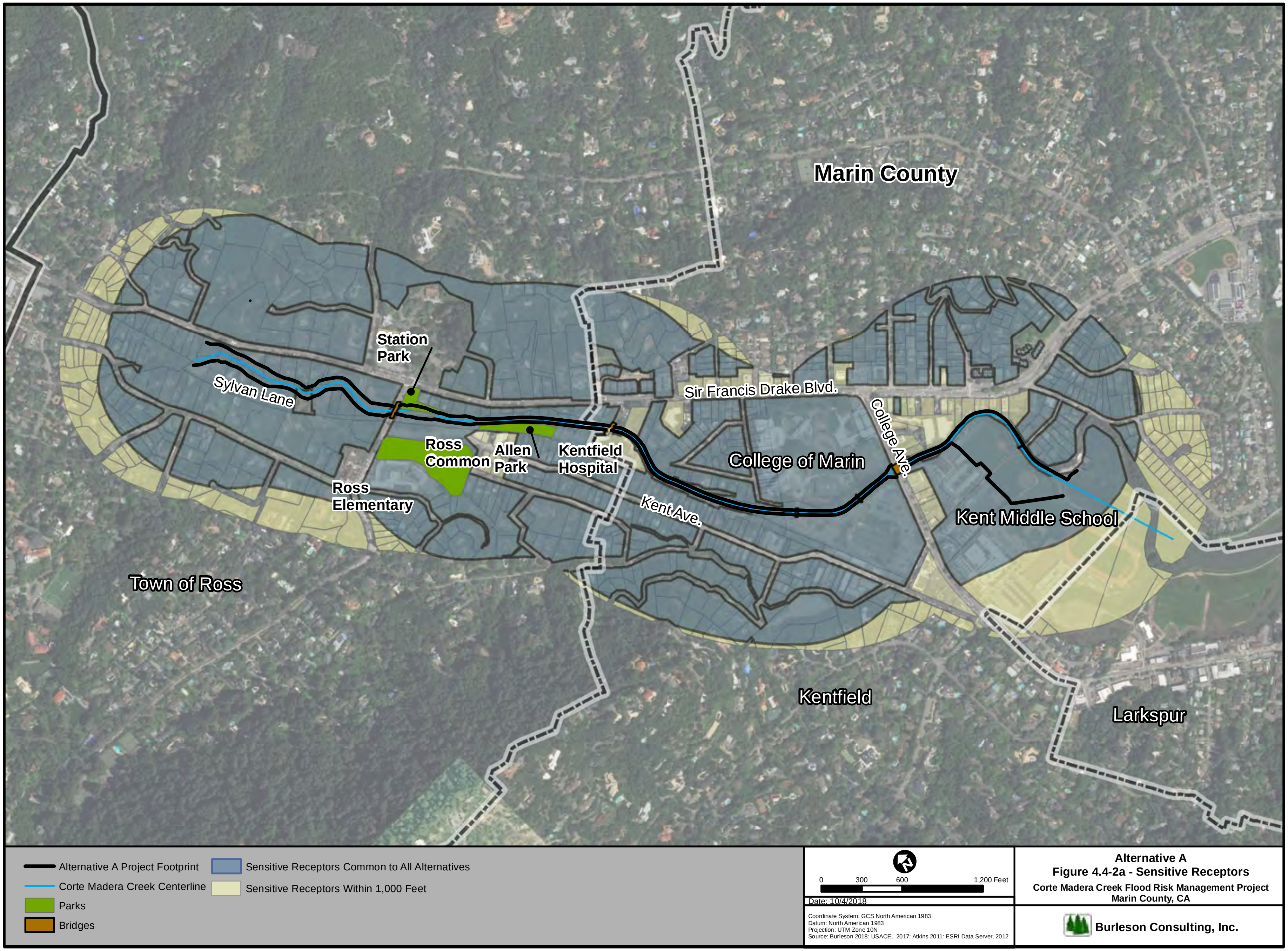
Corte Madera Creek Flood Risk Management Project

Marin County, CA

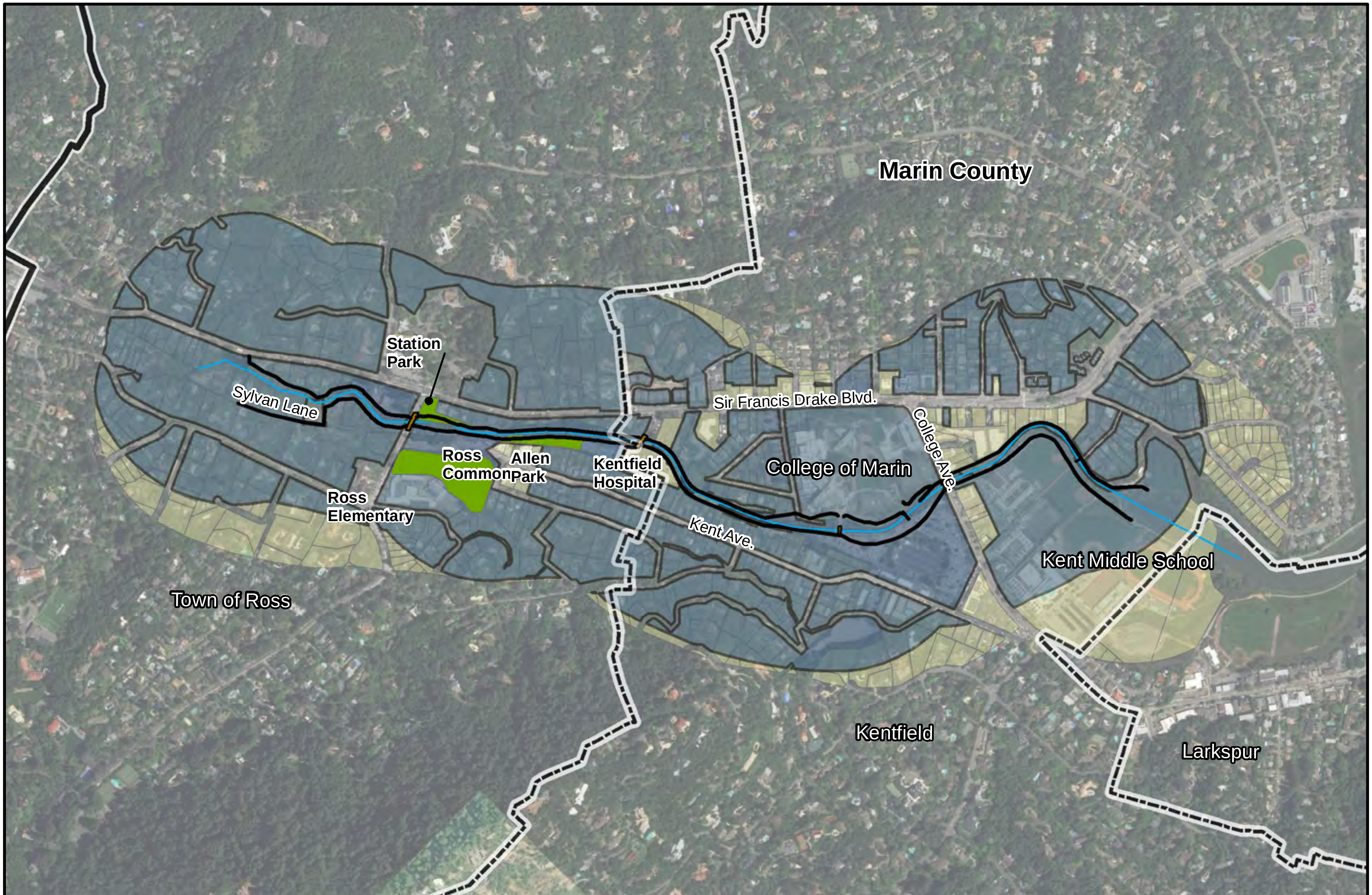
Figure 4.4-1
San Francisco Bay Area Air Basin Boundary

Date: 10/4/2018 Datum: NAD83

Burleson Consulting, Inc.



Alternative A
Figure 4.4-2a - Sensitive Receptors
Corte Madera Creek Flood Risk Management Project
Marin County, CA



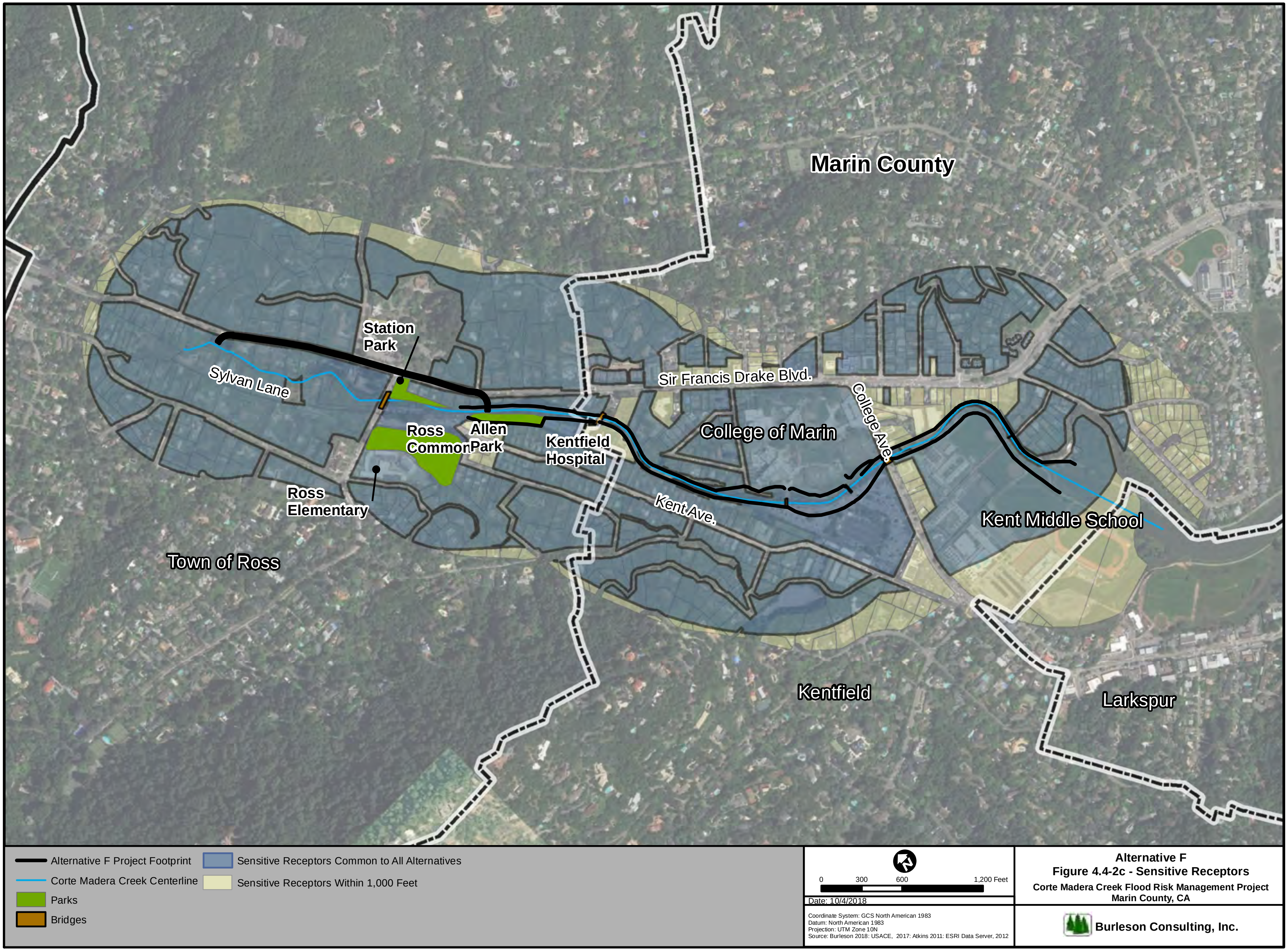
- Alternative B Project Footprint
- Corte Madera Creek Centerline
- Parks
- Bridges
- Sensitive Receptors Common to All Alternatives
- Sensitive Receptors Within 1,000 Feet

Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative B
Figure 4.4-2b - Sensitive Receptors
Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

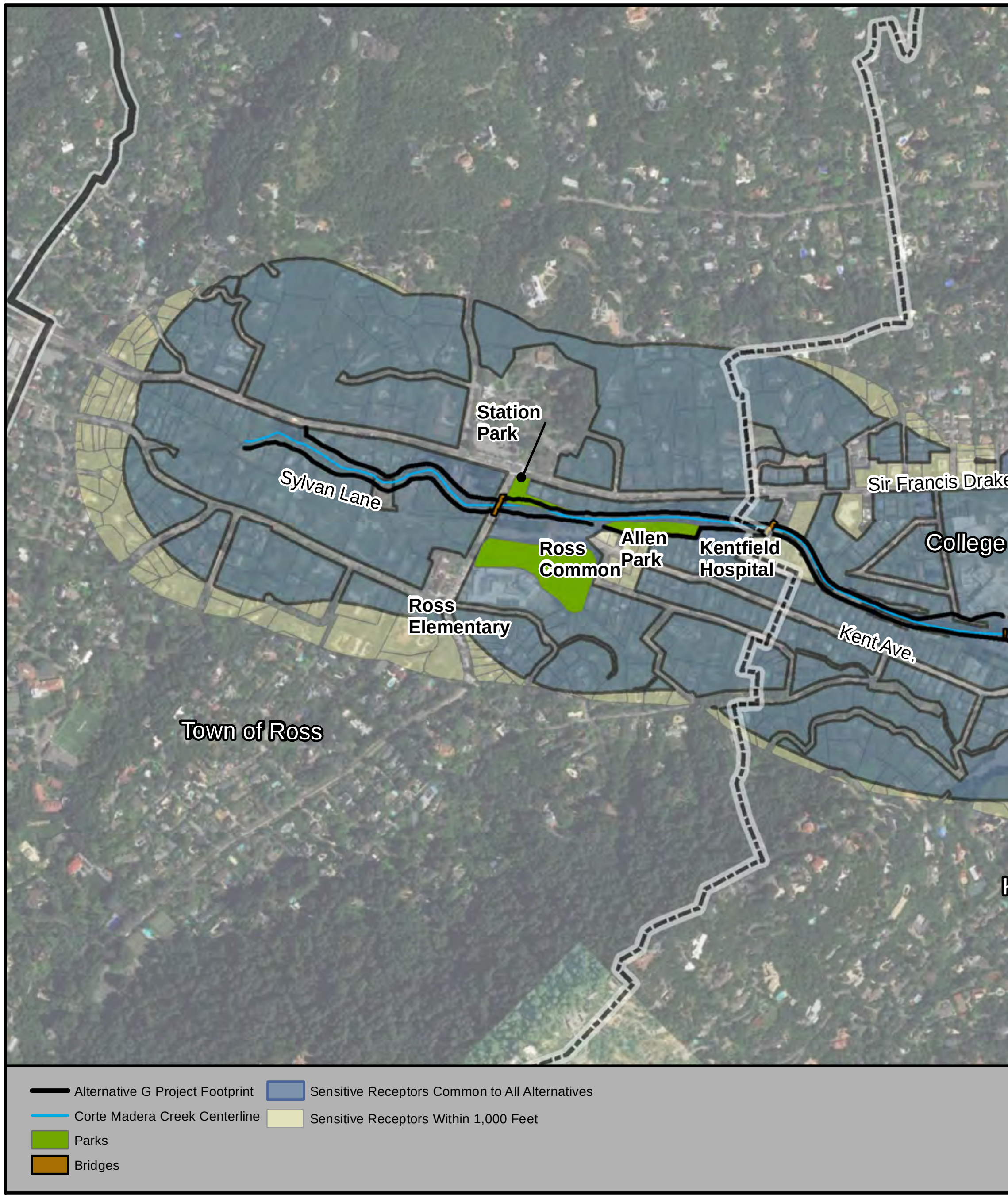


Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative F
Figure 4.4-2c - Sensitive Receptors
Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

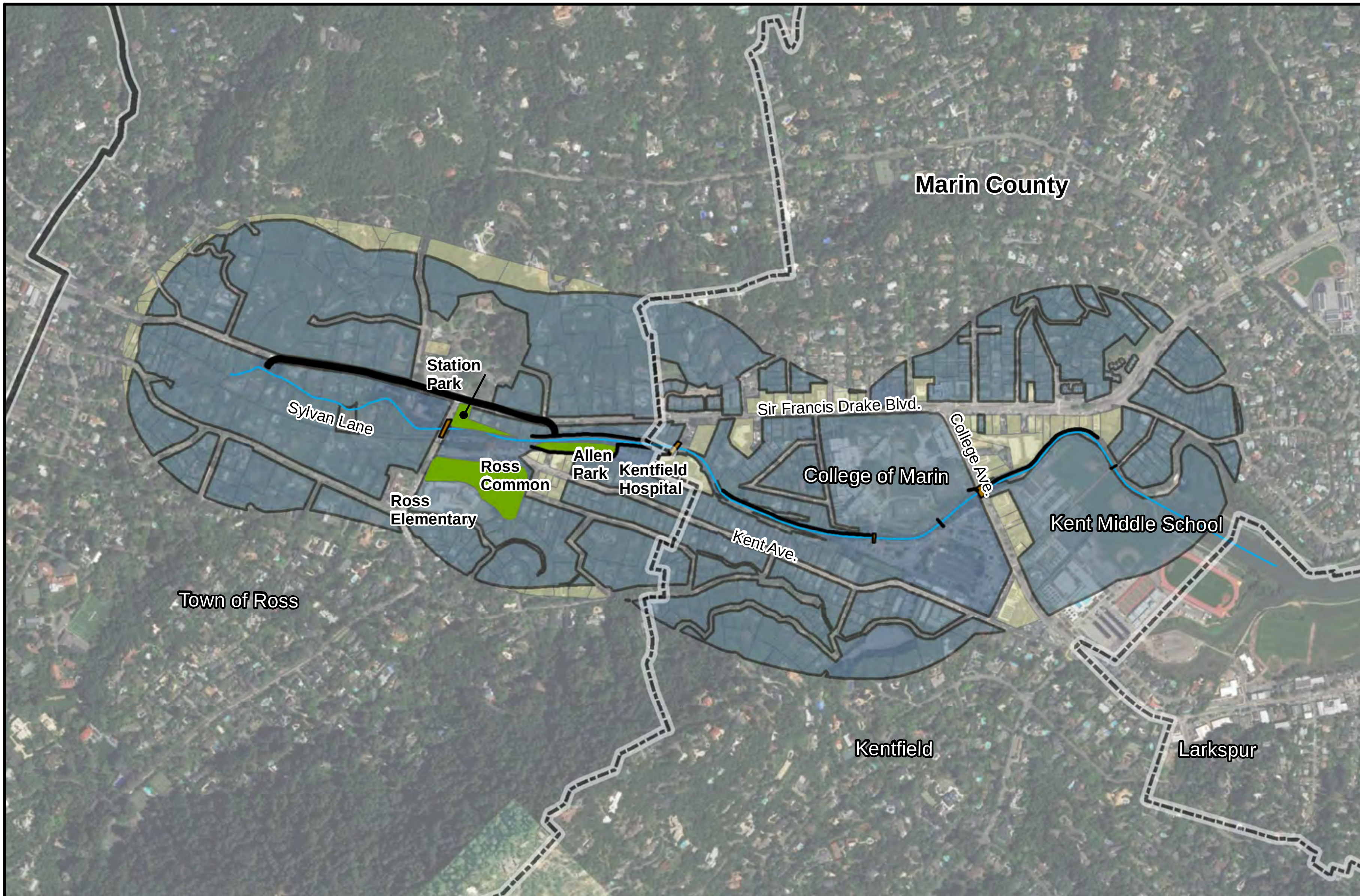


Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative G
Figure 4.4-2d - Sensitive Receptors
Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



- Alternative J Project Footprint
- Corte Madera Creek Centerline
- Parks
- Bridges
- Sensitive Receptors Common to All Alternatives
- Sensitive Receptors Within 1,000 Feet

Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Alternative J
Figure 4.4-2e - Sensitive Receptors
Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

4.5 Climate Change

This section describes existing climate change conditions relevant to the Corte Madera Creek Flood Control Study. The CEQA requires an analysis of the Project's GHG emissions and its effect on climate change. Data used to prepare this section were taken from various sources, including the California Climate Action Registry and the IPCC. Other sources for this section include information from the Marin County and Town of Ross GHG inventories, ARB, and the California Climate Action Team.

4.5.1 Regulatory Setting

This section discusses regulatory information that applies to climate change. Additional regulatory information appears in Chapter 9 Environmental Compliance.

4.5.1.1 Federal

The following federal policies and laws apply to the project; details are provided in Chapter 9.

- USACE Climate Preparedness and Resilience Policy Statement (June 2014).
- Engineering and Construction Bulletin (ECB) 2018-14, Guidance for Incorporating Climate Change Impacts to Inland Hydrology in Civil Works Studies, Designs, and Projects.

4.5.1.2 State

The following state policies and laws apply to the project; details are provided in Chapter 9.

- California Global Warming Solutions Act
- Senate Bill 97
- OPR Technical Advisory on CEQA and Climate Change
- Low Carbon Fuel Standard

4.5.1.3 Local

Marin Countywide Plan

The following policies of the Marin Countywide Plan are applicable to climate change regulation:

- **Policy AIR-4.1 Reduce GHG Emissions**. Adopt practices that promote improved efficiency and energy management technologies; shift to low-carbon and renewable fuels and zero emission technologies.
- **Policy AIR-4.2 Foster the Absorption of GHGs:** Foster and restore forests and other terrestrial ecosystems that offer significant carbon mitigation potential.
- **Policy PK-1.3 Protect Park Resources from Impacts of Climate Change:** Identify strategies to protect park resources from the effects of climate change, such as violent weather, plant loss or change due to moisture and temperature changes, and sea level rise.

Marin Climate Action Plan

The Marin County Climate Action Plan 2015 Update (Marin County 2015), builds on the County's 2006 GHG Reduction Plan and provides an update of GHG emissions in 2012, forecasts of emissions for 2020, and an assessment of actions that the County will take to further reduce emissions by 2020. The update includes two targets: reduce GHG emissions from community activities in the unincorporated areas of Marin County by at least 30 percent below 1990 levels by 2020; and reduce GHG emissions from the County's municipal activities by at least 15 percent below 1990 levels by 2020. The update includes a variety of regulatory and incentive-based strategies that aim to reduce GHG emissions from both existing and new development in the County, supplement State programs, and achieve additional emissions reductions. There are 15 local community actions and 8 local municipal actions included in the update.

Marin Sea Level Rise

Marin Sea Level Rise has initiated the BayWAVE project, a focused vulnerability assessment of the eastern Marin shoreline from the Golden Gate Bridge to the northern end of Novato. BayWAVE will evaluate the extent of impacted assets, assess the sensitivity and adaptability of selected assets and work with the local cities and towns to plan implementation of adaptation strategies. BayWAVE is an early action to begin the adaptation planning along the shoreline, including coordination with the Marin Multi-Jurisdictional Hazard Mitigation Planning team on flood warnings, an adaptation toolkit to explain how the various engineering solutions work, and lastly, a summary of several ongoing feasibility studies to integrate flood protection, sea level rise, and habitat in Novato, Santa Venetia, and Richardson Bay. BayWAVE is a long-term planning effort, expected to continue planning and response based on the vulnerability assessment (Marin County 2018).

BAAQMD

The BAAQMD 2017 CEQA Guidelines provide project level thresholds of significance for operational-related GHG emissions. The following threshold for land use development projects is applicable to the Project:

- For land use development projects, the threshold is compliance with a qualified GHG Reduction Strategy; or annual emissions less than 1,100 metric tons per year (MT/year) of CO_2e; or 4.6 MT CO_2e/service population/year (service population includes residents and employees). Land use development projects include residential, commercial, industrial, and public land uses and facilities.

The BAAQMD has not adopted thresholds of significance for construction-related GHG emissions. Instead, it recommends that the Lead Agency quantify and disclose GHG emissions that would occur during construction, and make a determination on the significance of these construction-generated GHG emission impacts in relation to meeting AB 32 GHG reduction goals, as required by the PRC, Section 21082.2. The Lead Agency is encouraged to incorporate BMPs to reduce GHG emissions during construction, as feasible and applicable.

4.5.2 Affected Environment

4.5.2.1 Terminology

GHG

Gases that trap heat in the atmosphere are called GHGs because they reduce radiative loss of atmospheric heat, similar to the glass walls of a greenhouse. Common GHGs include water vapor, CO_2, CH_4, N_2O, chlorofluorocarbons, HFC, PFC, SF_6, O_3, and aerosols. Without the natural heat-trapping effect of GHGs, the earth's surface would be about 34°C cooler (California Environmental Protection Agency 2006). However, it is the scientific consensus that emissions from human activities, such as electricity production and vehicle use, have elevated the concentration of these gases in the atmosphere beyond the level of naturally occurring concentrations.

Climate Change

Global climate change is a broad term used to describe any worldwide, long-term change in the earth's climate. This change could be, for example, an increase or decrease in temperatures, the start or end of an ice age, or a shift in precipitation patterns.

Global Warming

Global warming is a more specific type of global climate change and refers to a general increase in temperatures across the earth. These rising temperatures can cause other climatic changes, such as a shift in the frequency and intensity of rainfall events or hurricanes. Global warming does not necessarily imply that all locations would be warmer. Some specific, unique locations may be cooler even though the world, on average, is warmer.

Global Warming Potential

A gas or aerosol's global warming potential is defined as its ability to trap heat in the atmosphere; it is the "cumulative radiative-forcing effects of a gas over a specified time horizon resulting from the emission of a unit mass of gas relative to a reference gas" (USEPA 2018b).

CO_2 Equivalent

In emissions inventories, GHG emissions are typically reported in terms of pound, or MT CO_2e. Because CO_2 is emitted in such vastly higher quantities that it accounts for the majority of GHG emissions, the term CO_2e is generally used as the benchmark for quantifying the emissions levels of projects. The CO_2e of a particular GHG is calculated as the product of the mass emitted and the specific global warming potential of the GHG.

4.5.2.2 Existing Conditions

Flood risk in the Project area results from winter storms, primarily but not exclusively the result of atmospheric river events. Over the last 50 years, average annual temperatures in the region have increased by 1.7°F and there has been an increase in extremely hot days and nights. The number of fog hours in the Bay area has decreased by 33 percent. Annual precipitation totals are unchanged, but year-to-year precipitation variability has increased, resulting in larger swings between drought and wet years. In drought years, wildfires have increased in frequency and intensity, reflecting both an increase in weather conditions favorable to wildfire ignition and spread, and the increasing encroachment of housing and human activity in wildland areas. The Climate Hydrology Assessmetn and Nonstationarity Tools show no changes to the frequency and mangitude of peak floods along Corte Madera Creek in the historic period. This is further discussed in Appendix G.

4.5.2.3 Predicted Effects of Climate Change

Climate in the Project area is projected to change significantly over this century. Average annual temperatures are projected to rise 3.3 to 4.4°F by mid-century (average for 2040-2069) and 4.2 to 7.2°F by the end of the century (2070-2099) (Ackerly et al. 2018 in Appendix G). In response to climate warming, winter storm magnitudes are likely to increase in frequency and intensity, and the inter-annual variation in precipitation is likely to increase (increased frequency of drought and flood years). However, there is considerable uncertainty in the timing and magnitude of changes in precipitation in the Project area because of climate model differences in the future position of the winter storm track. Studies indicate that the magnitude of the largest precipitation may increase from 6 to 37% by the end of the century and large events may increase in frequency 2.5-fold compared to the historic period. At the same time, higher temperatures will exacerbate drought conditions, both in terms of drought frequency and duration. The result is likely to be an increase in "whiplash events," in which extremely dry periods are followed by extremely wet periods. Consequently, hydrologic regimes are also likely to become more variable with increases in both the frequency and magnitude of extreme events. This is further discussed in Appendix G.

Sea-Level Change and Flooding

Since 1993, sea level has been rising at a rate of 3.4 millimeters per year. Sea level in the San Francisco Bay Area has risen 8 inches in the past century, and could rise up to 70 inches by the end of the century, in a worst-case scenario. The BayWAVE Vulnerability Assessment predicts that the majority of buildings in Kentfield, including College of Marin and Kent Middle School, could be vulnerable to a 100-year storm surge (Marin County 2018). The impacts of sea-level change on hydrology and hydraulics as it pertains to the Project is discussed in Section 4.1 Hydrology and Hydraulics and Appendix A.

Water Quality

Climate change could have adverse effects on water quality, which would in turn affect the beneficial uses (i.e. habitat, water supply, etc.) of surface water bodies and groundwater. Changes in precipitation could result in increased sedimentation, higher concentration of pollutants, higher dissolved oxygen levels, increased temperatures, and an increase in the amount of runoff constituents reaching surface water bodies. Sea level rise, discussed above, could result in the encroachment of saline water into freshwater bodies, including the upper portions of Corte Madera Creek.

Drought

The frequency and intensity of droughts would be exacerbated by warming of temperatures and changes in rainfall and runoff patterns. Regions that rely heavily on surface water for water supplies may be particularly vulnerable to changes in runoff patterns placing more demand on groundwater. Temperature increases would in turn increase rates of evaporation, thereby increasing the amount of water needed for irrigation purposes. Furthermore, the potential exists for forests to experience more frequent and intense fires, subsequently causing changes in vegetation and a reduction in water supply and storage capacity of a healthy forest.

Ecosystems and Biodiversity

Climate change is expected to have effects on diverse types of ecosystems, from alpine to deep-sea habitat. As temperatures and precipitation change, seasonal shifts in vegetation will occur; this could affect the distribution of associated flora and fauna. As the range of species shifts, habitat fragmentation could occur, with acute impacts on the distribution of certain sensitive species. The IPCC states that “20 percent to 30 percent of species assessed may be at risk of extinction from climate change impacts within this century if global mean temperatures exceed 2 to 3°C (3.6 to 5.4°F) relative to pre-industrial levels” (USACE 2010). Shifts in existing biomes could also make ecosystems vulnerable to invasive species encroachment. Wildfires, which are an important control mechanism in many ecosystems, may become more severe and more frequent, making it difficult for native plant species to repeatedly regerminate. In general terms, climate change is expected to put a number of stressors on ecosystems, with potentially catastrophic effects on biodiversity.

Human Health Effects

Climate change may increase the risk of vector-borne infectious diseases. Warming of the atmosphere would also be expected to increase smog and particulate pollution, which could adversely affect individuals with heart and respiratory problems, such as asthma. Extreme heat events would also be expected to occur with more frequency, and could adversely affect the elderly, children, and the homeless. Finally, the water supply impacts and seasonal temperature variations expected as a result of climate change could affect the viability of existing agricultural operations, making the food supply more vulnerable.

4.5.2.4 GHG Emissions

Types and Global Warming Potentials

Individual GHGs have varying global warming potentials and atmospheric lifetimes (Table 4.5-1). As previously stated, CO_2e is a consistent methodology for comparing GHG emissions since it normalizes various GHG emissions to a consistent metric. The reference gas for global warming potential is CO_2; CO_2 has a global warming potential of one (1). By comparison, the global warming potential of CH_4 is 25, as CH_4 has a greater global warming effect than CO_2 on a pound-for-pound basis (ARB 2017b).

TABLE 4.5-1 GLOBAL WARMING POTENTIAL AND ATMOSPHERIC LIFETIMES OF SELECT GHGS

Gas	Atmospheric Lifetime (years)	Global Warming Potential
CO_2[a]	50–200	1
CH_4	12	25
N_2O	114	298
HFC-23	270	14,800
HFC-134a	14	1,430
HFC-152a	1.4	124
PFC: Tetrafluoromethane (CF_4)	50,000	7,390
PFC: Hexafluoroethane (C_2F_6)	10,000	12,200
SF_6	3,200	22,800

Note: Global warming potential is referenced to CO2, which is rated as "1."
SOURCE: ARB 2017b

CO_2: Carbon dioxide is an odorless, colorless gas, which has both natural and anthropogenic sources. Natural sources include decomposition of dead organic matter; respiration of bacteria, plants, animals, and fungus; evaporation from oceans; and volcanic outgassing. Anthropogenic sources of CO_2 are from burning coal, oil, natural gas, and wood. Concentrations of CO_2 were 379 parts per million (ppm) in 2005, which equates to an increase of 1.4 ppm per year since 1960. CO_2 is the most common GHG generated by California activities, constituting approximately 84 percent of all GHG emissions (ARB 2017c). CO_2 emissions attributed to California activities are mainly associated with in-state fossil fuel combustion and fossil fuel combustion in out-of-state power plants supplying electricity to California. Other activities that produce CO_2 emissions include mineral production, waste combustion, and land use changes that reduce vegetation.

CH_4: Methane is a flammable gas and is the main component of natural gas. A natural source of CH_4 is the anaerobic decay of organic matter. Geological deposits, known as natural gas fields, also contain CH_4, which is extracted for fuel. Other sources are landfills, fermentation of manure, and cattle.

N_2O: Nitrous oxide is produced naturally by microbial processes in soil and water. Anthropogenic sources of N_2O include agricultural sources, industrial processing, fossil fuel-fired power plants, and vehicle emissions.

Other GHGs: Other gases that contribute to the greenhouse effect include O_3, chlorofluorocarbons, HFC, PFC, SF_6, and aerosols. This analysis focuses on the major sources of GHGs, including CO_2, N_2O, and CH_4 because these are generally most prevalent and are currently regulated in the State of California.

4.5.2.5 GHG Emissions Inventories

A GHG inventory is an accounting of the amount of GHGs emitted to or removed from the atmosphere over a specified period of time attributed to activities by a particular entity (e.g., annual emissions and reductions attributed to the State of California). A GHG inventory also provides information on the activities that cause emissions and removals, as well as the methods used to make the calculations.

National Inventory

In 2016, GHG emissions in the United States were 6,511 MMT CO_2e. U.S. emissions increased 2.3 percent since 1990, but decreased by 2.5 percent from 2015 to 2016 (USEPA 2018a).

California Inventory

California is the second largest state contributor of GHG emissions in the United States and the sixteenth largest in the world (BLM 2009). In 2016, California produced 429 MMT CO_2e, which is approximately 6.6 percent of 2016 U.S. emissions. In California, the most common GHG is CO_2, which constitutes approximately 83 percent of all GHG emissions. The remainder of GHGs only makes up a small percentage of the total: N_2O constitutes 3 percent, CH_4 9 percent, and high global warming potential gases 5 percent. CO_2 emissions in California are mainly associated with fossil fuel consumption in the transportation sector (41 percent) and the industrial sector (23 percent). The electricity production, agricultural, residential, and commercial activities comprise the balance of California's GHG emissions (ARB 2018).

As part of AB 32, ARB is required to establish a statewide GHG emissions limit for 2020 equivalent to 1990 emissions. In addition, Executive Orders S-3-05 and B-30-15 set the following statewide emissions targets: a reduction of GHG emissions to 40 percent below 1990 levels by 2030 and a reduction of GHG emissions to 80 percent below 1990 levels by 2050. ARB estimates that California's annual emissions were equivalent to 431 MMT CO_2e in 1990 and 467 MMT CO_2e in 2000 (ARB 2017a).

Table 4.5-2 shows quantified California statewide emissions targets (AB 32, Executive Order S-3-05, and Executive Order B-30-15 targets) based on the California Energy Commission's 2015 Inventory of GHGs and Sinks, which was last updated in 2017.

TABLE 4.5-2 CALIFORNIA GHG REDUCTION TARGETS

Year[a]	California Population	Reduction Goal	GHG Emissions (MMT CO_2e)
1990	29,758,213	N/A	431
2000	33,873,086	N/A	467
2010	37,253,956	GHG emissions at or below 2000 levels	446
	California Estimated Population		**GHG Emission Targets (MMT CO_2e)**
2020	40,719,999	GHG emissions at or below 1990 levels	431
2030	44,019,846	GHG emissions 40% below 1990 levels	259
2050	49,158,401	GHG emissions 80% below 1990 levels	86

SOURCE: Population data are from California Department of Finance, 2017; GHG emissions targets are derived from ARB, 2017. GHG Emissions Inventory Summary [2000–2015].
a. Target years specified in Executive Order S 3 05 and/or AB 32. 1990 and 2000 data are provided as a baseline.

San Francisco Bay Area Inventory

In 2011, 86.6 MMT CO_2e of GHG were emitted in the San Francisco Bay Area (83.9 MMT CO_2e were emitted within the BAAQMD and 2.7 MMT CO_2e were indirect emissions from imported electricity). Transportation sources (e.g. fossil fuel combustion) were associated with 39.7 percent of the total emissions, industrial/commercial 35.7 percent, domestic 7.7 percent, power plants 14 percent, off-road equipment 1.5 percent, and agricultural/ farming operations 1.5 percent.

Marin County Inventory

Marin County completed a re-inventory of countywide GHG emissions in 2007, updating its previous inventory completed in 2003. Countywide GHG emissions increased by approximately 6 percent between 1990 and 2005, from 3.0 MMT CO_2e to 3.2 MMT CO_2e. While this represented an increase in emissions over 1990 levels, it was noted that countywide emissions decreased by 2 percent from those estimated in 2000 (Marin County 2007). The Marin County Climate Action Plan reported that the total GHG emissions generated by community activities in unincorporated areas in 2015 were 452,000 MT CO_2e, a 20 percent decrease from estimated 1990 emissions (Marin County 2017).

Town of Ross Inventory

In 2010, the Town of Ross completed its second GHG emissions inventory that reported approximately 17,469 MT CO_2e emitted in 2005 and 15,899 MT of CO_2e emitted in 2010. Of the total, only 237.6 MT were attributed to government/municipal operations, while the remaining 15,661 MT were associated with the Town of Ross. The residential sector represented the greatest source of community GHG emissions, producing 50 percent of the total community emissions (Town of Ross 2012).

4.5.3 Environmental Consequences

4.5.3.1 Avoidance and Minimization Measures

In conjunction with Air Quality AMMs, the following AMM would be implemented as part of the Project design to minimize adverse effects associated with climate change:

- **AMM-CC-1: GHG BMPs** - The contractor will utilize alternatively fueled construction equipment for at least 15 percent of the fleet, use local building materials for at least 10 percent of the total, and recycle or reuse at least 65 percent of construction waste or demolition materials.

4.5.3.2 Methodology for Impact Analysis and Significance Thresholds

Climate change analysis was based on modeled GHG emissions produced during construction. GHG emissions were calculated using the software CalEEMod with the same assumptions and methods as used for air quality emissions estimates (see Section 4.4.3.2).

Only minor activities would be expected for operations and maintenance, including sediment removal every 5 years and vegetation maintenance. Therefore, operations and maintenance emissions are not expected to be significant and were not considered for this analysis.

The Project would pose a significant impact to climate change if it would:

- **Impact CC-1:** Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment.
- **Impact CC-2:** Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

Significance criteria were based on state and BAAQMD CEQA Guidelines. A determination of significance was made by comparing CalEEMod emissions estimates to these guidelines. Because there is no BAAQMD threshold for construction-related GHG, the operational-related GHG threshold for projects other than stationary sources was used. Additionally, the BAAQMD recommendation of GHG emissions disclosure was satisfied.

No Action Alternative

With the no action alternative, climate change conditions within Corte Madera Creek would remain as existing. The no action alternative would avoid construction impacts associated with the action alternatives, including GHG emissions from construction equipment and activities. There would be ***no impact*** to climate change.

Action Alternatives

- **Impact CC-1:** Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment.

- **Impact CC-2:** Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.

Construction equipment and vehicles would produce GHG emissions during construction. Operation and maintenance activities would not be expected to substantially change from current activities conducted by the District and would not be expected to be significant. Table 4.5-3 presents emissions estimated using CalEEMod (detailed calculations in Appendix B). Because of the cumulative nature of GHGs, emissions were averaged over the period of analysis (50 years) to provide a clearer picture of emissions throughout the life of the Project.

TABLE 4.5-3 CONSTRUCTION GHG EMISSIONS ESTIMATES (MT CO_2e)					
	ALT A	ALT B	ALT F	ALT G	ALT J
2020	-	-	204	204	187
2021	1,150	1,112	995	1,000	349
2022	1,230	1,213	2,416	1,209	2,310
2023	0	4	-	54	-
Total	2,380	2,328	3,615	2,467	2,845
Annual Average over Construction & Period of Analysis	48	47	72	49	57

Greenhouse gas emissions would primarily occur during construction for all alternatives. Occasional vegetation removal equipment and worker commutes would contribute to operations and maintenance emissions and would be expected to be minor. The BAAQMD has not established a threshold of significance for GHG emissions during construction. However, the average emissions over construction and the period of analysis (50 years total) would be less than the threshold of significance for operational emissions from non-stationary sources (1,100 MT CO_2e per year) set by BAAQMD. Although the Project emissions would contribute to climate change, GHG emissions would not be substantial and would be further reduced by BMPs.

Best management practices identified by BAAQMD to reduce GHG emissions during construction include using alternatively fueled construction equipment for at least 15 percent of the fleet, using local building materials for at least 10 percent of the total, and recycling or reusing at least 65 percent of construction waste or demolition materials (AMM-CC-1). These and other applicable BMPs would be incorporated into the project construction as appropriate.

For all alternatives, impacts to climate change would be ***less than significant.***

Table 4.5-4 summarizes the impacts to climate change***.***

TABLE 4.5-4 CLIMATE CHANGE IMPACT CONCLUSIONS					
Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
CC-1: Generate GHG emissions, either directly or indirectly, that may have a significant impact on the environment.	AMM-AIR-2 AMM-AIR-3 AMM-CC-1	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
CC-2: Conflict with an applicable plan, policy, or regulation adopted for the purpose of reducing the emissions of GHGs.	AMM-AIR-2 AMM-AIR-3 AMM-CC-1	All Action Alternatives	LTS	--	--
		No Action	NI	--	--

AMM = avoidance and minimization measure
LTS = less than significant
NI = no impact

4.5.3.3 Cumulative Impacts

Climate change is cumulative by nature. If annual emissions of GHGs exceed the operational threshold set by BAAQMD, 1,100 MT CO_2e per year, the proposed Project would result in a cumulatively considerable contribution of GHG emissions and a cumulatively significant impact to global climate change (BAAQMD 2017a). Increases in operational emissions over existing emissions associated with the District's maintenance of Corte Madera Creek would be minor and construction emissions averaged over the period of analysis would fall below this threshold, as presented in Table 4.5-3. Thus, the Project would not make a cumulatively considerable contribution to climate change.

4.6 Biological Resources

This section describes the existing biological resources identified in the Project area and evaluates the potential impacts that could result from implementation of the proposed Project. Information from the Corte Madera Creek Final Baseline Report (USACE 2010), the Biological Resources Constraints Memorandum CMFCP Marin County, California (Atkins 2011), and Corte Madera Creek Flood Control Channel Fish Passage Assessment and Alternative Analysis (Love 2007) were primary references consulted to analyze the affected environment. Biological resources include all flora, fauna, and associated habitats (including wetlands and other waters of the U.S.).

Reconnaissance level field surveys were conducted on April 9, 2010 (USACE 2010) and November 2017 by the PDT. Reconnaissance surveys assessed the potential occurrence of special-status species and characterized the biological communities in the study area. During the first field visit in 2010, an inventory of all observed plant and animal species was compiled. The results from this survey were used in the development of this section to supplement background information on species and habitats in the study area.

4.6.1 Regulatory Setting

This section lists federal, state, regional, and local environmental laws, regulations, and executive orders applicable to the Project.

4.6.1.1 Federal

Federal policies and laws that apply to biological resources in the Project area are listed below. For details regarding these laws, please see Chapter 9.

- Clean Water Act, Sections 401 and 404
- Endangered Species Act
- Estuary Protection Act
- Executive Order 11988, Floodplain Management
- Executive Order 11990, Protection of Wetlands
- Fish and Wildlife Coordination Act
- Magnuson-Stevens Fisheries Conservation and Management Act
- Migratory Bird Treaty Act
- Sustainable Fisheries Act

4.6.1.2 State

State policies and laws that apply to biological resources in the Project area are listed below. For details regarding these laws, please see Chapter 9.

- California Endangered Species Act
- California Fish and Game Code
- Porter-Cologne Water Quality Control Act

4.6.1.3 Local Laws and Regulations

Marin Countywide Plan

The Marin Countywide Plan is made up of several elements that shape the manner in which development, including flood control projects, occur within the county. These elements include: natural systems and agriculture, socioeconomic (which includes public safety), community development, noise, and built environment. As the Project is located within unincorporated portions of the county, the policies of the countywide plan that are germane to the Project include, but are not limited to:

- **Policy EH-3.2: Retain Natural Conditions.** Ensure that flow capacity is maintained in stream channels and floodplains, and achieve flood control using biotechnical techniques instead of storm drains, culverts, riprap, and other forms of structural stabilization (see 4.1 Hydrology and Hydraulics, and 4.8 Aesthetics).
- **Policy BIO-4.16: Regulate Channel and Flow Alteration.** Allow alteration of stream channels or reduction in flow volumes only after completion of environmental review, commitment to appropriate mitigation measures, and issuance of appropriate permits by jurisdictional agencies based on determination of adequate flows necessary to protect fish habitats, water quality, riparian vegetation, natural dynamics of stream functions, groundwater recharge areas, and downstream users (see Section 4.1 Hydrology and Hydraulics, and Section 4.2 Water Quality).
- **Policy PK-1.3: Protect Park Resources from Impacts of Climate Change**. Identify strategies to protect park resources from the effects of climate change, such as violent weather, plant loss or change due to moisture and temperature changes, and sea level rise (see Sections 4.1 Hydrology and Hydraulics, and 4.5 Climate Change).

Town of Ross General Plan 2007–2025

Similar to the Marin Countywide Plan, the Town of Ross's General Plan 2007–2025 includes several applicable policies and direction with respect to social and physical resources. As the Project is located within the Town of Ross, the policies of the General Plan that are germane to the Project include, but are not limited to:

- **Policy 1.1 Protection of Environmental Resources**: Protect environmental resources such as hillsides, ridgelines, creeks, drainage ways, trees, tree groves, threatened and endangered species habitat, riparian vegetation, cultural places, and other resources.
- **Policy 1.2 Tree Canopy Preservation:** Protect and expand the tree canopy of Ross to enhance the beauty of the natural landscape. Recognize that the tree canopy is critical to provide shade, reduce ambient temperatures, improve the uptake of CO_2, prevent erosion and excess stormwater runoff, provide habitat for wildlife and birds, and protect the ecosystem of the under-story vegetation.
- **Policy 1.3 Tree Maintenance and Replacement**: Assure proper tree maintenance and replacement.
- **Policy 1.4 Natural Areas Retention:** Maximize the amount of land retained in its natural state. Wherever possible, residential development should be designed to preserve, protect, and restore native site vegetation and habitat. In addition, where possible and appropriate, invasive vegetation should be removed.
- **Policy 6.3 Ross Valley Flood and Watershed Protection:** The Town will work with other jurisdictions within the Ross Valley watershed to develop a comprehensive approach to flood protection and resource preservation strategies.
- **Policy 6.6 Creek and Drainageway Setbacks, Maintenance and Restoration:** Keep development away from creeks and drainageways. Setbacks from creeks shall be maximized to protect riparian areas and to protect residents from flooding and other hazards. Encourage restoration of runoff areas, to include but not be limited to such actions as sloping banks, providing native vegetation, protecting habitat, etc., and work with property owners to identify means of keeping debris from blocking drainageways.
- **Policy 6.7 Riparian Vegetation:** Protect existing creek and riparian vegetation and encourage the use of native species during creek restoration. Assure that modification of natural channels is done

in a manner that retains and protects creek-side vegetation, integrates fish passage and includes habitat restoration in its natural state.

Town of Ross Municipal Code

The Town of Ross Municipal Code includes standards for development, including a number of sections that relate to biological resources. Chapter 12.24 of the Town of Ross Municipal Code establishes the reasoning and procedure for protecting trees and preventing unnecessary loss of native trees within the city limits. Under this ordinance all pruning, maintenance, and removal of trees on town property is subject to the following provisions: (a) all work performed on public trees will be done in conformance with the Approved American National Standards Institute A300 pruning standards and Z133.1 safety standards; (b) tree service contractors working on public trees must have on their staff a certified arborist or other qualified person approved by the director of public works, and the approved arborist must certify that all work is performed in accordance with American National Standards Institute A300 pruning standards; and (c) no public tree will be altered or removed without a permit issued pursuant to Section 12.24.130 of the Town of Ross Municipal Code. Section 9.04.070 of the Town of Ross Municipal Code would also apply to the Project and requires a permit from the Town in the event that a tree must be modified within the public right-of-way.

4.6.2 Affected Environment

4.6.2.1 Regional Setting

The Project is located in the San Francisco Bay Area, a floristic subregion of the California Floristic Province's Central Western California region. The San Francisco Bay Area subregion occupies the northern third of the Central Western California region. Because it contains a diverse assemblage of plant communities and wildlife habitat types, this subregion is less well defined by flora than other subregions. Marin County has a mild Mediterranean climate with long dry summers and rainy winters. Rainfall in the county averages from 30 to 61 inches per year (Marin County Community Development Agency 2004). Mean annual precipitation for the watershed is 40.75 inches. Coastal fog is common, especially in late summer when it provides an important source of moisture for local plants and animals. Water flow in Corte Madera Creek is highest in early January and lowest from July through September, when flowing water is uncommon and the stream is predominantly dry (Friends 2008).

Elevation within the Project area varies from approximately -12 feet NGVD29 in the concrete channel at the head of the stilling basin to approximately 25 feet NGVD29 on the banks of the creek (Town of Ross 2009, in USACE 2010, Love 2007). The Baseline Report identified three primary vegetation/habitat types that occur in and adjacent to Corte Madera Creek in Units 2, 3, and 4: riparian, ruderal, and landscaping. A visual habitat survey of the study area further refined habitats in the Project area as: riverine (concrete-lined channel), riverine (earthen-lined channel), and riparian woodland, coastal brackish marsh, eucalyptus woodland and urban/developed (including ornamental landscaping) (Atkins 2011). Figure 4.6-1 shows the habitats within the Project area based on Atkins report (2011).

4.6.2.2 Habitat Types

Riparian Woodland

The primary vegetation community in Unit 4 upstream of the existing Denil fish ladder is riparian woodland. This habitat includes the earthen streambed channel of Corte Madera Creek. No riparian woodland habitat exists in the Project area downstream of the fish ladder in Units 2 and 3. Overall, canopy cover within the riparian community ranges from 10 to 100 percent (Town of Ross 2009, in USACE 2010). Dominant species in the overstory include box elder (*Acer negundo ssp. californicum*), silver waddle (*Acacia dealbata*), big leaf maple (*Acer macrophylum*), willow (*Salix sp*.), blue gum (*Eucalyptus sp.*), redwood (*Sequoia sempervirens*), western juniper (*Juniperus occidentalis var. occidentalis*), and white alder (*Alnus rhombifolia*). Species observed in the understory include Himalayan blackberry (*Rubus discolo*r), periwinkle (*Vinca major*), English ivy (*Hedera helix*), Bermuda buttercup (*Oxalis pes-caprae*), miner's lettuce (*Claytonia perfoliata*), cut-leaf geranium (*Geranium dissectum*), white-flowered onion (*Allium triquetrum*), giant reed (*Arundo donax*), scotch broom (*Cytisus scoparius*), bedstraw (*Galium sp.*), prickly lettuce (*Lactuca serriola)*, common horsetail (*Equisetum arvense*), field mustard (*Brassica rapa*), poison oak (*Toxicodendron diversilobum)*, California man-root (*Marah fabaceus*), and cheeseweed (*Malva parviflora*).

Riparian woodland is a structurally complex and productive terrestrial community that provides a variety of wildlife species with abundant food, cover, and nesting habitat. Because of the value and scarcity of riparian woodlands, on both a state and region-wide scale, they are considered a sensitive habitat type and monitored by the CDFW. The riparian woodland of Unit 4 is somewhat fragmented by encroaching urbanization including houses, streets, bridges, and landscaping vegetation.

Unit 4. From the crossing of Sir Francis Drake Boulevard and Corte Madera Creek near the upstream end of Unit 4 downstream to the existing Denil fish ladder, Corte Madera Creek has vegetated banks with a gravel bed. Unit 4 has a more natural appearance than Units 2 and 3 characterized by riparian woodland and native material streambed. The stream is incised about 15 to 20 feet and is about 20 to 25 feet wide in the channel bottom.

From the confluence with Ross Creek downstream to a point just upstream of Lagunitas Road Bridge, the stream habitat is characterized by long (30–400 feet) and deep (1.5 feet average depth) lateral scour pool/riffle sequences. This area had more structure (e.g., large wood, root wads) than in downstream areas. This reach is deeply incised throughout with resident-built retaining walls along much of the area. Substrate in pool areas was primarily sand and silt (A.A. Rich 2000) with some gravel and cobble deposited around the Lagunitas Road Bridge (Town of Ross 2009, in USACE 2010).

From about 80 feet upstream of the Lagunitas Road Bridge downstream to the existing wooden Denil fish ladder, riverine habitat was characterized by long (80–90 feet), shallow (1 foot average depth) alternating lateral scour pool/riffle sequences. These riffles were very narrow (3 to 8 feet wide) and shallow. Although shade in this area was abundant, the low stream flows, riprap, and wooden retaining walls resulted in fairly stagnant pool areas. Substrate in the pool areas consisted of sand, silt, and organic detritus. In the riffles, small gravel was the predominant substrate (A.A. Rich 2000).

Within Unit 4, a variety of homeowner-constructed bank stabilization structures occurs on the right bank north of the Lagunitas Road Bridge and at various locations on the left bank south of the Lagunitas Road Bridge. These structures include sand and/or concrete bag retaining walls, plank and railroad tie walls, gabion walls, log walls, and concrete current deflectors. The creek continues to provide habitat elements for migratory waterfowl and fish. Lagunitas Road Bridge and the existing Denil fish ladder are located at the downstream end of Unit 4. This ladder and 4-foot-high timber bulkhead grade control structure were installed in 1971 (Fluvial Geomorphology Consulting 2006) to provide fish passage over the bulkhead which protects two sewer lines that cross below the creek just upstream of this location (Love 2007).

Riverine (concrete-lined channel)

Riverine (concrete lined-channel) habitat in this instance is defined as the USACE Flood Control Channel that extends from the fish ladder downstream to Kent Middle School for about 4,900 feet. The channel has vertical walls with a 33-foot wide concrete streambed with a v-shaped thalweg in the center to concentrate low flows. The channel consists of long, straight sections, several subtle bends, and three tight curves. The upstream 1,900 feet of channel contains 28 pools, evenly spaced at 64 feet that were intended to function as resting pools for migrating steelhead trout and coho salmon. Each pool is 4 feet long and 13 feet wide with a flat bottom 0.1 feet below the channel invert. Due to the channel invert, the sides of the pools are 1.3 feet below the channel bed (Love 2007). From Unit 3 to the downstream end of the Project, the concrete channels restrict establishment of riparian vegetation. Trees remain along the creek outside of the concrete walls, but are often relics of riparian woodland or landscaping trees installed as part of urban development. The riverine vegetation in Units 2 and 3 of the Project area is sparse, often weedy and non-native, and provides little quality habitat or shade to the creek.

Riverine (earthen-lined channel)

Riverine (earthen-lined channel) habitat includes open-water areas and closely associated vegetation that occur within a defined channel of a stream. This definition includes perennial and intermittent stretches of streams and some major dry washes. This habitat type is typically dominated by plants that occur close to, or depend upon, high soil moisture that results from nearby water. Riverine habitat is generally bounded on the landward side by upland, channel bank, or wetland dominated-trees, shrubs, persistent emergent vegetation, emergent mosses, or lichens (USFWS 1979, in USACE 2010).

Riverine (earthen-lined channel) habitat within the Project area is limited to the most downstream section of the Project 450 feet below the Stadium Way pedestrian bridge. This section of channel is part of 2.9 miles of earthen channel that includes the lower portion of Unit 2 and Unit 1. Only the uppermost section of this habitat is within the Project area and includes the top of the stilling basin. This section of channel is periodically dredged.

Coastal Brackish Marsh

Coastal brackish marsh is an intertidal emergent wetland dominated by grasses, forbs, and shrubs that are tolerant to salinities ranging from slight to moderate (0.5 to 18 ppt salt). Approximately 0.232 acre is present within the Project area at the downstream end of Unit 2.

Eucalyptus Woodland

Eucalyptus habitats range from single-species thickets with little or no shrubby understory to scattered trees over a well-developed herbaceous and shrubby understory. Stand structure for this habitat may vary considerably. Up to 0.382 acre of this habitat lies in the Project footprint within Unit 2.

Urban/Developed

Urban/developed habitat includes both landscape vegetation and non-permeable non-vegetated infrastructure that includes buildings, roads, trails, and other infrastructure. Urban/developed describes ornamental plants found in areas of development associated with the Town of Ross Post Office, Town of Ross Police Station, city parks, residential backyards, Kentfield Hospital, and College of Marin. Vegetation associated with landscaping include oleander (*Nerium oleander*), honeysuckle (*Lonicera sp.*), cork oak (*Quercus suber*), rush (*Juncus sp.*), iris (*Iris sp*.), Japanese maple (*Acer sp.*), wisteria (*Wisteria sinensis*), wild plum (*Prunus sp.*), ornamental rose (*Rosa sp.*), and Mexican fan palm (*Washingtonia robusta*). This vegetation is present sporadically along the top of the vertical concrete channel walls, providing some shade to the creek and may serve as limited aquatic food web support.

In spring 2005, Friends of Corte Madera Creek Watershed received funding from Marin Municipal Water District's Willis Evans Watershed Habitat Improvement Grant Program to remove invasive nonnative plants and install 390 native plants at the College of Marin's Ecology Study Area. This area is directly adjacent to Corte Madera Creek. Native plant species planted include California box elder (*Acer negundo*), California buckeye (*Aesculus californica*), coyote brush (*Baccharis pilularis*), sedge (*Carex* *barbarae*), Oregon ash (*Fraxinus latifolia*), toyon (*Heteromeles arbutifolia*), cream bush (ocean-spray) *(Holodiscus discolor)*, rush *(Juncus patens*), black walnut (*Juglans californica*), coast live oak (*Quercus agrifolia*), Oregon oak (*Quercus garryana*), California black oak (*Quercus kelloggii*), valley oak (*Quercus lobata)*, coffee berry (*Rhamnus californica*), California rose *(Rosa californica*), elderberry (*Sambucus mexicanus*), California bay *(Umbellularia californica*), and yarrow (*Yarrow millefolium*).

Wetlands

The term "wetlands" refers to those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

A review of the National Wetland Inventory data for the study area identified several types of wetland features (e.g., emergent freshwater wetland, estuarine and marine wetland) located within the study area (portions of Unit 2) but outside of the Project footprint (USFWS 2009, in USACE 2010). Reconnaissance level surveys conducted in April 2010 (USACE 2010) and again in November 2017 by the PDT support the likely absence of wetland features within the Project footprint because no potential jurisdictional wetlands were observed. Although the upland boundary of the coastal brackish marsh intersects as much as 2.14 acres of the Project footprint that may be a wetland.

A formal jurisdiction determination of waters of the U.S. was performed for the Lagunitas Road Bridge Replacement Project in 2007 (Town of Ross 2009, in USACE 2010). This determination included portions of Corte Madera Creek extending from approximately 17 linear feet upstream of the Lagunitas Road Bridge and 224 linear feet downstream, covering approximately 0.212 acre (9,228 square feet) of jurisdictional non-wetland waters of the U.S. (Town of Ross 2009, in USACE 2010). With the exception of this small area near the Lagunitas Road Bridge, the rest of the study area has not been subject to a formal jurisdictional determination for waters of the U.S.; however, all of Corte Madera Creek within the Project is considered to be waters of the U.S. in this analysis.

4.6.2.3 Wildlife

Wildlife Observed

The overall quality of wildlife habitat within the study area is compromised by the proximity to human disturbance, fragmentation of the riparian woodland, density of nonnative vegetation, and lack of available food and escape cover. However, portions of the study area, especially within the natural creek bed segment (Unit 4), provides some value to wildlife species and may serve valuable habitat functions by offering wildlife species refuge from urban development. Wildlife species that were observed during the April 2010 reconnaissance survey (USACE 2010) included: mallard (*Anas platyrhynchos*), American crow (*Corvus brachyrhynchos*), black phoebe (*Sayornis nigricans*), western scrub jay (*Aphelocoma californica*), Brewer's blackbird (*Euphagus cyanocephalus*), raccoon (*Procyon lotor*), and fox squirrel (*Sciurus niger*).

In addition to wildlife species observed during the April 2010 reconnaissance survey, Friends of Corte Madera Creek Watershed conducted a survey for egrets in April 2005 and a Christmas Bird Count was conducted for the Corte Madera area from 1978 to 2003. Common bird species observed during these surveys include black-crowned night heron (*Nycticorax nycticorax*), snowy egret (*Egretta thula*), great egret (*Ardea alba*), green heron (*Butorides virescens*), great blue heron (*Ardea Herodias*), pied-billed grebe (*Podilymbus podiceps*), western grebe (*Aechmophorus occidentalis*), double-crested cormorant (*Phalacrocorax auritus*), turkey vulture (*Cathartes aura*), Canada goose (*Branta canadensis*), American wigeon (*Anas americana*), green-winged teal (*Anas crecca*), canvasback (*Aythya valisineria*), greater scaup (*Aythya marila*), lesser scaup (*Aythya affinis*), bufflehead (*Bucephala albeola*), common goldeneye

(*Bucephala clangula*), hooded merganser (*Lophodytes cucullatus*), ruddy duck (*Oxyura jamaicensis*), osprey (*Pandion haliaetus*), white-tailed kite (*Elanus leucurus*), northern harrier (*Circus cyaneus*), Cooper's hawk (*Accipiter cooperii*), red-tailed hawk (*Buteo jamaicensis*), red-shouldered hawk (*Buteo lineatus*), American kestrel (*Falco sparverius*), American coot (*Fulica americana*), killdeer (*Charadrius vociferus*), black-necked stilt (*Himantopus mexicanus*), American avocet (*Recurvirostra americana*), greater yellowlegs (*Tringa melanoleuca*), willet (*Catoptrophorus semipalmatus*), least sandpiper (*Calidris minutilla*), ring-billed gull (*Larus delawarensis*), California gull (*Larus californicus*), herring gull (*Larus argentatus*), western gull (*Larus occidentalis*), rock pigeon (*Columbia livia*), band-tailed pigeon (*Columba fasciata*), mourning dove (*Zenaida macroura*), Anna's hummingbird (*Calypte anna*), belted kingfisher (*Ceryle alcyon*), Nuttall's woodpecker (*Picoides nuttallii*), northern flicker (*Colaptes auratus*), common raven (*Corvus corax*), chestnut-backed chickadee (*Poecile rufescens*), oak titmouse (*Baeolophus inornatus*), ruby-crowned kinglet (*Regulus calendula*), hermit thrush (*Catharus guttatus*), American robin (*Turdus migratorius*), northern mockingbird (*Mimus polyglottos*), European starling (*Sturnus vulgaris*), cedar waxwing (*Bombycilla cedrorum*), yellow-rumped warbler (*Dendroica coronata*), California towhee (*Pipilo crissalis*), fox sparrow (*Passerella iliaca*), song sparrow (Melospiza *melodia*), white-crowned sparrow (*Zonotrichia leucophrys*), white-throated sparrow (*Zonotrichia albicollis*), golden-crowned sparrow (*Zonotrichia atricapilla*), dark-eyed junco (*Junco hyemalis*), red-winged blackbird (*Agelaius phoeniceus*), house finch (*Carpodacus mexicanus*), lesser goldfinch (*Carduelis psaltria*), American goldfinch (*Carduelis tristis*), and house sparrow (*Passer domesticus*).

Wildlife Movement

Wildlife movement activities usually fall into one of three movement categories: (1) dispersal (i.e., juvenile animals from natal areas, or individuals extending range distributions); (2) seasonal migration; and (3) local movements related to home range activities (foraging for food or water, defending territories, or searching for mates, breeding areas, or cover). Although a variety of terms have been used to discuss wildlife movement across the landscape, this discussion focuses on travel routes. Travel routes are determined by features on the landscape that provide food, water, and shelter while also connecting areas of suitable habitat.

Riparian and aquatic habitats can provide food, water, and cover for wildlife, and the habitats can be important travel routes. The manner in which these areas are used depends on the species being considered. In the case of terrestrial species, most truly migratory species that use the corridor in the study area are migratory birds. Larger animals, such as deer and coyote, are unlikely to make seasonal or life-cycle-driven movements through the study area beyond occasional dispersal movements of young animals. Steelhead (*Oncorhynchus mykiss*) are an exception and use the aquatic habitats as a travel route from the ocean to spawning sites upstream. Because terrestrial and aquatic species use the study area differently, terrestrial species movements are discussed below and aquatic species are described in section 4.6.2.4.

Amphibians and Reptiles

Several common amphibian and reptile species have the potential to occur with the study area. Riverine habitats with a native streambed and adjacent upland vegetation provide suitable habitat for amphibian and reptiles. Common species with the potential to occur within and adjacent to Unit 4 of Corte Madera Creek include arboreal salamander (*Aneides lugubris*), Californian slender salamander (*Batrachoseps attenuates),* California toad (*anaxyrus boreas halophilus)*, common garter snake (*Thamnophis sirtalis*), gopher snake (*Pituophis catenifer),* southern alligator lizard (*Elgaria multicarinata),* Sierran treefrog (*Pseudacris sierra*), and western fence lizard (*sceloporus occidentalis)*.

Riverine habitats comprised of a concrete-lined channel have a limited amount of suitable amphibian and reptile habitat due the lack of suitable upland vegetation cover. Although uncommon, developed urban areas contain potential suitable habitat for amphibians and reptiles. Suitable habitat depends on the density, structure, and diversity of vegetation cover. Common species with the potential to occur within urban habitat types include arboreal salamander, Californian slender salamander, California toad, common garter snake, southern alligator lizard, Sierran treefrog, and western fence lizard. Riparian woodland vegetation provides potential habitat for California toad, common garter snake, gopher snake, Sierran treefrog, southern alligator lizard, and western fence lizard. Several special-status amphibian and reptile species have a potential to occur within the study area and are discussed in Section 4.6.2.5.

Terrestrial Species Movement

The reconnaissance survey and review of aerial photos of the watershed indicate that, in many locations, urbanization has encroached into the riparian habitat. Modifications of the riparian area include construction of houses and related structures, riparian vegetation removal and landscaping, and channel stabilization work. Channelization, alteration, and encroachment into what were riparian areas in Units 2 and 3 have removed most of the riparian habitat. The result is that areas downstream of Unit 4 would not provide a substantial terrestrial wildlife movement corridor. While urbanization and other actions have also degraded the riparian area in Unit 4, a more natural channel form and riparian vegetation remain. Because it does not connect two habitat areas, Unit 4 is technically not functioning as a wildlife movement travel route; however, the adjacent riparian habitat in Unit 4 does provide for greater amounts of local movement than the surrounding urban landscape, including dispersal movements from areas upstream of Unit 4. As a result, Unit 4 has greater value than the downstream units with respect to local wildlife movement, and likely supports species adapted to survival in urbanized settings.

4.6.2.4 Fisheries

In 2000, A.A. Rich and Associates conducted field surveys of the Corte Madera Creek watershed to describe the flows, instream habitat, and fishes of Corte Madera Creek and its tributaries. These surveys collected the following five fish species from the Corte Madera Creek Watershed: rainbow trout/steelhead (*Oncorphynchus mykiss*), threespine stickleback (*Gasterosteus aculeatus*), California roach (*Hesperoleucus symmetricus*), sculpin (*Cottus sp.*), and Sacramento sucker (*Catostomus occidentalis*) (A.A. Rich 2000). Their report identified the limiting factor for rainbow steelhead production in the Corte Madera Creek watershed was lack of stream flows and high water temperatures, further discussed in Section 4.2.2, depending on the creek and the reach location within the creek.

Historically, Corte Madera Creek supported tidewater goby in the estuary near its mouth, but Leidy (1984) reports that the last time this fish species was collected from this locality was 1958, and believed the tidewater goby is probably extirpated in this area. Corte Madera Creek also historically supported a population of the anadromous salmonid, coho salmon (*Oncorhynchus kisutch*), but the last report of a fisheries survey finding the juveniles of this salmon species in this creek was in 1984 (Leidy 1984; Leidy 2005).

Though not historically present in Corte Madera Creek, another anadromous salmonid, adult chinook salmon (*Oncorhynchus tshawytscha)*, have been reported observed in the creek (Love 2007). Straying of hatchery-origin chinook salmon to small and medium tributaries to the San Francisco Bay estuary increased greatly once CDFW began trucking salmon smolt downstream of the Sacramento-San Joaquin

River Delta and releasing these smolts at Benicia to avoid excessive predation. Chinook salmon do not have a viable self-sustaining population in Corte Madera Creek.

Fish passage and instream habitat in the Corte Madera watershed are described below in context to the needs of the anadromous steelhead trout which still ascend the creek as adults, spawn, and rear juveniles in the headwater tributaries. These same habitat and passage requirements approximate the needs of coho salmon that may utilize Corte Madera Creek, and rearing habitat requirement for the juvenile steelhead are similar to that required for resident rainbow trout in the stream.

Most of the Project area along Corte Madera Creek functions as a migration route that links the saltwater habitat of San Francisco Bay with headwater steelhead spawning and juvenile rearing locations. The quality of the creek as a migration corridor is degraded by the concrete channelization found in Units 2 and 3. The bulkhead and poorly functioning fish ladder at the boundary between Units 3 and 4 further impairs upstream movement. A survey of the watershed identified 48 stream crossings within areas accessible to steelhead (Taylor 2006). Some of these stream crossings were complete barriers to upstream movement (e.g., Phoenix Lake Dam), some were considered partial barriers (e.g., the Denil fish ladder), and others, such as the Lagunitas Road crossing, were not considered an obstruction (Taylor 2006). Overall, Corte Madera Creek's anadromous fish migration corridor downstream of the Lagunitas Road Bridge has been modified and degraded by past human actions, but is still capable of supporting movement of fish under certain flow conditions (Love 2007).

Steelhead migrate from the ocean into coastal freshwater streams and rivers for spawning during high flow events occurring from December through March (Love 2007). Coho salmon typically make their spawning migration up small coastal streams like Corte Madera Creek with the rains of mid-November to mid- December (Moyle 2002). The concrete-lined channel below the existing Denil fish ladder acts as a velocity barrier for spawning salmonids during high-flow times because of limited low-velocity areas and may act as a thermal barrier to smolts as they swim downstream to the ocean (Town of Ross 2009, in USACE 2010). As a result, construction of the concrete-lined flood control channel downstream of the Denil fish ladder severely reduced access to the creek for spawning runs of these species (Friends of Corte Madera Creek 2008). Steelhead have often been observed attempting to pass through the existing Denil fish ladder. The fish ladder was constructed as a temporary solution to provide fish passage over the bulkhead until the Unit 4 project could be constructed. Although repairs to this ladder in 2005 reportedly improved its performance, the ladder still fails to provide suitable passage at higher flows that are more common during the period of migration (Love 2007).

Water flow in Corte Madera Creek is highest in early January and lowest from July through September when flowing water is uncommon and the stream is predominantly dry (Town of Ross 2009, in USACE 2010). The upper 1,900 feet of Unit 3 contains small concrete pools placed at regular intervals along the channel bottom, intended to create resting areas for adult steelhead during their upstream spawning migration (Love 2007). A total of 28 rectangular concrete pools, each spaced roughly 64 feet apart centered along the channel invert. Each pool is 4 feet long and 13 feet wide, with a flat bottom approximately 0.1 foot below the channel invert. Because of the v-shaped channel bottom, the pool bottom along the sides is roughly 1.3 feet below the channel. Minor sediment deposition was observed in nearly all pools during low flows in the spring of 2005 (Love 2007). Because there is no structure or cover for protection, and the poor condition of the fish ladder, the channel also provides an excellent opportunity for birds to prey upon juvenile emigrating steelhead (A.A. Rich 2000).

Beginning in late May and extending through September, water temperatures are high (65 to 75°F) in the concrete-lined flood control channel (A.A. Rich 2000). These water temperatures are stressful to any steelhead or coho salmon in the area during spring and summer months and may be lethal during the smoltification/emigration and rearing life stages of steelhead. Based on 1999 data, adults migrating through the channel after mid-April could encounter stressful thermal conditions that could impact steelhead. Similarly, if the parr to smolt transformation was not complete by the end of April, there may have been thermal stress, beginning in May. For rearing steelhead, summer water temperatures were potentially stressful, beginning in June and extending through September. Healthy water temperatures for steelhead range from 54 to 64˚F for the spawning, incubation, fry emergence, rearing, and adult life stages (A.A. Rich 2000).

Upstream of the concrete-lined flood control channel, water temperatures during fry and juvenile rearing do not approach stressful levels until June. The upstream areas of Corte Madera Creek consist of long lateral scour pools alternating with riffle areas and a riparian canopy which help keep the water temperatures cooler. These are used as habitat by a variety of fish species, although none in great abundance (A.A. Rich 2000).

4.6.2.5 Special-Status Species and Habitats

The following section addresses special-status biological resources observed, reported, or potentially occurring within the study area. These resources include plant, wildlife, fish species, and habitats that have been afforded special-status and/or recognition by federal and state resource agencies, as well as nongovernmental organizations such as the California Native Plant Society (CNPS). The principal reason an individual taxon (species, subspecies, or variety) is given such recognition is the documented or expected decline or limitation of its population size or geographical extent and/or distribution that results in most cases, from habitat loss.

Information on sensitive species and habitats occurring in the vicinity of the Project was obtained from the California Natural Diversity Database (CNDDB) (October 2017) and USFWS (October 2017) for the USGS 7.5-minute San Rafael quadrangle map, and the CNPS Electronic Inventory of Rare and Endangered Vascular Plants of California (CNPS 2017). Figure 4.6-2a presents CNDDB sensitive plant occurrences within a 5-mile radius of the study area. The symbols on the maps represent the center of the area or habitat where the sighting occurred. Figure 4.6-2b presents CNDDB sensitive wildlife occurrences within a 5-mile radius of the study area. Table 4.6.1 provides a list of species derived from the CNDDB, USFWS, and CNPS database queries that evaluates those species identified in the review as having the highest likelihood to occur in the study area (i.e., within the known range or with potential habitat present). Special-status species without the potential to occur in the study area (because suitable habitat is not present or the study area is outside the species range) are not discussed further.

For the purposes of this section, special-status species include the following:

- Species listed, proposed, or candidate species for listing as threatened or endangered by the USFWS pursuant to the ESA of 1969, as amended
- Species listed as rare, threatened, or endangered by the CDFW pursuant to the CESA of 1970, as amended
- Species designated as fully protected under Sections 3511 of the California Fish and Game Code
- Species designated by the CDFW as California species of concern
- Plant species listed as Category 1B and 2 by the CNPS
- Species not currently protected by statute or regulation, but considered rare, threatened, or endangered under CEQA (Section 15380)

Sensitive Plants

The study area is highly developed and most vegetation in this area was introduced as landscape plants and turf grass along city parks. Ruderal habitat and ornamental landscaping dominate along the concrete-lined section of Corte Madera Creek. The general absence of suitable habitat or soil types over the study area in conjunction with the absence of observed sensitive plants cited in CNDDB species accounts indicates that no sensitive plant species are likely to occur within the study area. No special-status plant species were observed during the reconnaissance survey performed in April, 2010. Focused floristic surveys were not conducted in the Project area.

Protected Trees

Native trees in the Project area, as defined by the town of Ross Municipal Code, Chapter 12.24 include any tree with "a single trunk diameter greater than 12 inches" that is "native to those lands that now constitute the town of Ross" (Town of Ross 1968). Native trees found in the town of Ross in the vicinity of the Project area include coast live oak *(Quercus agrifolia)*, California buckeye *(Aesculus californica),* black oak *(Quercus kelloggii)*, coast redwood *(Sequoia sempervirens),* California bay laurel *(Umbellularia californica),* tanoak *(Lithocarpus densiflorus)* and Douglas-fir *(Pseudotsuga menziesii)* (Fluvial Geomorphology Consulting 2006). The health and survival of coast live oak trees is of particular concern in the town due to the threat of Sudden Oak Death, a nonnative fungal pathogen that is responsible for widespread mortality in coast live oaks and tanoaks across Marin County.

Central California Coast Steelhead (*Oncorhynchus mykiss*)

The steelhead inhabiting Corte Madera Creek are Central California Coast steelhead and were federally listed as a threatened species in 1998 (USFWS 2005, in USACE 2010). The Central California Coast steelhead population is a distinct population segment that includes all naturally spawned populations of steelhead in coastal streams and rivers from the Russian River to Aptos Creek (inclusive) and their tributaries; also included are the drainages of San Francisco, Suisun, and San Pablo bays. This evolutionarily significant unit (ESU) includes the fish reported from within Corte Madera Creek. Critical habitat was designated in September 2005 for this species that includes the Project area (NMFS 2005, in USACE 2010).

Adult steelhead migrate upstream into Corte Madera Creek December through March and spawn in the upper watershed during early spring. Migration of steelhead occurs in pulses, coinciding with storm events, resulting in temporary highwater flows (freshet conditions). Studies suggest that these freshet conditions are required to initiate both movement into a lagoon or bay, and upstream into the creeks.

After spawning over clean gravels in the headwaters of Corte Madera Creek, adult steelhead may survive the spawning activity and outmigrate back to the ocean to spawn again in following years. The young steelhead that emerge from the gravels typically spend 1 or 2 years rearing in the freshwater stream before outmigrating to the ocean as smolts about 6-7 inches in length from March into June. They then rear for 2 to 3 years in the ocean before returning to their natal stream to reproduce. Unobstructed upstream passage for adults (and downstream for smolts) plus suitably cold summer/fall rearing temperatures (55 to 60˚F optimal) for the juvenile fish are limiting factors for salmonids in Corte Madera Creek (A.A. Rich 2002).

Corte Madera Creek and its tributaries are designated by NMFS as critical habitat for Central California Coast steelhead. The primary constituent elements of critical habitat for this species are freshwater spawning, rearing, and migration areas; estuarine areas free of obstructions and of sufficient quality to support adult and juvenile rearing; and nearshore and offshore marine areas. The lateral extent of the critical habitat includes the stream channels within the designated stream reaches, and includes a lateral extent as defined by the ordinary high-water line (USACE 1986). This critical habitat designation would be applicable to any in-water portion of the Project.

Central California Coast Coho Salmon (*Oncorhynchus kisutch*)

The Central California Coast coho salmon between Punta Gorda in northern California and the San Lorenzo River in central California are designated by both the State of California and the federal government as endangered since 2005. Corte Madera Creek and its tributaries are designated as critical habitat for this population of coho salmon. Historically present in Corte Madera Creek, they have rarely been observed since 1984 (Leidy 1984; Leidy 2005). Juvenile coho salmon were not found in the Corte Madera Creek watershed survey conducted in 2000 (A.A. Rich 2000).

Adult coho salmon typically enter small coastal watersheds such as Corte Madera Creek about a month earlier than steelhead, ascending the stream with the first rains in mid-November. The adult coho salmon are smaller than Chinook salmon and are approximately the size of steelhead. The passage, spawning, and rearing needs of coho salmon are very similar to steelhead, so focusing on achieving the habitat needs of steelhead would also benefit coho salmon. Adult coho salmon would migrate up Corte Madera Creek from mid-November through mid-January, then spawn into February or early March. As typical of Pacific salmon, the coho die after this single spawning episode. After rearing in the freshwater creek for usually 1 year, the juvenile coho salmon outmigrate during spring high flows in April and May. They then spend 16 to 18 months at sea before returning as adults to spawn in their natal creek (Moyle 2002).

Juvenile coho salmon prefer deeper pools (> 1 meter [m]) with overhead cover and habitat created by large woody debris in the stream channel. The juveniles do best in summer waters of 54-57˚F and do not persist in waters of 72 to 77˚F (Moyle 2002).

Western Pond Turtle (*Actinemys marmorata*)

The western pond turtle is a SSC. This aquatic turtle can be found from the Sierra Nevada foothills to the coast, and in coastal drainages from the Oregon border to Baja California (Stebbins 1985). It occurs in suitable habitat throughout its range in ponds, slow moving streams and rivers, irrigation ditches, and reservoirs that have abundant emergent and/or riparian vegetation. The turtle requires adjacent (i.e., within 650 to 1,300 feet of water) uplands for nesting and egg laying—typically in soils with high clay or silt content on unshaded, south-facing slopes. Additionally, they hibernate in uplands within 984 feet of water in the winter. The closest known occurrence for this species is in Phoenix Lake, a dammed impoundment of Ross Creek which is located roughly 1.5 miles upstream from Lagunitas Road Bridge. Although there is marginal aquatic and basking habitat in the Project area, the absence of deep escape pools and recorded sightings of the species in the creeks contiguous to the Project area suggest that permanent residence by the species in the Project area is unlikely. It is possible, however, that some individuals potentially living in adjacent waters could disperse through the Project area and use the marginal basking habitat that is present.

White-Tailed Kite (*Elanus leucurus*) and Other Raptor Species

The nearest documented occurrence of the white-tailed kite is approximately 9.5 miles east of the Project area, where this species was observed in Wildcat Creek Marsh in the City of Richmond in 1986. No raptors were seen during site visits in the Project area. Due to the absence of nearby foraging habitat (undisturbed grasslands, meadows, farmlands, and emergent wetlands), it is highly unlikely these species would use the Project area for nesting.

Pallid Bat (*Antrozous pallidus*)

The pallid bat is a SSC common in arid regions with rocky outcroppings, particularly near water. This gregarious species usually roosts in small colonies of 20 or more individuals in rock crevices and buildings, but occasionally roosts in caves, mines, rock piles, and tree cavities. They chiefly feed on large prey that is taken on the ground or, perhaps less frequently, in flight within a few feet of the ground or from the surfaces of vegetation. Prey items include scorpions, crickets, centipedes, ground beetles, grasshoppers, cicadas, katydids and they are also known to eat lizards and rodents. One or two babies are born by each breeding female in May or June (Harvey 1999, in USACE 2010). Potential habitat for this species is present within the eucalyptus and other mature trees within the study area. However, most bat species are sensitive to human-generated disturbance. Identification of bats requires special surveys that were not conducted for this analysis. Therefore, the conservative assumption is that this species of sensitive bat is present within the study area.

Hoary Bat (*Lasiurus cinereus*)

The hoary bat, a SSC is large and heavily furred. They spend summer days concealed in the foliage of trees, where they choose a leafy site well covered above, but open from beneath, generally 10 to 15 feet above the ground and usually at the edge of clearing. They prey on moths, bugs, mosquitoes, other insects, and occasionally other bats. Hoary bats bear babies in mid-May, June, or early July (Harvey 1999, in USACE 2010). Potential habitat for this species is present in the eucalyptus and other mature trees in the study area. However, most bat species are sensitive to human-generated disturbance. Identification of bats requires special surveys that were not conducted for this analysis. Therefore, the conservative assumption is that this species of sensitive bat is present within the study area.

Sensitive Natural Communities

Besides special-status plant and animal species, the CNDDB also generates a list of ecologically sensitive and/or threatened habitat types within California. The CNDDB query for the San Rafael quadrangle reported four sensitive natural communities: coastal brackish marsh, coastal terrace prairie, northern coastal salt marsh, and serpentine bunchgrass. Approximately 6.5 acres of coastal brackish marsh is present near the southeast end of the study area in Unit 2. Up to 0.214 acre of this habitat occurs within the Project area although acreage varies for alternatives.

TABLE 4.6-1 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA				
Common Name	**Scientific Name**	**Status[a] Fed/ CA/ other**	**Habitat and Seasonal Distribution in California**	**Likelihood of Occurrence Within the Study Area**
Plants				
Baker's navarretia	*Navarretia leucocephala ssp. bakeri*	--/--/1B.1	Cismontane woodland, meadows and seeps, valley and foothill grassland, lower montane coniferous forest, vernal pools and swales; adobe or alkaline soils. 16–3,117 feet; Blooms April–July.	**Not Likely.** Cismontane woodland, meadows and seeps, valley and foothill grassland, lower montane coniferous forest, vernal pools and swales; adobe or alkaline soils do not occur in the study area.
Bent flowered fiddleneck	*Amsinckia lunaris*	--/--/1B.2	Shaded or sheltered slopes in openings or edges of oak woodland; in herb-rich understory of coast live oak and big-leaf maple, on edges of poison oak thickets, and on steep grassy banks in woodland openings.	**Unlikely.** Cismontane woodland does not occur in Project area. One siting documented in Baltimore Canyon Open Space Preserve.
Congested-headed hayfield tarplant	*Hemizonia congesta ssp. congesta*	--/--/1B.2	Coastal scrub, valley, and foothill grassland. Grassy valleys and hills, often in fallow fields. 82–656 feet; Blooms April–November.	**Not Likely.** Coastal scrub, valley and foothill grassland, grassy valleys and hills, often in fallow fields and coastal prairie do not occur in the study area.
Dark-eyed gilia	*Gilia millefoliata*	--/--/1B.2	Occurs in coastal dunes. Blooms April-June.	**Absent.** Coastal dunes do not occur in the study area.
Diablo helianthella	*Helianthella castanea*	--/--/1B.2	Broadleafed upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, and valley and foothill grassland. 197–4,265 feet; Blooms March–June.	**Not Likely**. Broadleafed upland forest, chaparral, cismontane woodland, coastal scrub, riparian woodland, and valley and foothill grassland do not occur in the study area. This species is unlikely to occur in the study are because Corte Madera Creek has been urbanized by the surrounding residential, commercial and industrial uses.
Hairless popcorn-flower	*Plagiobothrys glaber*	--/--/1A	Coastal salt marshes and alkaline meadows. 16–591 feet; Blooms March–May.	**Absent.** This species is presumed extinct. In addition, suitable habitat does not exist.
Marin checkerbloom	*Sidalcea hickmanii ssp. viridis*	--/--/1B.1	Occurs in chaparral (serpentine).	**Absent.** Serpentine soils do not occur in the study area.
Marin checker lily	*Fritillaria lanceolata var. tristulis*	--/--/1B.1	Coastal bluff scrub, coastal scrub, coastal prairie. Occurrences reported from canyons and riparian areas as well as rock outcrops; often on serpentine. 98–984 feet; Blooms February–May.	**Not Likely.** Coastal bluff scrub, coastal scrub, and coastal prairie do not occur in the study area.

TABLE 4.6-1 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA				
Common Name	**Scientific Name**	**Status[a] Fed/ CA/ other**	**Habitat and Seasonal Distribution in California**	**Likelihood of Occurrence Within the Study Area**
Marin County navarretia	*Navarretia rosulata*	--/--/1B.2	Closed-cone coniferous forest, chaparral. Dry, open rocky places; can occur on serpentine. 656–2,083 feet; Blooms May–July.	**Not Likely.** Closed-cone coniferous forest and chaparral do not occur in the study area.
Marin Knotweed	*Polygonum marinese*	--/--/1B.1	Endemic to California north and east of San Francisco Bay. It is a resident of salt marsh and other wet coastal habitat.	**Not likely.** Known to occur in the coastal brackish approximately 1000 feet downstream of the Project area.
Marin Manzanita	*Arctostaphylos virgata*	--/--/1B.2	Broadleafed upland forest, closed-cone coniferous forest, chaparral, north coast coniferous forest with sandstone or granitic soil. 196–2,296 feet; Blooms January–March.	**Not Likely.** Broadleafed upland forest, closed-cone coniferous forest, chaparral, and cismontane woodlands with sandstone or granitic soil do not occur in the study area.
Marin western (dwarf) flax	*Hesperolinon congestum*	FT/ST/1B.1	Chaparral and valley and foothill grassland habitats in association with serpentinite soils. 16–1,214 feet; Blooms April–July.	**Not Likely.** Chaparral and valley and foothill grassland habitats in association with serpentinite soils do not occur in the study area.
Marsh microseris	*Microseris paludosa*	--/--/1B.2	Closed-cone coniferous forest, cismontane woodland, coastal scrub, valley and foothill grassland. 16–984 feet; Blooms April–June.	**Not Likely.** Closed-cone coniferous forest, cismontane woodland, coastal scrub, valley, and foothill grassland do not occur in the study area.
Minute pocket moss	*Fissidens pauperculus*	--/--/1B.2	North coast coniferous forest. Moss growing on damp soil along the coast. 33–328 feet.	**Not Likely.** North coast coniferous forest does not occur in the study area.
Mt. Tamalpais bristly jewel-flower	*Streptanthus glandulosus ssp. pulchellus*	--/--/1B.2	Broadleafed upland forest, chaparral, cismontane woodlands. 390–6,562 feet; Blooms April–July.	**Not Likely**. Broadleafed upland forest, chaparral, and cismontane woodlands do not occur in the study area.
Mt. Tamalpais manzanita	*Arctostaphylos montana ssp. montana*	--/--/1B.3	Chaparral, valley, and foothill grassland with serpentinite rocky soil. 196–2,490 feet; Blooms February–April.	**Not Likely.** Chaparral, valley and foothill grassland with serpentinite rocky soil do not occur in the study area.
Mt. Tamalpais thistle	*Cirsium hydrophilum var. vaseyi*	--/--/1B.2	Broadleafed upland forest, serpentine seeps and streams in chaparral and woodland. 869–2,034 feet; Blooms May–August.	**Not Likely**. Broadleafed upland forest, serpentine seeps, and streams in chaparral and woodland do not occur in the study area. This species is unlikely to occur in the study are because Corte Madera Creek has been urbanized by the surrounding residential, commercial and industrial uses.
Napa false indigo	*Amorpha californica var. napensis*	--/--/1B.2	Broadleafed upland forest, chaparral, cismontane woodlands. 390–6,562 feet; Blooms April–July.	**Not Likely**. Broadleafed upland forest, chaparral, and cismontane woodlands do not occur in the study area.

TABLE 4.6-1 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA				
Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
North Coast semaphore grass	*Pleuropogon hooverianus*	--/ST/1B.1	Broadleafed upland forest, meadows and seeps, north coast coniferous forest. Wet grassy, usually shady areas, sometimes freshwater marsh; associated with forest environments. 33–3,773 feet; Blooms April–June.	**Absent.** Broadleafed upland forest, meadows and seeps, north coast coniferous forest do not occur in the study area.
Point Reyes salty bird's-beak	*Chloropyron maritimum ssp. palustre*	--/--/1B.2	Occurs in marshes and swamps (coastal salt). Blooms June-October.	**Not Likely.** Freshwater marshes and swamps do not occur in the study area.
Point Reyes checkerbloom	*Sidalcea calycosa ssp. rhizomata*	--/--/1B.2	Freshwater marshes near the coast. 16–246 feet; Blooms April–September.	**Not Likely.** Freshwater marshes near the coast do not occur in the study area.
San Francisco Bay spineflower	*Chorizanthe cuspidate var. cuspidata*	--/--/1B.2	Coastal bluff scrub, coastal dunes, coastal prairie, and coastal scrub with sandy soils. 10–705 feet; Blooms April–July (uncommon in August).	**Not Likely.** Coastal bluff scrub, coastal dunes, coastal prairie, and coastal scrub with sandy soils do not occur in the study area.
Santa Cruz microseris	*Stebbinsoseris decipiens*	--/--/1B.2	Broadleafed upland forest, closed-cone coniferous forest, chaparral, coastal prairie, coastal scrub. Open areas in loose or disturbed soil usually derived from sandstone, shale, or serpentine, on seaward slopes. 33–1,640 feet; Blooms April–May.	**Not Likely.** Broadleafed upland forest, closed-cone coniferous forest, chaparral, coastal prairie, and coastal scrub do not occur in the study area.
Santa Cruz tarplant	*Holocarpha macradenia*	FT/SE/1B.1	Coastal prairie, valley, and foothill grassland. Light, sandy soil or sandy clay; often with nonnatives. 33–853 feet; Blooms June–October.	**Not Likely.** Coastal prairie, valley and foothill grassland with sandy soil do not occur in the study area.
Showy Indian clover (two-fork clover)	*Trifolium amoenum*	FE/--/1B.1	Valley and foothill grassland, coastal bluff scrub. Sometimes on serpentine soil, open sunny sites, swales. Most recently sited on roadside and eroding cliff face. 16–1,837 feet; Blooms April–June.	**Not Likely.** Valley and foothill grassland, coastal bluff scrub with serpentine soil, open sunny sites, and swales do not occur in the study area.
Small groundcone	*Kopsiopsis hookeri*	--/--/2.3	North Coast coniferous forest. 296–2,903 feet; Blooms April–August.	**Not Likely.** North Coast coniferous forest does not occur in the study area.
Tamalpais jewel-flower	*Streptanthus batrachopus*	--/--/1B.3	Closed-cone coniferous forest, chaparral. Talus serpentine outcrops. 1,345–2,133 feet; Blooms April–July	**Not Likely.** Closed-cone coniferous forest, chaparral, and talus serpentine outcrops do not occur in the study area.
Tamalpais lessingia	*Lessingia micradenia var. micradenia*	--/--/1B.2	Chaparral, valley, and foothill grassland. Usually on serpentine, in serpentine grassland or serpentine chaparral. Often on roadsides. 328–1,001 feet; Blooms July–October.	**Not Likely.** Chaparral, valley and foothill grassland with serpentine soil do not occur in the study area.

TABLE 4.6-1 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA				
Common Name	**Scientific Name**	**Status[a] Fed/ CA/ other**	**Habitat and Seasonal Distribution in California**	**Likelihood of Occurrence Within the Study Area**
Tamalpais oak	*Quercus parvula var. tamalpaisensis*	--/--/1B.3	Lower montane coniferous forest. 328–2,461 feet; Blooms March–April.	**Not Likely**. Lower montane coniferous forest does not occur in the study area.
Thin-lobed horkelia	*Horkelia tenuiloba*	--/--/1B.2	Coastal scrub, chaparral. Sandy soils; mesic openings. 148–1,640 feet; Blooms May–July.	**Not Likely.** Coastal scrub, chaparral, and sandy soils with mesic openings do not occur in the study area.
Thurber's reed grass	*Calamagrostis crassiglumis*	--/--/2B.1	Coastal scrub (mesic), Marshes and swamps (freshwater). Blooms in May-Aug.	**Not Likely.** Coastal scrub, marshes and swamps do not occur in the study area.
Tiburon buckwheat	*Eriogonum luteolum var. caninum*	--/--/1B.2	Chaparral, valley and foothill grassland, cismontane woodland, coastal prairie. Serpentine soils; sandy to gravelly sites. 0–2,297 feet; Blooms May–September.	**Not Likely.** Chaparral, valley and foothill grassland, cismontane woodland, and coastal prairie do not occur in the study area.
Tiburon mariposa lily	*Calochortus tiburonensis*	FT/ST/1B.2	Associated with rocky serpentine slopes on the Tiburon Peninsula of Marin County.	**Absent**. Serpentine soils do not occur in the study area.
Tiburon paintbrush	*Castilleja affins ssp. neglecta*	FE/ST/1B.2	Semi-woody perennial species which occurs in serpentine bunchgrass communities on north to west facing slopes on the Tiburon Peninsula of Marin County.	**Absent.** Serpentine soils do not occur in the study area.
Two-fork clover	*Trifolium amoenum*	--/--/1B.1	Occurs in coastal bluff scrub, valley and foothill grassland (sometimes serpentinite). Blooms April –June.	**Not Likely.** Coastal bluff, valley and foothill grassland, and serpentine soils do not occur in the study area.
Western leatherwood	*Dirca occidentalis*	--/--/1B.2	Occurs in broadleafed upland forest, closed-cone coniferous forest, chaparral, cismontane woodland, North Coast coniferous forest, riparian forest, and riparian woodland. Blooms in Jan-Mar (Apr).	**Low.** Suitable habitat occurs in the Project area that could support this species.
White-rayed pentachaeta	*Pentachaeta bellidiflora*	FE/SE/1B.1	Occurs in cismontane woodland and valley and foothill grassland, often in serpentinite. 115–2,034 feet; Blooms March–May.	**Absent.** Serpentine soils do not occur in the study area.
Wooly-headed gilia	*Gilia capitata spp. tomentosa*	--/--/1B.1	Valley and foothill grasslands/ coastal bluff scrub/outcrops. Associated with serpentinite soils.	**Absent.** Serpentine soils do not occur in the study area.
Sensitive Natural Communities				
Coastal brackish marsh	N/A	CDFW Sensitive Habitat		**Known.** 6.5 acres of marginal Coastal Brackish Marsh occurs near the Project area downstream end. A small portion (0.23 acre) is within the Project footprint. This habitat is interspersed with nonnative grasses.

TABLE 4.6-1 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA				
Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Coastal Terrace Prairie	N/A	CDFW Sensitive Habitat		**Absent.** Coastal terrace prairie does not occur in the study area.
Northern Coastal Salt Marsh	N/A	CDFW Sensitive Habitat		**Absent.** Northern salt marsh does not occur in the study area.
Serpentine Bunchgrass	N/A	CDFW Sensitive Habitat		**Absent.** Serpentine bunchgrass does not occur in the study area.
Invertebrates				
Marin Hesperian	*Vespericola marinensis*	--/--/--	Frequent moist areas in coastal brushfield and chaparral vegetation in Marin County.	**Not Likely.** Suitable habitat does not occur in the study area.
Mimic tryonia	*Tryonia imitator*	--/--/--	Found in brackish salt marshes.	**Not Likely.** Suitable habitat does not occur in the study area.
Mission blue butterfly	*Plebejus* [*Icaricia*] *icarioides missionensis*	FE/--/--	The adults feed on hairy false goldenaster (*Heterotheca villosa*), blue dicks (*Dichelostemma capitatum*), and seaside buckwheat (*Eriogonum latifolium*). They do not wander far from the three species of lupine that are the larval food plant: silver lupine (*Lupinus albifrons*), summer lupine (*L. formosus*), and many-colored lupine (*L. versicolor*). Females lay eggs throughout the mating flight. The eggs are laid singly on leaves, stems, flowers, and seedpods of lupine species.	**Absent.** The study area does not support a substantial stand of lupine to support this species.
Myrtle's silverspot butterfly	*Speyeria zerene myrtleae*	FE/--/--	Occurs in grassland habitats around the northern Bay Area. The larval host plant is hookspur violet (*Viola adunca*). Adults feed on nectar from flowers including hairy gumweed, coastal sand verbena (*Abronia latifolia*), mints (or monardella) (*Monardella* spp.), bull thistle (*Cirsium vulgare*), and seaside fleabane (*Erigeron glaucus*).	**Absent**. There are no recorded occurrences of this species within 5 miles of the study area. The study area does not support the suitable host plants for this species, Known populations occur within western Marin County.
Obscure bumble bee	*Bombus caliginosus*	--/--/--	Occurs in Mediterranean California and the Pacific Coast, from southern California to southern British Columbia, with scattered records from the east side of California's Central Valley and inhabits open grassy coastal prairies and Coast Range meadows. Nesting occurs underground as well as above ground in abandoned bird nests.	**Absent**. There are no recorded occurrences of this species within 5 miles of the study area. Coastal terrace prairie does not occur in the study area.
Opler's longhorn moth	*Adela oplerella*	--/--/--	Small moth that inhabits serpentine habitats, primarily serpentine bunchgrass grassland.	**Not Likely.** Suitable habitat does not occur in the study area.

TABLE 4.6-1 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA				
Common Name	**Scientific Name**	**Status[a] Fed/ CA/ other**	**Habitat and Seasonal Distribution in California**	**Likelihood of Occurrence Within the Study Area**
Robust walker	*Pomatiopsis binneyi*	--/--/--	The Robust walker is a riparian associate semi-aquatic snail with very specialized habitat. It is found in perennial seeps and rivulets, where it is protected from seasonal flushing in the rainy season; also on shallow mud banks and marsh seepages leading into shallow streams.	**Not Likely.** Suitable habitat does not occur in the study area.
San Bruno elfin butterfly	*Callophyrs [Incisalia] mossii bayensis*	FE/--/--	Endemic to the coastal mountains near San Francisco Bay. Eggs are laid in small clusters or strings on the upper or lower surface of broadleaf stonecrop (*Sedum spathulifolium*). The adult food plants have not been fully determined but Montara Mountain colonies are suspected to use Montara manzanita (*Arctostaphylos montaraensis*) and California huckleberry (*Vaccinium ovatum*).	**Absent.** The San Bruno elfin is found in the fog-belt of steep north facing slopes that receive little direct sunlight. It lives near prolific growths of the larval food plant, stonecrop, which is a low growing succulent. The study area does not support suitable larval and adult host plants.
San Francisco Bay Area leaf-cutter bee	*Trachusa gummifera*	--/--/--	Found in San Francisco, Marin, and San Mateo Counties.	**Not Likely**. Suitable habitat does not occur in the study area.
western bumble bee	*Bombus occidentalis*	--/--/--	Inhabits a wide variety of natural, agricultural, urban, and rural habitats, although species richness tends to peak in flower-rich meadows of forests and subalpine zones.	**Not Likely.** Suitable habitat does not occur in the study area.
Fish				
Coho salmon-Central California Coast ESU (Critical habitat)	*Oncorhynchus kisutch*	FE/SE/--	Spawning in accessible coastal streams, generally in areas with complex instream habitat, heavy forest cover, and high-quality water. Juveniles rear in these areas for up to 2 years before migrating to the ocean. The endangered status applies to coho salmon south of Punta Gorda.	**Not likely.** Although historically present in the Corte Madera Creek watershed, this species is assumed to be extirpated from the creek and has not been observed in the creek since 1981 (Leidy 2007, in USACE 2010).
Delta smelt	*Hypomesus transpacificus*	FT/SE/--	Endemic to the Sacramento-San Joaquin Delta. Adults spawn in freshwater in the upper Delta. The rest of the year, they reside primarily in the interface between salt and freshwater of the Sacramento-San Joaquin Delta at salinities less than 2 parts per million.	**Absent.** The study area is outside the known range of this species.
Longfin smelt	*Spirinchus thaleichthys*	SC/ST/--	Scattered populations found in estuaries, rivers, and lakes from California to Alaska.	**Absent.** Suitable habitat for this species does not occur in the study area. Instream work (Unit 4) in Corte Madera Creek will occur outside of this species suitable habitat.

TABLE 4.6-1 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA				
Common Name	**Scientific Name**	**Status[a] Fed/ CA/ other**	**Habitat and Seasonal Distribution in California**	**Likelihood of Occurrence Within the Study Area**
Steelhead- Central California Coastal ESU (Critical habitat)	*Oncorhynchus mykiss*	FT/--/--	Spawns in cool, clear, well-oxygenated streams. Juveniles remain in fresh water for one or more years before migrating to the ocean.	**Known**. This species is known to occur in Corte Madera Creek. The study area occurs within designated critical habitat for this species.
Steelhead- Central Valley ESU	*Oncorhynchus mykiss*	FT/--/--	Spawns in cool, clear, well-oxygenated streams. Juveniles remain in fresh water for one or more years before migrating to the ocean.	**Not Likely.** This steelhead population spawns in the Sacramento and San Joaquin rivers and their tributaries.
Tidewater goby	*Eucyclogobius newberryi*	FE/SSC/--	Brackish water habitats along coast, fairly still but not stagnant water, and high oxygen levels.	**Not likely**. This species was last collected in a tidal lagoon near the mouth of Corte Madera Creek in 1958 and is likely extirpated from this locality (Leidy 1984). However, instream work (Unit 4) in Corte Madera Creek will occur approximately 1 mile upstream of this tidal lagoon.
Amphibians				
California giant salamander	*Dicamptodon ensatus*	--/SSC/--	Year-round residents of north-central California, from southern Santa Cruz Co.to extreme southern Mendocino and Lake Cos. They occur up to 2,160 m (6,500 feet) primarily in humid coastal forests, especially in Douglas fir, redwood, red fir, and montane and valley-foothill riparian habitats. They live in or near streams in damp forests, and California giant salamanders tend to be common where they occur. Aquatic adults and larvae are found in cool, rocky streams and occasionally in lakes and ponds.	**Not Likely.** Suitable habitat does not occur in the study area. Humid coastal forests, especially in Douglas fir, redwood, red fir, and montane and valley-foothill riparian habitats are not found in the study area.
California red-legged frog	*Rana aurora draytonii*	FT/SSC/--	Permanent and semi-permanent freshwater habitats, such as creeks and cold-water ponds, with emergent and submergent vegetation.	**Not likely.** Suitable habitat is present in the study area, but it is not hydrologically connected to a known population of California red-legged frogs. Red-legged frog is presumed to be absent for eastern Marin County (District 2017).
Foothill Yellow-Legged Frog	*Rana boylii*	--/SSC/--	Found in or near rocky streams in a variety of habitats, including valley-foothill hardwood, valley-foothill chaparral, and wet meadow types.	**Not Likely.** Marginal habitat is present in the study area, but it is not hydrologically connected to a known population of foothill yellow-legged frogs.

TABLE 4.6-1 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA				
Common Name	**Scientific Name**	**Status[a] Fed/ CA/ other**	**Habitat and Seasonal Distribution in California**	**Likelihood of Occurrence Within the Study Area**
California tiger salamander	*Ambystoma californiense*	FT/SSC/--	Occurs in grasslands and open oak woodland that provide suitable aestivation (i.e., summer retreats) and/or breeding habitat in close proximity to vernal pools, seasonal wetlands, or artificial impoundments (e.g., stock ponds).	**Absent.** Suitable habitat does not occur in the study area.
Reptiles				
Western pond turtle	*Actinemys marmorata*	--/SSC/--	Typically inhabit ponds, slow-moving streams and rivers, irrigation ditches, and reservoirs with abundant emergent and/or riparian vegetation.	**Low.** Suitable habitat for this species occurs in the study area. There are no CNDDB records from for this species in the vicinity of the study area.
Birds				
Burrowing owl	*Athene cunicularia*	--/SSC/--	Found in swamp lands, both fresh and salt; lowland meadows irrigated alfalfa field. Tule patches/tall grass needed for nesting/daytime seclusion. Nests on dry ground in depression concealed vegetation.	**Low.** Suitable open habitat is fragmented in the Project area due to roads and dense development.
California black rail	*Laterallus jamaicensis coturniculus*	--/ST/FP	Inhabits tidal salt marshes bordering larger bays, or other freshwater and brackish marshes, at low elevations.	**Not Likely.** Small mats of pickleweed adjacent to brackish wetlands are too limited in extent and too highly disturbed to provide suitable habitat. Tidal zone is very narrow.
California clapper rail	*Rallus longirostris obsoletus*	FE/SE/FP	Restricted to salt marshes and tidal sloughs; usually associated with heavy growth of pickleweed; feeds on mollusks removed from the mud in sloughs.	**Absent.** This species has not been recorded on the Corte Madera Ecological Reserve, approximately 1 mile east of Corte Madera. Salt marsh with pickleweed does not occur in the study area.
California Ridgway's rail	*Rallus obsoletus obsoletus*	FE/SE/FP	Inhabits tidal salt marshes of the greater San Francisco Bay, although some individuals use brackish marshes during the spring breeding season. It formerly occurred at Humboldt Bay in Humboldt County, Elkhorn Slough in Monterey County, and Morro Bay in San Luis Obispo County.	**Not Likely.** Brackish wetlands are too limited in extent and too highly disturbed to provide suitable habitat. Tidal zone is very narrow.
California least tern (nesting colony)	*Sternula antillarum browni*	FE/ST/FP	Nests on sandy, upper ocean beaches, and occasionally uses mudflats; forages on adjacent surf line, estuaries, or the open ocean.	**Absent.** Suitable habitat does not occur in the study area.

TABLE 4.6-1 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA				
Common Name	Scientific Name	Status[a] Fed/ CA/ other	Habitat and Seasonal Distribution in California	Likelihood of Occurrence Within the Study Area
Great blue heron	*Ardea herodias*	--/S/--	Colonial nester in tall trees, cliffsides, and sequestered spots on marshes. Common over most of North America.	**Moderate**. Trees within the study area provide potential roosting habitat for this species and may forage in slow moving sections of the creek.
Marbled murrelet (Critical habitat)	*Brachyramphus marmoratus*	FT/SE/--	Mature, coastal coniferous forests for nesting; nearby coastal water for foraging; nests in conifer stands greater than 150 years old and may be found up to 35 miles inland; winters on subtidal and pelagic waters often well offshore.	**Absent.** Suitable habitat not present in the study area.
Northern spotted owl	*Strix occidentalis caurina*	FT/SSC/--	Northern spotted owls generally inhabit older forested habitats because they contain the structural characteristics required for nesting, roosting, and foraging. Specifically, northern spotted owls require a multi-layered, multi-species canopy with moderate to high canopy closure. The stands typically contain a high incidence of trees with large cavities and other types of deformities; large snags (standing dead trees); an abundance of large, dead wood on the ground; and open space within and below the upper canopy for spotted owls to fly (USFWS 2010).	**Absent.** Suitable habitat does not occur in the study area.
San Pablo song sparrow	*Melospiza melodia samuelis*	--/SSC/--	Its year-round range is confined to tidal and muted tidal salt marshes fringing San Pablo Bay in the northern reaches of the San Francisco Bay estuary (Grinnell and Miller 1944, PRBO unpublished data). Abundance varies considerably by site, with highest densities at the Petaluma River mouth (Shuford 2008).	**Absent.** Suitable habitat does not occur in the study area.
Short –tailed albatross	*Diomedia albatrus*	FE/SSC/--	The species occurs in waters throughout the North Pacific, primarily along the east coast of Japan and Russia, in the Gulf of Alaska, along the Aleutian Islands and in the Gulf of Alaska.	**Absent.** Suitable habitat does not occur in the study area.
Western snowy plover (nesting)	*Charadrius alexandrinus nivosus*	FT/SSC/--	Coastal beaches above the normal high tide line in flat, open areas with sandy or saline substrates; vegetation and driftwood are usually sparse or absent.	**Absent.** Suitable habitat does not occur in the study area.
White tailed Kite	*Elanus leucurus*	FP	Found in lowlands of California west of Sierra Nevada range. Common in the Central Valley and along the entire California coast.	**Low.** Due to the absence of nearby foraging habitat, it is highly unlikely these species would use the Project area for nesting.

TABLE 4.6-1 SPECIAL-STATUS SPECIES POTENTIALLY OCCURRING WITHIN THE STUDY AREA				
Common Name	**Scientific Name**	**Status[a] Fed/ CA/ other**	**Habitat and Seasonal Distribution in California**	**Likelihood of Occurrence Within the Study Area**
Mammals				
Hoary bat	*Lasiurus cinereus*	--/SSC/--	Roosts in foliage of trees.	**Moderate.** Trees within the study area provide potential roosting habitat for this species.
Townsend's big-eared bat	*Corynorhinus townsendii*	--/ST/--	Found in a variety of locations that range from coniferous forests and woodlands, deciduous riparian woodland, semi-desert and montane shrublands. Within these communities, they are specifically associated with limestone caves, mines, lava tubes, and buildings.	**Not Likely.** Suitable habitat (caves, mines) does not occur in the study area.
Pallid bat	*Anterozous pallidus*	--/SSC/--	Found in deserts, grasslands, shrub lands, woodlands and forests. Roosts in rock crevices, buildings, and bridges in arid regions.	**Moderate**. Trees within the study area provide potential roosting habitat for this species during migration. This species does not breed within the study area.
Salt marsh harvest mouse	*Reithrodontomys raviventris*	FE/SE/FP	Salt marshes with a dense plant cover or pickleweed or fat hen; adjacent to an upland site.	**Not Likely.** This species has been recorded in the Corte Madera Ecological Reserve, approximately 1 mile east of Corte Madera, however no suitable habitat is found within the Project. The mice recorded on the north bank of the mouth of Corte Madera Creek are from specimens collected in the 1940s and 1960s when upland refugia was more abundant. This species is likely extirpated from the northern shoreline of Corte Madera Creek due to the lack of adjacent upland habitat.

SOURCE: California Department of Fish and Wildlife (CDFW) 2017 (CNDDB), October 2017 for the U.S. Geological Survey's (USGS) 7.5-minute San Rafael quadrangle.
California Native Plant Society (CNPS), October 2017 for the U.S. Geological Survey's (USGS) 7.5-minute San Rafael quadrangle.
U.S. Fish and Wildlife Service (USFWS), October 2017 for Marin County and Project area coordinates.

a. Status:

Federal

FE Federally listed as endangered
FT Federally listed as threatened
FPD Federally proposed for delisting
S Federally sensitive
SC National Marine Fisheries Service or U.S. Fish and Wildlife Service designated species of concern. Species of Concern status does not carry any procedural or substantive protections under the ESA.

State

SE	State-listed as endangered
ST	State-listed as threatened
SPD	State-proposed for delisting
S	State sensitive
SR	State rare
SSC	California Department of Fish and Wildlife designated species of special concern

Other

FP	California Department of Fish and Wildlife designated fully protected (a permit will be issued for any take of a fully protected species)
CWL	California Department of Fish and Wildlife designated “California Watch List”
SLC	California Native Plant Society (CNPS) ranking species of local concern
1B	California Native Plant Society (CNPS) Ranking. Defined as plants that are rare, threatened, or endangered in California and elsewhere.
2	California Native Plant Society (CNPS) Ranking. Defined as plants that are rare, threatened, or endangered in California, but more common elsewhere.
3	California Native Plant Society (CNPS) Ranking. Plants about which more information is needed - a review list.

Recent modifications to the CNPS ranking system include the addition of a new threat code extension to listed species (e.g., List 1B.1, List 2.2 etc.). A threat code extension of x.1 signifies that a species is seriously endangered in California; x.2 is fairly endangered in California; and x.3 is not very endangered in California.

b. Likelihood of occurrence evaluations:

A rating of **“Known”** indicates that the species/natural community type has been observed in the study area.

species is expected to occur in the study area.

A rating of **“Moderate”** indicates that it is not known if the species is present, but suitable habitat exists in the study area.

A rating of **“Low”** indicates that species was not found during biological surveys conducted to date on the Study area and may not be expected given the species’ known regional distribution or the quality of habitats located in the study area.

A rating of **“Not Likely”** indicates that the taxon would not be expected to occur within the study area because the study area does not include the known range or does not support suitable habitat.

A rating of **“Absent”** indicates that no recorded occurrences or suitable habitat(s) occur within the study area to support this species. These species are not discussed further in this document.

4.6.3 Environmental Consequences

4.6.3.1 Avoidance and Minimization Measures

The following AMMs would be implemented as part of the Project design and would avoid or minimize adverse effects associated with biological resources:

- **AMM-BIO-1: Conduct Preconstruction Surveys -** Pre-construction biological clearance surveys shall be performed to minimize impacts on special-status plants or wildlife species and nesting migratory birds excluding salmonids. Minimizing action would be taken if species are found, as described below. Pre-construction surveys would include the following:

  Nesting Migratory Birds

  - To the extent feasible, tree removal will take place outside the migratory bird and raptor nesting period (February 1 through August 31 for most birds).
  - If tree removal or construction must occur during the nesting season, a qualified wildlife biologist will conduct pre-maintenance surveys for raptors and nesting birds within suitable habitat within 300 feet of the worksite. The surveys should be conducted within one week before initiation of activities.
  - If no active nests are detected during surveys, activities may proceed. If active nests are identified, non-disturbance buffers shall be established at a distance sufficient to minimize disturbance based on the nest location, topography, cover and species' tolerance to disturbance. Buffer size shall be determined in cooperation with the CDFW.
  - If construction work is resulting in nest disturbance, work shall cease and CDFW shall be contacted.

  Western Pond Turtle

  - A qualified biologist shall survey the work site no more than 72 hours before the onset of ground disturbing activities for signs of western pond turtles and/or western pond turtle nesting activity (i.e., recently excavated nests, nest plugs) or nest depredation (partially to fully excavated nest chambers, nest plugs, scattered egg shell remains, egg shell fragments).
  - Preconstruction surveys to detect western pond turtles should focus on suitable aerial and aquatic basking habitat such as logs, branches, root wads, and riprap, as well as the shoreline and adjacent warm, shallow waters where pond turtles may be present below the water surface beneath algal mats or other protective cover.
  - Preconstruction surveys to detect western pond turtle nesting activity should be concentrated within suitable aquatic habitat and should focus on areas along south- or west-facing slopes with bare hard-packed clay or silt soils or a sparse vegetation of short grasses or forbs.
  - If western pond turtles or their nesting sites are found, the biologist shall contact the CDFW to determine whether relocation and/or exclusion buffers and nest enclosures are appropriate.
  - If the CDFW approves moving the animal, the biologist shall be allowed sufficient time to move the western pond turtle(s) from the work site before work activities begin following guidelines according to USFWS.

  Pallid Bat and Hoary Bat

  - Prior to construction, a qualified biologist shall survey the trees within the project area and the underside of bridge structures for evidence of bat roosts (e.g., bat guano). If bat roosts are found in trees during pre-construction surveys the roosts shall be flagged and avoided during construction.

- If roosts are found in trees or under existing bridges, they shall be removed in April, September, or October in order to avoid the hibernation and maternity seasons. Appropriate exclusion methods shall be used, as needed, during habitat removal.
- If bats must be excluded, a qualified biologist shall work with CDFW to determine appropriate exclusion methods based upon the species found and their location within the project area.
- If bats are found onsite and the proposed construction cannot be altered to avoid the species, the USACE and sponsor shall work with a qualified biologist and CDFW to determine additional mitigation measures based upon the species present and their specific ecological preferences/requirements.
- Pre-construction surveys for roosting bats shall be conducted concurrent with those for land birds. If surveys occur during the daytime, the biologist shall look for presence of bat droppings at likely roost sites (under bridges and trees (in layers of bark, woodpecker holes, and hollow branches). The droppings are black and small, about 4 - 8 millimeters long. Bat droppings crumble into powder when crushed, as they consist of insect remains (in contrast, mouse droppings are sticky when fresh and hard when old). During evening hours bats may be confirmed visually at dusk although species identification cannot be ascertained without the use of sonar recordings and specialized software. If no signs of bats are detected during the pre-construction surveys, avoidance has been achieved and maintenance activities can proceed.

- **AMM-BIO-2: Seasonal Restrictions -** Implement wet-season restrictions on construction for wildlife protection. Construction activities in or adjacent to the channel of Corte Madera Creek shall be conducted during the dry season (June 15 through October 15).
- **AMM-BIO-3: Minimize Disturbance to Existing Vegetation -** Disturbance to existing vegetation shall be limited to the project area. Existing ingress and egress points shall be used, and staging and material storage areas shall be confined to the paved areas as much as possible.
- **AMM-BIO-4: Minimize Footprint -** The amount of disturbance within the project area shall be reduced to the absolute minimum necessary to accomplish the proposed project.
    - Topsoil from the creek banks shall be removed, stockpiled, covered, and encircled with silt fencing to prevent loss or movement of the soil into Corte Madera Creek. All disturbed soils shall undergo erosion control treatment prior to the rainy season and after construction is terminated.
    - Treatment typically includes temporary seeding with native species and sterile straw mulch. All topsoil shall be replaced in a manner as close as possible to pre-disturbance conditions.
    - All construction-related holes in the ground will be covered to prevent entrapment of California red-legged frogs or foothill yellow-legged frogs.
- **AMM-BIO-5: Site Restoration** - Exposed soil will be stabilized to prevent erosion and revegetated with native vegetation as soon as feasible after construction is complete.
    - Revegetation will occur at a ratio of at least 1.5:1 to account for initial mortality of plantings. Revegetation will occur with native species appropriate for site conditions.
    - If soil moisture is deficient, new vegetation will be supplied with supplemental water until vegetation is firmly established.

- Erosion control fabric, hydromulch, or other mechanisms will be applied as appropriate to provide protection to seeds, hold them in place, and help retain moisture.
- Revegetation shall be regularly monitored for survival for at least five years or until adequate ground cover and survival is achieved. Monitoring for colonization of invasive species will occur, and eradicated if established.

- **AMM-BIO-6: Biological Construction Monitoring for non-Salmonids -** Biological monitors shall be assigned to the project when working in sensitive areas. The monitors shall be responsible for ensuring that impacts on special-status species, native vegetation, wildlife habitat, or unique resources shall be avoided to the fullest extent possible. Where appropriate, monitors shall flag the boundaries of areas where activities need to be restricted to protect native plants and wildlife or special-status species. These restricted areas shall be monitored to ensure their protection during construction. Monitoring would include the following:

Northwestern pond turtle

- Each day, before maintenance activities begin, a qualified biologist shall make a quick survey for turtles, paying close attention to areas where turtles or burrows had been noted during the pre-construction survey. If turtles are observed, the biologist shall use any means necessary to avoid "take" of these species, including hand removal, installation of fencing, or other measures. The biologist shall assess the likelihood of project impacts to these species and coordinate findings with the USFWS and CDFW to ensure that appropriate protective measures are applied.
- At any time during maintenance activities, if a northwestern pond turtle is observed by the ECC, maintenance crew, or other knowledgeable persons, maintenance activities shall stop to avert the avoidable take of these species.

Ridgway's rail and California black rail

- The following measures apply to all sites in or near salt or brackish marshland and will also serve to protect other tidal-marsh dependent species such as saltmarsh common yellowthroat and San Pablo song sparrow.
- When working within 250 feet of salt or brackish marshland during the period February 1 through August 31, presence for either rail species shall be assumed.
- When possible, activities shall be scheduled to occur between September 1 and January 31 to avoid the rail breeding season.
- Work shall be scheduled to occur between 8:00 AM and 4:00 PM in order to avoid early morning and late afternoon/evening hours when rails are most active.
- Work shall be scheduled to avoid periods of high tides, as the high water reduces the amount of refugial habitat for the rails. No work shall occur near salt marsh habitats within two hours before or after predicted extreme high tides of 6.5 feet above the National Geodetic Vertical Datum (NGVD), as measured at the Golden Gate Bridge, and adjusted to the timing of local extreme high tide events at the project sites.
- Activities shall proceed as quickly as possible to reduce disturbance from noise, dust, etc.
- Removal or disturbance of emergent tidal marsh vegetation shall be avoided, and removal or disturbance of vegetation at the tidal marsh/upland interface shall be avoided to provide a buffer of refugial habitat within as wide a swath as possible (3 meter minimum) from the Mean Higher High Water line. If removal is necessary, the work shall be scheduled outside of the breeding season (February 1 - August 31); all vegetation shall be salvaged and retained for replacement after work is completed.

Raptors and Wading Birds

- Several of the sites are adjacent to suitable habitat for raptors and wading birds. Although none of these species are listed, they are protected by the Migratory Bird Treaty Act, and impacts to them shall be minimized.
- If work is scheduled to occur between August 31 and January 31 after the nesting season, then avoidance has been achieved and work can proceed; however, to protect late- or second-nesters, a qualified biologist shall walk the site before work occurs to check for nests and presence of birds at the work site.
- If work in the riparian zone or mowing on levees will occur before July 31, the ECC shall conduct a survey for nesting birds within one week prior to the proposed vegetation removal and/or maintenance activities and ensure no nesting birds will be impacted by the project. Work can proceed if surveys determine that nesting birds will not be impacted or if no nesting birds are observed. If active nests are found, the ECC shall postpone maintenance activities for that site until the young have left the nest and will no longer be impacted by the project.
- During nesting season, (February 1 - September 1), a qualified biologist shall walk the area of proposed activity each day before maintenance activities begin to determine presence of nesting raptors and wading birds. If none are observed, avoidance can be assumed and work can proceed.

Landbirds

- Many of the project sites are along riparian corridors that potentially support many passerine and non-passerine birds, some of which are seasonal and some of which are year-round residents. These birds are known to occur along Corte Madera Creek, particularly within Unit 4.
- Any removal of trees or shrubs, or maintenance activities in the vicinity of active bird nests, could result in nest abandonment, nest failure, or premature fledging. Destruction or disturbance of active nests violates the federal Migratory Bird Treaty Act and CDFW.
- Avoidance will be achieved if construction activities are scheduled for August 1 to January 31 to avoid the nesting season (February 1 to July 31); however, to protect late- or second-nesters, a qualified biologist shall walk the site before work occurs to check for nests and presence of birds at the work site.
- If construction activities are scheduled during the nesting season, then the following AMMs should be followed:
    - The removal of any trees or shrubs shall occur in August, after the nesting season. If removal of trees or shrubs occurs, or maintenance begins between February 1 and July 31 (includes nesting season for passerine or non-passerine birds, and raptors), a nesting bird survey shall be performed within 14 days prior to the removal or disturbance of potential nesting trees or shrubs.
    - All trees with active nests shall be flagged and a non-disturbance buffer zone shall be established around the nesting tree, or the site shall be avoided until it has been determined that the young have fledged. Buffer zones typically range between 50-90 feet for passerines and non-passerine land birds. Active nests shall be monitored to determine when the young have fledged and are feeding on their own.
    - In addition to surveying trees and shrubs for nesting birds, surveys shall be conducted for ground nesting birds by walking narrow transects through the

grassland adjacent to the project site within 14 days prior to the commencement of project related activities.
- A qualified biologist shall be present at the commencement of construction activities to ensure that nesting birds and sensitive bird species have not inhabited the project site during the window following pre-construction surveys. The biologist shall also review all staging areas to ensure nesting and special-status birds are not present.

Roosting bats

- If bats were detected during the pre-construction survey, and removal of trees, shrubs, or dense ivy is scheduled to occur during bat breeding season, a qualified biologist shall conduct a bat presence-absence survey. If bats are detected, work should be re-scheduled to occur within these dates: March 1 - April 15 and/or September 1 - October 15 in order to avoid the breeding season.
- Removal of vegetation where bats have been known to roost shall follow the two- phased removal system: Day 1, in the afternoon, limbs and branches are removed by a tree cutter using chainsaws only. Limbs with cavities, crevices, or deep bark fissures will be avoided, and only branches or limbs with those features will be removed. Day 2: the entire tree will be removed.

- **AMM-BIO-7: Environmental Awareness Training -** A Worker Environmental Awareness Program shall be prepared, and all construction crews and contractors shall be required to participate in Worker Environmental Awareness Program training prior to starting work on the project. The Worker Environmental Awareness Program training shall include a review of the special-status species and other sensitive resources that could exist in the project area, the locations of sensitive biological resources as well as their legal status and protections, and measures to be implemented for avoidance of these sensitive resources. A record of all personnel trained shall be maintained. Species-specific training would include:

  - A qualified biologist shall conduct a training session for all construction personnel. At minimum, the training shall include a description of the western pond turtle and its aquatic and upland nesting habitat, the general measures to implement to avoid and minimize impacts to habitat in the project area as they relate to the western pond turtle, and the boundaries within which construction activities can take place.
  - Training sessions shall be given to all workers during bat breeding season to inform them of protective measures, details about the two-phase tree removal protocol, and inform them of when work needs to be stopped and appropriate officials informed of species presence if bats are identified during pre-construction surveys.

- **AMM-BIO-8: Signing -** Interpretive signs prohibiting access to areas that are closed to the public, and indicating the importance of protection of sensitive biological resources, will be placed in key locations, such as along trails near sensitive habitats.

  - A qualified biologist shall determine the appropriate buffer size, in consultation with CDFW, and delineate the buffer using Environmentally Sensitive Area fencing, pin flags, and yellow caution-tape. The project area shall be delineated with high-visibility temporary orange-colored fence at least 4 feet in height, flagging, or other barriers.
  - Signs shall be posted that clearly state that construction personnel and equipment will not move outside of the marked area. The fencing shall be inspected by a qualified biologist and

maintained daily until project completion. The fencing shall be removed only when all construction equipment is removed from the site. No construction activities shall take place outside the delineated project area.

- Buffers shall be established around active migratory bird nests and marked by a qualified biologist using ESA fencing, pin flags, and/or yellow caution tape. The size of the buffer may vary for different species and shall be determined in coordination with CDFW. A buffer zone shall be maintained around all active nest sites until the young have fledged and are foraging independently. In the event that an active nest is found after the completion of preconstruction surveys and after construction begins, all construction activities shall be stopped until a qualified biologist has evaluated the nest and erected the appropriate buffer around it.

- **AMM-BIO-9: Cleaning of Equipment and Vehicles -** Equipment will be cleaned of any sediment or vegetation before transfer and use between sites to prevent spreading pathogens or exotic/invasive species. Vehicle and equipment washing will occur on-site as needed. No runoff from vehicle or equipment washing will be permitted to enter waters of the State without adequate treatment.
- **AMM-BIO-10: Project Site Maintenance -** Project sites will be maintained trash-free, and food refuse will be contained in secure bins and removed daily.
- **AMM-BIO-11: Vehicle Staging and Fueling** - Vehicle staging, cleaning, maintenance, refueling, and fuel storage will be located 150 feet or more from Corte Madera Creek. All fueling shall be equipped with secondary containment and avoid a direct connection to underlying soil, surface water, and storm drains.
- **AMM-BIO-12: Vehicle and Equipment Maintenance -** All equipment will be maintained free of petroleum leaks and kept clean.
    - No equipment will enter live water except for aquatic equipment or amphibious equipment designed specifically for aquatic or amphibious use. All vehicles operated within 150 feet of any body of water will be inspected daily for leaks and, if necessary, repaired before leaving the staging area. Inspections will be documented in a record that is available for review on request.
- **AMM-BIO-13: Hazardous Materials Management/Fuel Spill Containment Plan -** A hazardous materials management and fuel spill containment plan will be developed prior to construction and given to all contractors and biological monitors working on the project. The plan will require:
    - Equipment and materials for cleanup of spill be available on site and that spills and leaks will be cleaned up immediately and disposed of properly. Authorities will be notified of spills as required by 40 CFR 110.
    - Prior to entering the work site, all field personnel shall be appropriately trained in spill prevention, hazardous material control, and clean-up of accidental spills.
    - Field personnel shall implement measures to ensure that hazardous materials are properly handled and the quality of water resources is protected by all reasonable means. Preventative measures will be implemented, such as vehicle and equipment staging, cleaning, maintenance, and refueling; and contaminant (including fuel) management and storage.
- **AMM-BIO-14: Salmonid Monitoring -** If Coho salmon are observed in the project area during winter months or during preconstruction fish capture and relocation activities, all project activities shall cease and DFW and NMFS shall immediately be notified. If steelhead are determined or presumed

to be present in the project site, then the following Avoidance and Minimization Measures shall be implemented:

- All in-stream maintenance activities will be restricted to the low-flow period of June 15 through October 15. Work above the top of bank or outside of the channel will not be subject to this modified work period.
- To minimize turbidity and stress to special-status species, personnel shall avoid walking through stream pools and the thalweg of the channel, and shall instead walk across riffles or outside of the stream bed to access a project site.
- No equipment is to be operated from within the active stream channel unless the stream has been dewatered and fish have been relocated by a qualified and permitted biologist.
- If anadromous salmonids are present, a fisheries biologist with appropriate licenses and equipment (buckets, aerators, etc.) must be on-site to catch and move fish downstream as dewatering proceeds. Captured fish shall be handled with extreme care and kept in water to the maximum extent possible during relocation activities. All captured fish shall be kept in cool shaded, aerated water protected from excessive noise, jostling, or overcrowding any time they are not in the stream and fish shall not be removed from this water except when released. To avoid predation, the biologist shall have at least two containers and segregate young-of-year fish from larger age-classes and other potential aquatic predators. Captured salmonids will be relocated, as soon as possible, to a suitable instream location in which habitat condition are present to allow for adequate survival of transported fish and fish already present. Cofferdams used to divert water shall be constructed with clean river gravel or sand bags and sealed with sheet plastic.
- If any salmonids are found dead or injured, the biologist shall contact a NMFS biologist or the NMFS North Central Coast Office. The purpose of the contact is to review the activities resulting in take and to determine if additional protective measures are required. All salmonid mortalities shall be retained, placed in an appropriately-sized sealable plastic bag, labeled with the date and location of collection, fork length measured, and frozen as soon as possible. Frozen samples shall be retained by the biologist until specific instructions are provided by NMFS. The biologist may not transfer biological samples to anyone other than the NMFS North Central Coast Office without obtaining prior written approval from the North Central Coast Office, Supervisor of the Protected Resources Division. Any such transfer will be subject to such conditions as NMFS deems appropriate.
- Intakes and outlets shall be designed to minimize turbidity and the potential to wash contaminants into the stream.
- If a work site is to be temporarily dewatered by pumping, intakes shall be completely screened with wire mesh not larger than 5 millimeters to prevent amphibians from entering the pump system. On salmonid streams, the intake pipe shall be fitted with fish screens meeting CDFW and NMFS Fisheries' criteria to prevent entrainment or impingement of small fish (NMFS 1997, in USACE 2010).
- A filtration/settling system must be included to reduce downstream turbidity (i.e. filter fabric, turbidity curtain). The selection of an appropriate system is based on the rate of discharge. If feasible, water that is pumped into a pipe shall discharge onto the top of bank into a densely vegetated area, which may require extra hose length.
- Once the project work is complete, water shall be slowly released back into the work area to prevent erosion and increased turbidity.
- The channel and soil surface shall be restored to its original or design configuration after the work is complete. Any material added to the channel or basin to provide support for the

work approved under this provision shall be removed unless required for erosion control or habitat enhancement and/or restoration.

- For minor actions where the disturbance to construct cofferdams to isolate the work site would be greater than that which would occur in completing the proposed action, measures will be put in place immediately downstream of the work site to capture suspended sediment. This may include installation of silt catchment fences across the drainage or placement of a straw wattle or filter berm of clean river gravel. Silt fences and other non-native materials will be removed from the stream following completion of the activity. Gravel berms may be left in place after breaching, provided they do not impede the stream flow.

- **AMM-BIO-15: Night Lighting during Construction** - During nighttime work for project construction, night lighting shall be used only in the area actively being worked on and focused on the direct area of work.

4.6.3.2 Methodology for Impact Analysis and Significance Thresholds

The analysis in this section used the following resources to identify potential impacts on aquatic and terrestrial biological resources.

GIS Data

Components for each alternative were provided in both polygon and polyline format. Polyline features were limited to floodwalls, retaining walls, and setback floodwalls. These walls were assumed to be 12 inches wide. Per USACE requirements, a 15-foot zone of vegetation clearance (no woody vegetation) on all sides of the walls is necessary. As a result, habitat related to wall components was based on a 15-foot wide buffer from a 12-inch wide wall.

Existing baseline habitat was estimated from habitat mapping completed by Atkins (2011). The study identified six habitat types in the Project area (riverine [concrete-lined channel], riverine [earthen channel], urban/developed, riparian woodland, eucalyptus, and coastal brackish marsh), displayed in Figures 4.6-1a through 1f. In Unit 4 the earthen channel appears to be incorporated into riparian woodland habitat type. Based on reporting of stream width in this reach (20-25 feet wide) the average width of the earthen channel was estimated to be 23 feet as illustrated in habitat maps.

All project components are located within the Atkins survey area with the exception of the setback floodwalls at Kent Middle School (Alternative A) and Sir Francis Drake Boulevard (Alternatives A and G) and bypass culverts (Alternatives F and J). Based on aerial imagery and general knowledge of the area, components outside of the Atkins survey area would be classified as urban/developed.

Project features with buffers applied were overlain on Atkins baseline habitat data. The area of habitat that intersected project features, and in some cases nearby habitat, were identified as potentially impacted areas. The degree of the potential impact is discussed in the environmental consequences.

GIS Data Overlap Resolution

To avoid duplicating calculated acreages from overlapping GIS components, the following procedures were developed and implemented:

- **Allen Park:** Allen Park overlapped with floodwalls and the fish passage grading. Both floodwalls and the new transition grading were subtracted from the Allen Park area for all alternatives.

- **Grading Polygon:** Grading polygons overlapped with floodwalls and retaining walls. The grading polygon was not altered in size (floodwalls and retaining walls were altered to accommodate the grading polygon and avoid double counting acreage).
- **Fish Transition Grading:** The fish transition grading overlapped with floodwalls and Allen Park. The fish transition grading polygon was not altered in size (floodwalls and Allen Park were altered to accommodate the fish transition grading and avoid double counting acreage).
- **Bench Excavation:** Bench excavation overlapped with floodwalls and retaining walls and the fish transition grading in Alternative B. The fish transition area was subtracted from the bench excavation; however, floodwalls and retaining walls did not alter the size of the bench excavations (floodwalls and retaining walls were altered to accommodate the bench excavation and avoid double counting acres).
- **Floodwalls:** With the exception of Allen Park, any overlap with floodwalls was subtracted from the footprint of the floodwall/vegetation free zone. Any overlap with retaining walls or setback floodwalls was split between the wall categories to avoid double counting acreage.
- **Retaining Walls:** Any overlap with retaining walls was subtracted from the retaining wall/vegetation free zone. Any overlap with floodwall or setback walls was split between the wall categories to avoid double counting.
- **Setback Floodwalls:** Any overlap with setback floodwalls was subtracted from the setback floodwall/vegetation free zone. Any overlap with floodwall or retaining walls was split between the wall categories to avoid double counting.
- **College Avenue Culvert Grading (Alt A):** The culvert grading was overlapped by floodwalls. The culvert grading was not altered in size (floodwalls were altered to accommodate the culvert grading and avoid double counting).

Habitat Type Changes

Implementation of project components would affect the habitat type within the Project. Some shifts in habitat type are by design (e.g. conversion of Allen Park to riparian habitat) while other shifts are solely a byproduct of flood control structure implementation (e.g. conversion of riparian woodland to riparian herbaceous vegetation within 15 feet of a floodwall). Methods used to describe and quantify habitat changes from Project implementation are described below.

- **Tidal Marsh:** Tidal marsh was assigned to the area within the grading polygon downstream of the Stadium Way pedestrian bridge. This would replace the concrete-lined channel, urban developed, and eucalyptus woodland habitats.
- **Transitional Freshwater Marsh:** Transitional freshwater marsh was assigned to the area within the grading polygon between College Avenue Bridge and Stadium Way pedestrian bridge. This replaces the concrete-lined channel and urban developed habitats.
- **Riparian Vegetation (Woodland & Herbaceous):** This habitat was assigned to the area within the grading polygon upstream of College Ave Bridge (replacing concrete-lined channel and urban developed habitats). Additionally this habitat change would also occur in narrow segments of Allen Park and narrow segments of the fish transition grading (Alternatives A, B, and G). It is assumed that these areas would be too narrow to support dense riparian woodland; however, there would likely be sparse riparian trees and other riparian vegetation present. Areas too narrow to sustain riparian woodland were estimated to have less than approximately 15 feet of riparian habitat from the channel edge to the riparian landward edge or edge of the floodwall buffer. In Alternatives A, B, and G, floodwalls constructed in Unit 4 would remove existing riparian woodland habitat including 15-foot vegetation clearance on both sides. This would result in segments of Unit 4 becoming riparian

vegetation (woodland and herbaceous) habitat. In the fish transition grading area and Allen Park, riparian vegetation (woodland & herbaceous) would replace urban/developed, concrete-lined channel, and riparian woodland.

- The riparian habitat impact analysis is conservative and addresses the loss to riparian habitat without a variance, as one is not yet in place. However, ETL 1110-2-583 provides USACE design policy for vegetation near levees, dams and floodwalls. Vegetation policy guidance letters (October 2017) indicates that vegetation variances may be granted in cases where the flood safety risks of the vegetation do not outweigh the benefits of allowing non-policy compliant vegetation. A risk analysis will be performed for Corte Madera Creek prior to PED and the results of those findings will be included final designs to assess compliance with ETL 1110-2-583. This will determine to what extent riparian vegetation could be restored at Frederick Allen Park Riparian Corridor.

- **Riparian Herbaceous:** This habitat consisting of low lying riparian vegetation was assigned to formerly riparian woodland habitat creek-side of floodwalls and within floodwall 15-foot buffers. This habitat would also be present creek-side of Allen Park floodwalls within the 15-foot floodwall buffer since Allen Park components are proposed riparian woodland.
- **Riparian Woodland:** Riparian woodland habitat was assigned to wide areas of Allen Park and the downstream segment of the fish transition grading in Alternatives F and J.
- **Riverine (Concrete-Lined Channel):** This habitat was assigned to the bench excavation areas and culvert grading areas and would replace urban/developed habitat.
- **Urban/Developed:** This habitat is assigned to land on the landward side of floodwalls/retaining walls/setback floodwalls. This habitat would replace some areas of eucalyptus woodland and coastal brackish marsh and riparian woodland in instances where walls bisect woodland.

Previous Studies

Compiled and reviewed data collected in the Project area include Corte Madera Creek Final Baseline Report (USACE 2010), Biological Resources Constraints Memorandum Corte Madera Flood Control Project (Atkins 2011), Corte Madera Stream Crossing Inventory and Fish Passage Evaluation Final Report (Ross Taylor 2006), and Draft Corte Madera Creek Flood Control Channel Fish Passage Assessment and Alternatives Analysis (Love 2007). The steelhead passage assessment by Love (2007) was an extensive modeling study that warrants review of its methods and findings. This study is summarized below.

Assessment of Steelhead Upstream Passage Report Summary

Michael Love and Associates in association with Jeff Anderson and Associates conducted a steelhead passage assessment for Corte Madera Creek in 2007. The specific objectives of this project were to assess current upstream passage conditions and develop feasible alternatives for providing suitable passage for returning adult steelhead within the existing concrete channel. An overview of this study relevant to the Project is presented below. Detailed information of the study is available in their final report (Love 2007). The following section summarizes this report’s relevance to the Project.

During 2007, observations of water velocities within the existing resting pools suggested these pools are too small to sufficiently reduce water velocities at most upstream migration flows, but larger pools could potentially provide suitable resting areas. Existing fish passage conditions were assessed using a combination of a field monitoring program and numerical model estimates. These field observations were calibration data for two-dimensional (2-D) hydrodynamic model of the project reach that was used to estimate water velocities and depths encountered by steelhead at typical migration flows. These results were used in a fish routing and energetics model to estimate the proportion of the steelhead population able to ascend the concrete flood control channel over a range of stream flows and tidal conditions.

A design flow of 5,400 cfs for Unit 3 was used to evaluate its impact on water surface elevations. In drainages such as Corte Madera Creek, a common high fish passage flow for salmon and steelhead is the 10 percent exceedance flow (177 cfs) during the period of migration, December through March. The low passage design flow at 50 percent exceedance is 14 cfs at Ross Creek, a tributary to Corte Madera Creek.

Steelhead Depth and Velocity Criteria: The CDFW and the NMFS have guidelines for upstream passage of adult steelhead through culverts, but not for flood control channels (Love 2007). These guidelines recommend a minimum water depth of 1.0 foot and a maximum average cross-sectional water velocity of less than 2 cfs for culverts exceeding 300.0 feet in length. Preliminary hydraulic analysis of Unit 3 of the Project area found that these depth and velocity criteria are never mutually satisfied throughout the entire channel reach. Yet, on numerous occasions individual steelhead have been observed swimming through the entire Unit 3 channel. To provide a more accurate assessment of fish passage conditions in Unit 3, a fish routing, locomotion, and energetics model was developed. Factors considered were flow velocities, water depth, swimming speeds, time to fatigue and rest, and body size.

The average length of 24.5 inches was used for the Corte Madera Creek adult steelhead body length (BL). Because different size steelhead have different swimming strength and endurance, models of steelhead swim speed are expressed as BL/s (body length [24.5 inches] per second). A water velocity of 1 BL/s was selected as the maximum suitable velocity for allowing an adult steelhead to rest and recover from fatigue.

Assuming the largest steelhead in the Corte Madera population is 32 inches in length and has a body depth of 0.6 feet, a minimum required water depth of 0.6 feet was used for fish routing purposes in the model. For evaluating the existing resting pools in Unit 3, it was assumed that a resting pool must be an area at least 2 feet long by 2 feet wide, with water velocities less than 2 BLs, and a water depth of at least 0.6 feet to be considered effective as a rest area for steelhead.

Assessment of Existing Pools in Unit 3: Using the resting pool criteria above, evaluation of the existing pools found they provide resting habitat at the analyzed flows of 14 cfs, 23 cfs, and 40 cfs, and to a lesser extent at 77 cfs. At 113 cfs and 177 cfs, only a select few of the existing pools provided suitable resting habitat, resulting in excessively long sections of channel with no areas for fish to rest. Given the distances involved, these water velocities are extremely challenging to a migrating adult steelhead and result in fatigue relatively quickly (Love 2007).

Steelhead Passage Efficiency Relative to Flow and Tidal Conditions: Results from the model, Fish_REALMS, for existing conditions found tidal conditions in Unit 3 are as important a factor influencing fish passage as flow magnitude. The lower 900 feet of the modeled reach does not contain resting pools and at MLLW tidal condition, this section of channel is not tidally backwatered. The result is an excessively long reach with relatively swift water velocities and no resting opportunities. Therefore, nearly the entire population of Corte Madera Creek steelhead are unable to ascended Unit 3 at any of the assessed fish passage flows during low tide (Table 4.6-2).

TABLE 4.6-2 ESTIMATED PROPORTION OF STEELHEAD POPULATION CAPABLE OF ASCENDING UNIT 3 OF CORTE MADERA CREEK AT VARIOUS FLOW AND TIDAL CONDITIONS

Tide	Percent Successful					
	14 cfs	23 cfs	40 cfs	77 cfs	113 cfs	177 cfs
MLLW	7	2	2	2	2	1
MTL	98	85	51	13	7	1
MHHW	99	92	97	73	54	4

MHHW = mean-higher-high-water
MLLW = mean-lower-low-water
MTL = mean tide level

Determining Significance

In addition to environmental review requirements related to NEPA/CEQA and federal and state ESA regulations, according to the USACE Planning Guidance Notebook (ER 1105-2-100), the criteria for determining the significance of potential impacts associated with ecological resources “shall include, but not be limited to, the scarcity or uniqueness of the resource from a national, regional, state, and local perspective” (ER 1105-2-100, Appendix C, p. C-15). When identifying significant resources and effects, the USACE is to consider:

Significant environmental quality resources: ecological resources, including fish and wildlife resources and associated habitats, that are technically, institutionally, or publicly recognized as having substantial nonmonetary value from an ecological, cultural, or aesthetic standpoint.

Significant effects: effects an alternative would have on ecosystems or ecological resources, including fish and wildlife that are determined to have a material bearing on the USACE decision-making process.

In ER 1105-2-100, Appendix E (p. E-162), regarding ecosystem restoration activity, the Planning Guidance Notebook states:

> *In summary, the case can be made that environmental resources are significant based on technical recognition when, within a specified geographic range, those resources are either scarce; are representative of their respective ecosystems; will improve connectivity or reduce fragmentation of habitat; represent limiting habitat for important species; will improve or increase biodiversity; or trends indicate that the health of the resource is imperiled and declining, but can be recovered through human intervention.*

Potential impacts were measured based on how each alternative could affect:

- The relative abundance of scarce resources (sensitive natural communities and special-status species and their habitats)
- Wildlife movement (e.g., ability to retreat to high ground in flooding)
- Habitat connectivity and habitat fragmentation
- Biodiversity
- Current wildlife population and habitat trends
- Conflicts with existing policies and plans

Significance Thresholds

The Project is considered to have a significant impact on biological resources of the surrounding area if it meets any of the following criteria. Because additional mitigation measures for Impacts BIO-1, BIO-2, and BIO-4 are not feasible beyond the extensive AMMs, significant impacts were determined to be significant and unavoidable.

- **Impact BIO-1:** Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the USFWS, NMFS, or CDFW.
- **Impact BIO-2:** Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by USFWS, NMFS, or CDFW.
- **Impact BIO-3:** Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.
- **Impact BIO-4:** Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.
- **Impact BIO-5:** Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.
- **Impact BIO-6:** Conflict with the provisions of an adopted Habitat Conservation Plan, Natural Community Conservation Plan, or other approved local, regional, or state habitat conservation plan.

Impacts Not Analyzed Further

The Project area is highly developed and built-out. The Project would not result in downstream adverse impacts to the estuary or reduce protected coastal marsh lands that are protected or managed under conservation plans, thus **Impact BIO-6** is not relevant to the Project and was omitted from further evaluation.

4.6.3.3 Effects and Mitigation

No Action Alternative

In the no action alternative, the existing biological resources in the study area would remain the same or worsen. The fish ladder, originally intended to be a temporary structure, would continue to constrain fish passage. The County of Marin modified and repaired the fish ladder following severe damage during the flood of December 31, 2005. These repairs appear to have slightly improved overall fish passage through the ladder (Love 2007). Since then, the fish ladder has deteriorated and will eventually have to be repaired or replaced to protect the underlying sewer lines. The concrete channel with ineffective resting pools and stressful water temperatures would continue to impact fish passage. Coho salmon would likely remain extirpated from Corte Madera Creek because the construction of the flood control channel was likely a contributing factor to the salmons' extirpation (Love 2007). Ongoing Impacts BIO-1, BIO-2, and BIO-4 would remain ***significant***. Impacts BIO-3 would have ***no impact*** because no actions would be taken within protected wetlands. Impact BIO-5 would have ***no impact*** because no actions would occur that would conflict with local policies or ordinances.

Action Alternatives Evaluation

The following sections discuss the potential effects of the action alternatives on biological resources (including special-status species and their habitats), representative habitats and sensitive natural communities, wildlife movement, habitat connectivity, and plan and policy conflicts. All action alternatives for the EIS/EIR are intended to increase current channel capacity to convey flood flows through Units 2, 3, and 4, and were developed in consideration of improving fish passage for threatened fish species that migrate in Corte Madera Creek.

Action alternatives were evaluated by discussing fish ladder removal and the new transition common to all action alternatives, and then discussing each action alternative individually, starting in Unit 4 and continuing downstream. Sensitive species and potential effects are discussed after the alternatives. Figures 4.6-3a through 4.6-3e show the overview of action alternatives and their associated impact footprint overlaid on habitats mapped in the Project area.

The Project would incorporate multiple AMMs to ensure that construction-related effects on special-status species and sensitive natural communities are minimized.

Flow velocities were modeled at multiple flood flows, however the model employed did not produce stable results at flows when salmonids would be migrating. Sections of channel that would be modified under various alternatives (fish ladder removal and transition, Allen Park Riparian Corridor, and College of Marin Widening) would incorporate design features to create habitat diversity and channel roughness to reduce flow velocities and improve fish passage.

Fish Ladder Removal and New Transition

All action alternatives would remove the Denil fish ladder and create a smooth grade transition between Units 3 and Unit 4 using a combination of natural bed material and biotechnical bank treatments to meet fish passage criteria. The biotechnical bank treatments would provide an armored transition between earthen streambank and vertical concrete channel wall. The footprint of this action is mostly within the channel although a small area of streambank could be modified. Riparian vegetation on streambanks would be preserved; however, Alternatives A, B, and G would include top-of-bank floodwalls along this reach that would require removal of riparian vegetation to protect floodwalls. The potential exists to provide a high-flow refuge habitat.

Fish ladder replacement would result in temporary disturbance to Steelhead Critical Habitat that would primarily occur during construction. AMMs would include streamflow diversion if channel flow is present and temporary relocation of aquatic species, if present, during removal and reconstruction of the streambed. In-channel work could increase turbidity and suspended solids within the channel from diversion of the channel and post construction, but would be localized (not extend below Unit 2) and of short duration (less than one month). Long term benefits that would be realized post-construction include improved fish passage and quality of fish habitat. Fish ladder removal would result in minimal vegetation disturbance and leave sensitive riparian woodland habitat in Unit 4 intact, thereby preserving shade to Corte Madera Creek. Impacts BIO-1 and BIO-4 would be ***less than significant*** from this action. Short term effects as described above would be minor, and permanent long-term effects would be beneficial. Impacts-BIO-2 and BIO-5 would be ***less than significant*** because the riparian woodland vegetation along Unit 4 would remain intact and any trees removed would not conflict with the Town of Ross Policy 1.2.

No federally protected wetlands are known to occur in this area, although an area along the stream less than 0.1 acre could exist and be affected the fish ladder removal. Downstream wetlands along the earthen channel in Unit 2 would not be affected. Impact BIO-3 would have a ***less than significant*** effect.

Alternative A: Top-of-bank Floodwall

Alternative A would include approximately 13,220 linear feet of top-of-bank floodwalls and one setback wall encompassing some of the Kent Middle School athletic fields. Impacts from floodwalls are discussed separately for each unit because many of the biological conditions are remarkably different within Unit

4 as compared to Units 2 and 3. The Project would result in both temporary and long-term impacts to riverine, riparian woodland, and upland habitat. Temporary effects would result from general construction activities and vegetation removal; however, these would be local and of low magnitude. Adverse long-term effects would result from vegetation removal, floodwalls, and other structural components. Beneficial long-term effects would result from removal of the fish ladder and associated channel redesign. Floodwall heights for Alternative A are shown in Table 3-1 and on Figures 3-1a through 3-1f. Figure 4.6-3a shows an overview of Project features and existing habitat classification, and Figures 4.6-4a-4e shows habitat change expected from Alternative A.

Unit 4

Alternative A would result in construction of approximately 4,393 linear feet of top-of-bank floodwalls in Unit 4. Maximum floodwall heights would range from 7 to 9 feet within Unit 4. Tall floodwalls require a greater thickness for structural support. They would constrain terrestrial wildlife movement impacting species that routinely migrate between the channel and upland such as turtles and frogs.

Unit 4 streambanks support abundant riparian woodland vegetation that helps stabilize streambanks during high flow. Construction would result in removal of all woody vegetation directly affecting 0.96 acre of riparian woodland habitat and approximately 1.5 acres of landscaped habitat within Unit 4. This action would result in conversion of 0.96 acre of sensitive riparian woodland habitat to non-woody vegetation capable of surviving being mown to 3 inches high. Residual riparian woodland habitat would be more fragmented. The number of trees removed to support floodwall construction would be determined during preconstruction engineering and design (PED). Loss of riparian woodland would likely result in reduced streambank stability, cover, food, nesting habitat, and invertebrate population. Portions of woodland riparian habitat that provide large woody debris to the stream would no longer be available, thus reducing cover and habitat diversity. The high floodwalls would likely increase velocity, shear stress, and scour in Unit 4, potentially worsening fish passage and increasing turbidity and suspended sediment thus further degrading habitat for native fish and amphibians. Nutrient loading from runoff and sewage contribute to growth of algae and other aquatic plants in portions of Corte Madera Creek, particularly areas that are unshaded by riparian vegetation (Town of Ross 2009, in USACE 2010). Reduction of shade in Unit 4 would result in increased algal growth in Unit 4.

Floodwall construction would occur on top of and on streambanks and likely involve equipment in the channel during installation of floodwalls and result in increased sediment transport to the channel. Implementation of AMMs would minimize the accelerated erosion, but impacts could persist several years or longer if deeply rooted dense vegetation or other bank armoring is not in place.

Construction of floodwalls and vegetation removal would likely affect temperatures. Loss of the riparian woodland vegetation would remove effective shading along the stream and likely increase water temperature that could in turn make habitat less suitable for salmonids.

Units 2 and 3

Alternative A would construct 8,726 feet of top-of-bank floodwalls along both sides of Corte Madera Creek from the Denil fish ladder to the downstream end of the concrete channel on the left bank and the athletic field at Kent Middle School on the right bank. A 1,092-foot setback floodwall on the right bank would tie into the top-of-bank floodwalls, circumvent the athletic fields, and tie back into the right bank of Corte Madera Creek at the end of the concrete channel. Maximum top-of-bank floodwall heights would range from 5.5 to 11 feet in Units 2 and 3 and the setback wall would have a maximum height of 7 feet. These floodwalls would act as a barrier to terrestrial wildlife. However, the change to wildlife movement would be less in Units 2 and 3 than in Unit 4 because the existing channel is concrete.

The riverine habitat in Units 2 and 3 would also be impacted, but to a much lesser extent than in Unit 4, as the concrete-lined channel currently experiences high flow velocities, is resistant to scour, and supplies little if any cover, food, shade and large woody debris. The little riparian vegetation that exists would be reduced, at least temporarily, but it currently provides minimal benefit.

Alternative A, including the vegetation clearance zones around floodwalls intersects approximately 3.16 acres of riverine (concrete-lined) habitat. Construction of these floodwalls would require little, if any in-channel work. Although a vegetation clearance zone is required, only sparse weedy urban/developed vegetation, not meeting vegetation clearance requirements, would be removed. This vegetation provides a small amount of shade, organic detritus, and food to the creek that would be reduced with the construction of the floodwalls.

Species affected and areas to be revegetated and number of trees removed during construction would be identified during PED. Stream temperatures stressful to salmonids occur at least a month earlier in Units 2 and 3 than in Unit 4, and would likely occur even earlier as a result of warmer temperatures in Unit 4 due to reduced shade following construction.

College Avenue Bridge Culvert Installation

Due to capacity limitation under the College Avenue Bridge, three underground bypass culverts would be installed for Alternatives A, B, F, and G. To accommodate the culverts, both concrete banks would receive grading and benching or trenching. Benched areas would be planted with native vegetation appropriate for the area. Culverts would be installed primarily outside of the active channel in urban landscape, but could affect a small amount of riverine-concrete channel habitat by concrete removal to replace with bypass openings. A few landscaping trees planted by the County of Marin, and other ruderal vegetation could require removal for culvert installation. Any streambanks with exposed soil would be planted with native vegetation meeting USACE requirements for structures. Temporary impacts that could result would be increased turbidity and suspended sediment. These impacts could occur during construction or post construction until streambank vegetation is established. Bypass culverts would be screened to prevent fish entrapment. Other than potential removal of vegetation, all effects to biological resources would be short term, localized, and low magnitude.

No pre-jurisdictional wetlands were identified in the Project area except for the coastal brackish marsh at the downstream end of the Project area in Unit 2. Increased sedimentation, either short or long-term could occur, but is not considered to be significant. Floodwalls would extend to the edge of this habitat that is that is not considered high quality marsh. The vegetation is low lying and would not require removal.

Summary Impacts of Alternative A

Alternative A would include the longest and tallest floodwalls of all action alternatives. Continuous floodwalls along both sides of the creek would create the greatest disturbance to the creek of all action alternatives. Alternative A has a footprint that would directly affect a total of 10.5 acres, 1.4 acres within riparian woodland, 5.8 acres of urban/developed land, and 3.16 acres of riverine (concrete-lined channel). Small amounts of eucalyptus woodland (0.12 acre), riverine (earthen-lined channel) (0.01 acre) and coastal brackish marsh (0.015 acre) at the downstream end of the Project would also be affected (Table 4.6-3). A total of 1.63 acres would result in long-term or permanent habitat modification. A net loss of 1.34 acres of riparian woodland would occur because floodwall construction would require vegetation clearance. Remaining riparian woodland vegetation would be more fragmented. An increase of 0.68 acre herbaceous riparian vegetation would replace riparian woodland because of floodwall vegetation clearance requirements. Floodwalls would also divide upland areas from the riparian corridor resulting in an increase in urban/developed habitat of approximately 0.3 acre and more restricted wildlife movement. Alternative A would convert approximately 1,171 linear feet of riparian woodland and 80 linear feet of riverine (concrete-lined channel) to herbaceous/woody riparian habitat (see Table 4.6-8). This alternative has the most linear feet and tallest floodwalls of the action alternatives.

Table 4.6-9 presents a summary of habitat change for action alternatives. Impact BIO-1 (impacts to special-status species) would be ***significant and unavoidable*** for Alternative A because of adversely altered habitat resulting in higher stream temperatures within Unit 4 and downstream in Units 2 and 3. The increase in temperature is unknown, but is considered significant because current stream temperatures already result in stressful conditions to salmonids. Loss of cover, food, and habitat diversity would contribute to adverse effects. The areal disturbance within the riparian corridor would have a significant impact to already degraded habitat for salmonids. Impact BIO-2 (impacts to sensitive habitat) would be ***significant and unavoidable*** because riparian woodland is a valuable, scarce habitat and its removal would adversely impact habitat that would require off-site mitigation that would not be effective for several decades. Impact BIO-3 (impacts to protected wetlands) would be ***less than significant*** to downstream wetlands. Impact BIO-4 (impede wildlife movement) would be ***significant and unavoidable*** because increased velocities would likely contribute adversely to fish passage, although removal of the fish ladder would improve fish passage. Floodwalls would decrease wildlife movement between the stream and upland and reduce connectivity of ecosystems. Impact BIO-5 (conflict with local policy) would be ***less than significant*** because conflict with the policy would be addressed through mitigation and consideration of other long-term benefits of the Project.

TABLE 4.6-3 ALTERNATIVE A POTENTIAL HABITAT IMPACTS

Activity	Affected Habitat	Project Footprint (acres)	Future Condition (acres)	Habitat Change (acres)
Summary of Project Areas	Coastal Brackish Marsh	0.015	0.015	0.000
	Eucalyptus Woodland	0.121	--	-0.121
	Riparian Herbaceous	--	0.679	0.679
	Riparian Vegetation (Woodland & Herb)	--	0.468	0.468
	Riparian Woodland	1.393	0.053	-1.340
	Riverine (Concrete)	3.164	3.176	0.012
	Riverine (Earthen)	0.001	0.001	0.000
	Tidal Marsh	--	--	0.000
	Transitional Freshwater Marsh	--	--	0.000
	Urban/Developed	5.801	6.102	0.301
Top of Bank Floodwalls	Coastal Brackish Marsh	0.007	0.007	--
	Eucalyptus Woodland	0.076	--	-0.076
	Riparian Woodland	0.960	--	-0.960
	Riparian Herbaceous	--	0.679	0.679
	Riparian Vegetation (Woodland & Herb)	--	--	--
	Riverine (Earthen)	0.001	0.001	0.000
	Riverine (Concrete)	3.052	3.052	0.000
	Urban/Developed	5.454	5.810	0.356

TABLE 4.6-3 ALTERNATIVE A POTENTIAL HABITAT IMPACTS				
Activity	**Affected Habitat**	**Project Footprint (acres)**	**Future Condition (acres)**	**Habitat Change (acres)**
Setback Floodwalls	Coastal Brackish Marsh	0.008	0.008	0.000
	Eucalyptus Woodland	0.045	--	-0.045
	Riverine (Concrete)	0.003	0.003	0.000
	Urban/Developed	0.151	0.197	0.046
Fish Transition Grading	Riparian Woodland	0.433	0.053	-0.380
	Riparian Vegetation (Woodland & Herb)	--	0.468	0.468
	Riverine (Concrete)	0.094	0.030	-0.060
	Riverine (Earthen)	--	--	--
	Urban/Developed	0.120	0.095	-0.025
College Ave Culvert Grading	Riverine (Concrete)	0.015	0.091	0.076
	Urban/Developed	0.076	--	-0.076

Alternative B: Top-of-bank Floodwall/Setback Floodwall/College of Marin Widening

Alternative B would result in construction of approximately 3,090 linear feet of top-of-bank floodwalls, setback walls within Unit 4, widening and excavation around College of Marin, and three College Avenue culverts. Setback walls would have a low vegetation zone on both sides of each floodwall. A 48-foot-long setback wall would tie the upstream end of the left bank floodwall into Sir Francis Drake Boulevard. A second 741-foot setback wall, unique to Alternative B, would extend from the right bank to Sylvan Lane and would widen the local floodplain. Properties within the regulated flood zone as a result of the Project, would be acquired by USACE and structures would be removed or demolished. Abandonment of these properties would return approximately 1.94 acres to the floodplain. Detailed design for restoration has not been completed for properties waterward of the setback wall, thus long-term effects to biological resources are unknown; however, most of the riparian corridor in Unit 4 would be impacted from top-of-bank floodwall construction with consequences similar to, but somewhat less than, Alternative A.

Construction would result in removal of all woody vegetation directly affecting 0.65 acre of riparian woodland habitat within Unit 4. This action would result in conversion of 0.65 acre of sensitive riparian woodland habitat to non-woody vegetation capable of surviving mowing to 3 inches in height. Residual riparian woodland habitat would be fragmented.

Bench Excavation

Alternative B would entail widening the channel downstream of the fish ladder. The right bank of the channel would be excavated as much as 20 feet wide and as low as 5 feet below the existing top-of-bank elevation, thereby lowering the concrete channel walls. Excavation would extend approximately 2,213 feet from the Denil fish ladder to the College of Marin. Up to 0.96 acre would be excavated depending on available real estate to reduce channel entrenchment and increase channel capacity. Revegetation would be with native species complying with USACE vegetation guidelines within 15 feet of FRM structures. A retaining wall up to 5 feet tall would be constructed on the right bank from the Denil fish ladder to just downstream of the hospital. The resting pools that extend from the fish ladder to station 350 + 85 would remain. Top-of-bank floodwalls would be constructed on the left bank, and on the right bank at the downstream end of the retaining wall to the College of Marin setback walls. Maximum height of the floodwalls would be 1.5 to 5 feet. Trees line Corte Madera Creek in intermittent pockets, sometimes providing morning and evening shade to the channel. Tree removal would occur following USACE clearance guidelines around floodwalls and in excavated areas. Trees along this section provide little effective shading although their removal could incrementally increase water temperature that would combine with indirect effects of increased water temperature from reduced shade in Unit 4. Clearing of vegetation, construction of floodwalls and retaining walls, and excavation would temporarily increase sediment transport to the channel. Implementation of AMMs and mitigation measures would minimize sediment transport. The effects from these activities would be similar to those in Alternative A, along the same reach, but to a lesser extent because of the added floodplain and lower floodwalls. Wildlife movement between stream and upland areas would be less constrained.

College of Marin Widening

Alternatives B would result in changes to multiple features along the creek in close proximity to College of Marin and Kent Middle School (upstream and downstream from College Avenue). Grading activities associated with College of Marin and Kent School area have a footprint of approximately 5.17 acres during construction, 2.16 acres within the existing channel. Permanent impacts would occur to 3.17 acres of urban habitat that would be converted to a mix of earthen channel and vegetated riverine habitat. This action would result in beneficial effects to steelhead and other species.

Actions taken within Units 2 and 3 would cause effects to biological resources resulting from channel improvements such as removing concrete sections of the concrete channel bottom and walls and excavating streambank, which would result in an earthen channel with diversified habitat and improved fish passage. The removal of the concrete channel bed and portions of the right channel wall would likely increase groundwater flow into the channel that would increase baseflow because of relatively high water tables in the vicinity. Stream temperatures would likely be reduced because groundwater is cooler than surface water and the increased flow would slow in-stream temperature rise. The increase in baseflow would also improve fish movement in this reach during summer. Benefits from the groundwater recharge would be most apparent during low flow conditions in summer. In the long-term, diversified habitat, slower flow velocities, and lower shear stress in the channel are anticipated to contribute to the recovery of biological resources, particularly steelhead, by improving habitat used by both upstream migrating adults and downstream migrating and rearing juveniles. This would also be of similar benefit to any coho salmon that enter Corte Madera Creek.

In the unlikely even they return to the area, improved habitat conditions could also benefit California red-legged frogs, foothill yellow-legged frogs, and Western pond turtle by creating a larger upland dispersal area and providing improved aquatic habitat. Where the right bank retaining wall would be removed, lowered banks would be planted with native vegetation that would provide cover, forage, bank stabilization, and nesting habitat for local species. Vegetation would adhere to USACE height requirements within 15 feet of FRM structures. Some overhanging vegetation could supply in-stream cover and food. Increase of invertebrate population and diversity would likely occur. Overall, College of Marin widening activities would benefit biological resources.

Summary Impacts of Alternative B

Alternative B has a footprint that would directly affect a total of 14.72 acres, which includes 1.08 acres within riparian woodland, 9.71 acres of urban/developed land, and 3.12 acres of riverine (concrete-lined channel), and small amounts of eucalyptus woodland (0.38 acre), riverine (earthen-lined channel) (0.20 acre) and coastal brackish marsh (0.23 acre at the downstream end of the Project) also affected (Table 4.6-4). A total of 7.44 acres would result in long-term or permanent habitat modification. Approximately

2.12 acres of riverine (concrete-lined channel) would become a combination of riparian/herbaceous woodland, transitional freshwater marsh, and tidal marsh habitats, all with native surface channels. A net loss of 1.03 acres of riparian woodland and0.38 acre of eucalyptus woodland would occur because floodwall construction would require vegetation clearance and expansion of floodplains. Remaining riparian woodland vegetation in Unit 4 would be more fragmented. An increase of 0.49 acre herbaceous riparian vegetation would replace urban/developed habitat because of floodwall vegetation clearance requirements. An increase of 2.66 acres riparian/herbaceous woodland, 2.06 acres of transitional freshwater marsh, and 1.20 acres of tidal marsh would occur as a result of College of Marin Widening. Because stream channels are linear features, habitat length along the stream was also calculated and included in Table 4.6-8. Alternative B would convert approximately 927 feet of riparian woodland and 2,756 feet of riverine (concrete-lined channel) to approximately 2,075 feet of riparian herbaceous/woodland, 1,144 feet of transitional freshwater marsh, and 464 feet of tidal marsh.

Table 4.6-9 reports a summary of habitat change for action alternatives. Alternative B Unit 4 floodwall construction would result in a ***significant and unavoidable*** effect to Impact BIO-1 (impacts to special-status species) because of adversely altered habitat and higher stream temperatures. The increase in temperature is unknown, but is considered significant because stream temperatures already result in stressful conditions to salmonids. The areal disturbance within the riparian corridor would likely have a significant impact to already degraded habitat for salmonids. Loss of cover, food, and habitat diversity would contribute adverse effects. The areal disturbance within the riparian corridor would likely have a significant impact to already degraded habitat for salmonids. Impact BIO-2 (impacts to sensitive habitat) would be ***significant and unavoidable*** because riparian woodland is a valuable, scarce habitat and its removal would adversely impact habitat that would require off-site mitigation that would not be effective for several decades. Impact BIO-3 (impacts to protected wetlands) would be ***less than significant*** to downstream wetlands, as no wetlands would be adversely affected, either directly or indirectly. Impact BIO-4 (impede wildlife movement) would be ***significant and unavoidable*** because increased velocities would likely contribute adversely to fish passage despite improvements from fish ladder removal. Floodwalls would decrease wildlife movement between the stream and upland and reduce connectivity of ecosystems. Impact BIO-5 (conflict with local policy) would be ***less than significant*** because the conflict with the policy would be addressed through mitigation and consideration of other long-term benefits of the Project.

TABLE 4.6-4 ALTERNATIVE B POTENTIAL HABITAT IMPACTS

Activity	Affected Habitat	Project Footprint (acres)	Future Condition (acres)	Habitat Change (acres)
Summary of Project Area	Coastal Brackish Marsh	0.232	0.221	-0.011
	Eucalyptus Woodland	0.382	--	-0.382
	Riparian Herbaceous	--	0.488	0.488
	Riparian Vegetation (Woodland & Herb)	--	2.660	2.660
	Riparian Woodland	1.080	0.053	-1.027
	Riverine (Concrete)	3.117	1.796	-1.321
	Riverine (Earthen)	0.197	0.197	0.000
	Tidal Marsh	--	1.195	1.195
	Transitional Freshwater Marsh	--	2.059	2.059
	Urban/Developed	9.714	6.052	-3.662

TABLE 4.6-4 ALTERNATIVE B POTENTIAL HABITAT IMPACTS				
Activity	Affected Habitat	Project Footprint (acres)	Future Condition (acres)	Habitat Change (acres)
College of Marin Grading	Coastal Brackish Marsh	0.214	0.214	0.000
	Eucalyptus Woodland	0.293	--	-0.293
	Riparian Vegetation (Woodland & Herb)	--	2.187	2.187
	Riverine (Earthen)	0.197	0.197	0.000
	Riverine (Concrete)	2.038	--	-2.038
	Tidal Marsh	--	1.195	1.195
	Transitional Freshwater Marsh	--	2.059	2.059
	Urban/Developed	3.109	--	-3.109
Bench Excavation	Riverine (Concrete)	0.177	0.958	0.781
	Urban/Developed	0.782	--	-0.782
Top of Bank Floodwalls	Coastal Brackish Marsh	0.018	0.007	-0.011
	Eucalyptus Woodland	0.089	--	-0.089
	Riparian Woodland	0.647	--	-0.647
	Riparian Herbaceous	--	0.488	0.488
	Riparian Vegetation (Woodland & Herb)	--	--	--
	Riverine (Earthen)	--	--	--
	Riverine (Concrete)	0.797	0.797	0.000
	Urban/Developed	3.521	3.779	0.258
Retaining Walls	Coastal Brackish Marsh	--	--	--
	Eucalyptus Woodland	--	--	--
	Riverine (Earthen)	--	--	--
	Riverine (Concrete)	0.008	0.008	0.000
	Urban/Developed	1.186	1.186	0.000
Setback Floodwalls	Coastal Brackish Marsh	--	--	--
	Eucalyptus Woodland	--	--	--
	Riverine (Concrete)	0.003	0.003	0.000
	Urban/Developed	0.996	0.996	0.000
Fish Transition Grading	Riparian Woodland	0.433	0.053	-0.38
	Riparian Vegetation (Woodland & Herb)	--	0.473	0.473
	Riverine (Concrete)	0.094	0.03	-0.064
	Riverine (Earthen)	--	--	--
	Urban/Developed	0.12	0.091	-0.029

Alternative F: Bypass/Allen Park Riparian Corridor/College of Marin Widening

Alternative F would include a bypass to redirect flood flows around Unit 4, removal and new transition for the fish ladder, Allen Park Riparian Corridor, bench excavation, and College of Marin Widening.

Unit 4

Bypass Culvert at Sir Francis Drake Boulevard

The bypass culvert beneath Sir Francis Drake Boulevard adjacent to Unit 4 would re-enter the channel at the Allen Park Riparian Corridor in Unit 3. Bypass construction would require minimal riparian vegetation removal (about 0.017 acre) because the majority of the construction would occur beneath an existing roadway. Implementation of Alternative F would leave the riparian woodland vegetation in Unit 4 intact, thereby protecting sensitive habitat and maintaining the existing shade, cover, and nesting habitat. The bypass would not adversely impact fish passage by incorporating screening or grating to prevent entry of fish. Impacts to biological resources would be minimal because most of the construction would occur beneath Sir Francis Drake Boulevard, where there is minimal ecological value. Construction impacts at the inflow and outflow would be negligible because of the small area and implementation of AMMs. In the long-term, an increased potential for channel stabilization in Unit 4 exists by reducing flood flow frequency and stream power within the channel. Few, if any, trees would be removed at the bypass inflow and outflow. Construction of the bypass could require nighttime construction that would utilize up to 4 portable lights. The lighting could be an impact to nocturnal species. The AMM BIO-15 would restrict the use of lighting to the immediate work area. The construction would occur on Sir Francis Drake Boulevard that is already impacted from headlights of heavy traffic. Because the lighting that would occur is limited in size and would not create a substantial change in lighting, it is not expected to have a substantial effect.

Units 2 and 3

Allen Park Riparian Corridor

Alternative F would include the Allen Park Riparian Corridor, a widened natural channel that would allow higher flows to spread over a larger area and include floodwalls on both banks. Initially construction would disturb a large area; although, AMMs would mitigate sediment reaching the stream as well as direct impacts to aquatic species. Allen Park is a wooded upland area comprised of both native and ornamental species. Tree removal and regrading would occur to create a floodplain in the short term and eventual revegetation with riparian woodland habitat. Approximately 950 feet (plus or minus 50 feet) of concrete channel would be removed including 14 of the poorly designed resting pools. The channel would be redesigned to include new resting pools, cover, and diverse aquatic habitat. In the long-term, the riparian corridor would be expected to improve aquatic and riparian steelhead habitat for both upstream migrating adults and downstream migrating and rearing juveniles. Impacts to biological resources related to this action would be similar to bench excavation, channel widening, and retaining wall construction. Long-term impacts would persist until regrowth of the riparian canopy occurs; however, fairly rapid revegetation of the area coupled with erosion control measures would protect the floodplain and minimize sediment delivery to the channel. The number of trees to be removed would be determined during PED.

Construction of Allen Park Corridor could require relocation of the sewer line that crosses underneath the fish ladder and extends along the left bank of Corte Madera Creek on the landward side of the concrete wall. The pipe was likely built concurrently with the flood control channel. If realignment is necessary, the new line would be constructed before the current line is demolished. A temporary bypass line could be required during part of the construction. The length of demolished line would be approximately 1,115 feet and the added line would be approximately 1,031 feet. The new line would include a new inverted syphon beneath the creek that connects with the line from Sir Francis Drake Boulevard and a second inverted syphon to re-connect with the existing trunk line downstream near College of Marin. The current line is within an existing right-of-way and the new location would be located on public property. The sewer line would be installed within the Project footprint of Allen Park Riparian Corridor and a small amount of pavement along Ross Commons. A lateral 12-inch pipe could be required that would cross under Courte Madera Creek at Allen Park Riparian Corridor. The main line would cross under Corte Madera Creek near Kentfield Hospital. Sewer line relocation would not likely impact water quality with implementation of BMPs during relocation to prevent sewer spills. A sewer spill could increase nutrients that would encourage algal growth and other aquatic plants.

Bench Excavation

Alternative F would be identical to Alternative B downstream of Allen Park Riparian Corridor, including 1,240 linear feet of floodwalls and approximately 0.6 acre of excavation. The 14 resting pools in the concrete channel below Allen Park Riparian Corridor to station 350 + 85 would remain.

Summary Impacts of Alternative F

Alternative F has a footprint that would directly affect a total of 13.94 acres, which includes 0.43 acre within riparian woodland, 9.26 acres of urban/developed land, and 3.43 acres of riverine (concrete-lined channel). Small amounts of eucalyptus woodland (0.38 acre), riverine (earthen-lined channel) (0.20 acre) and coastal brackish marsh (0.23 acre) at the downstream end of the Project would also be affected (Table 4.6-5). A total of 8.05 acres would result in long-term or permanent habitat modification. Approximately 4.29 acres of riverine (concrete-lined channel) would become a combination of riparian/herbaceous woodland, transitional freshwater marsh, and tidal marsh habitats, all with native surface channels. A net loss of 4.88 acres of urban/developed and 0.38 acre of eucalyptus woodland would occur because floodwall construction would require vegetation clearance while Allen Park Riparian Corridor and College of Marin Widening would result in expansion of floodplains. An increase of 1.34 acres of riparian woodland, 2.38 acres riparian/herbaceous woodland, 2.06 acres of transitional freshwater marsh, and 1.20 acres of tidal marsh would occur as a result of College of Marin Widening and Allen Park Riparian Corridor. Because stream channels are linear features, habitat length along the stream was also calculated and included in Table 4.6-8. Alternative F would add approximately 677 feet of riparian woodland, 1,300 feet of riparian herbaceous/woodland, 1,144 feet of transitional freshwater marsh channel habitat, and 464 feet of tidal marsh by removal of 3,585 feet riverine (concrete-lined channel).

Table 4.6-9 reports a summary of habitat change for action alternatives. Impact BIO-1 (impacts to special-status species) would be ***less than significant*** in the short term, and ***beneficial*** in the long term. Impact BIO-2 (impacts to sensitive habitat) would be ***less than significant*** because riparian woodland is a valuable, scarce habitat and this alternative would increase the habitat in the long-term. Impact BIO-3 (impacts to protected wetlands) would be ***less than significant*** to downstream wetlands and could create wetland habitat. Impact BIO-4 (impede wildlife movement) would be ***less than significant*** because fish passage would be improved through a large portion of the Project area. Although floodwalls would decrease wildlife movement between the stream and upland in localized areas, connectivity would improve from the upstream extent of the fish ladder downstream to the stilling basin. Impact BIO-5 (conflict with local policy) is considered ***less than significant*** because removal of trees would result in the creation of improved habitat, and in the long term, more desirable tree species. Alternative F would provide the greatest benefit to biological resources.

TABLE 4.6-5 ALTERNATIVE F POTENTIAL HABITAT IMPACTS

Activity	Affected Habitat	Project Footprint (acres)	Future Condition (acres)	Habitat Change (acres)
Summary of Project Area	Coastal Brackish Marsh	0.232	0.221	-0.011
	Eucalyptus Woodland	0.382	--	-0.382
	Riparian Herbaceous	--	0.570	0.570
	Riparian Vegetation (Woodland & Herb)	--	2.38	2.380
	Riparian Woodland	0.433	1.768	1.335
	Riverine (Concrete)	3.434	1.169	-2.265
	Riverine (Earthen)	0.197	0.197	0.000
	Tidal Marsh	--	1.195	1.195
	Transitional Freshwater Marsh	--	2.059	2.059
	Urban/Developed	9.258	4.382	-4.876
College of Marin Grading	Coastal Brackish Marsh	0.214	0.214	0.000
	Eucalyptus Woodland	0.293	--	-0.293
	Riparian Vegetation (Woodland & Herb.)	--	2.187	2.187
	Riverine (Earthen)	0.197	0.197	0.000
	Riverine (Concrete)	2.038	--	-2.038
	Tidal Marsh	--	1.195	1.195
	Transitional Freshwater Marsh	--	2.059	2.059
	Urban/Developed	3.109	0.000	-3.109
Bench Excavation	Riverine (Concrete)	0.076	0.590	0.514
	Urban/Developed	0.509	--	-0.509
Top of Bank Floodwalls	Coastal Brackish Marsh	0.018	0.007	-0.011
	Eucalyptus Woodland	0.089	--	-0.089
	Riparian Woodland	--	--	--
	Riparian Herbaceous	--	0.570	0.570
	Riparian Vegetation (Woodland & Herb)	--	0.007	0.007
	Riverine (Earthen)	--	--	--
	Riverine (Concrete)	0.554	0.538	-0.016
	Urban/Developed	2.957	2.495	-0.462
Retaining Walls	Coastal Brackish Marsh	--	--	--
	Eucalyptus Woodland	--	--	--
	Riverine (Earthen)	--	--	--
	Riverine (Concrete)	0.008	0.008	0.000
	Urban/Developed	0.907	0.907	0.000
Setback Floodwalls	Coastal Brackish Marsh	--	--	--
	Eucalyptus Woodland	--	--	--
	Riverine (Concrete)	0.003	0.003	0.000

TABLE 4.6-5 ALTERNATIVE F POTENTIAL HABITAT IMPACTS				
Activity	Affected Habitat	Project Footprint (acres)	Future Condition (acres)	Habitat Change (acres)
	Urban/Developed	0.889	0.889	0.000
Allen Park	Riparian Woodland	--	1.254	1.254
	Riparian Vegetation (Woodland & Herb)	--	0.174	0.174
	Riparian Herbaceous	--	--	--
	Riverine (Concrete)	0.661	--	-0.661
	Riverine (Earthen)	--	--	--
	Urban/Developed	0.767	--	-0.767
Fish Transition Grading	Riparian Woodland	0.433	0.514	0.081
	Riparian Vegetation (Woodland & Herb)	--	0.012	0.012
	Riverine (Concrete)	0.094	0.03	-0.064
	Riverine (Earthen)	--	--	--
	Urban/Developed	0.12	0.091	-0.029

Alternative G: Top-of-bank floodwall/Allen Park Riparian Corridor/College of Marin Widening

Alternative G would have similar impacts to biological resources as Alternative A, and result in construction of approximately 4,016 linear feet of top-of-bank floodwalls in Unit 4 and a 48-foot setback wall to tie Corte Madera Creek to Sir Francis Drake Boulevard with a low vegetation zone on either side of the floodwall. The top-of-bank floodwalls would be 2 to 3 feet lower than for Alternative A, but still high enough to be a barrier for wildlife. Alternative G would have impacts similar to Alternative A within Unit 4 that would substantially impact biological resources. Improvements from the Allen Park Corridor and College of Marin Widening would partially offset these impacts.

Summary of Alternative G

Alternative G has a footprint that would directly affect a total of 16.73 acres, including 1.34 acres within riparian woodland, 11.16 acres of urban/developed land, and 3.44 acres of riverine (concrete-lined channel). Small amounts of eucalyptus woodland (0.38 acre), riverine (earthen-lined channel) (0.20 acre), and coastal brackish marsh (0.23 acre) at the downstream end of the Project would also be affected (Table 4.6-6). A total of 9.10 acres would result in long-term or permanent habitat modification. Approximately 4.07 acres of riverine (concrete-lined channel) would become a combination of riparian/herbaceous woodland, transitional freshwater marsh, and tidal marsh habitats, all with native surface channels. A net loss of 0.022 acre riparian woodland, 4.66 acres of urban/developed and 0.38 acres of eucalyptus woodland would occur. A loss of 0.647 acre of riparian woodland in Unit 4 would occur, However, Allen Park Riparian Corridor and College of Marin Widening would partially mitigate for the lost habitat. Remaining riparian woodland vegetation in Unit 4 would be fragmented. An increase of 2.84 acres riparian/herbaceous woodland, 1.25 acres of riparian herbaceous habitat, 2.06 acres of transitional freshwater marsh, and 1.18 acres of tidal marsh would occur as a result of College of Marin Widening of Allen Park Riparian Corridor. Because stream channels are linear features, habitat length along the stream was also calculated and included in Table 4.6-8. Alternative G would result in 1,451 feet of riparian woodland, 2,551 feet of riparian herbaceous/woodland, 1,144 feet of transitional freshwater marsh channel habitat, and 464 feet of tidal marsh, but much of the riparian woodland in Unit 4 would be converted to herbaceous vegetation from floodwall construction.

Table 4.6-9 reports a summary of habitat change for action alternatives. Impact BIO-1 (impacts to special-status species) would be ***significant and unavoidable*** because of adversely altered habitat resulting in higher stream temperatures within Unit 4 and downstream in Units 2 and 3. The increase in temperature is unknown, but is considered significant because stream temperatures already result in stressful conditions to salmonids. Loss of cover, food, and habitat diversity would contribute to adverse effects. The areal disturbance within the riparian corridor would likely have a significant impact to already degraded habitat for salmonids. Impact BIO-2 (impacts to sensitive habitat) would be ***significant and unavoidable*** because riparian woodland is a valuable, scarce habitat and its removal would adversely impact habitat that would require off-site mitigation, which would not be effective for multiple decades. Impact BIO-3 (impacts to protected wetlands) would be ***less than significant*** to downstream wetlands. Impact BIO-4 (impede wildlife movement) would be ***significant and unavoidable*** because increased velocities would likely contribute adversely to fish passage, despite improvements from fish ladder removal. Floodwalls would decrease wildlife movement between the stream and upland and reduce connectivity of ecosystems. Impact BIO-5 (conflict with local policy) would be ***less than significant*** because conflict with the policy would be addressed through mitigation and consideration of other long-term benefits of the Project.

TABLE 4.6-6 ALTERNATIVE G POTENTIAL HABITAT IMPACTS

Activity	Affected Habitat	Project Footprint (acres)	Future Condition (acres)	Habitat Change (acres)
Summary of Project Area	Coastal Brackish Marsh	0.232	0.221	-0.011
	Eucalyptus Woodland	0.382	--	-0.382
	Riparian Herbaceous	--	1.252	1.252
	Riparian Vegetation (Woodland & Herb)	--	2.841	2.841
	Riparian Woodland	1.341	1.292	-0.022
	Riverine (Concrete)	3.441	1.168	-2.273
	Riverine (Earthen)	0.197	0.197	0.000
	Tidal Marsh	--	1.195	1.195
	Transitional Freshwater Marsh	--	2.059	2.059
	Urban/Developed	11.165	6.506	-4.659
College of Marin Grading	Coastal Brackish Marsh	0.214	0.214	0.000
	Eucalyptus Woodland	0.293	--	-0.293
	Riparian Veg. (Woodland & Herb.)	--	2.187	2.187
	Riverine (Earthen)	0.197	0.197	0.000
	Riverine (Concrete)	2.038	--	-2.038
	Tidal Marsh	--	1.195	1.195
	Transitional Freshwater Marsh	--	2.059	2.059
	Urban/Developed	3.109	--	-3.109
Bench Excavation	Riverine (Concrete)	0.081	0.590	0.509
	Urban/Developed	0.509	--	-0.509

TABLE 4.6-6 ALTERNATIVE G POTENTIAL HABITAT IMPACTS				
Activity	Affected Habitat	Project Footprint (acres)	Future Condition (acres)	Habitat Change (acres)
Top of Bank Floodwalls	Coastal Brackish Marsh	0.018	0.007	-0.011
	Eucalyptus Woodland	0.089	--	-0.089
	Riparian Woodland	0.881	--	-0.881
	Riparian Herbaceous	--	1.244	1.244
	Riparian Veg. (Woodland & Herb)	--	0.007	0.007
	Riverine (Earthen)	--	--	--
	Riverine (Concrete)	0.556	0.537	-0.019
	Urban/Developed	4.828	4.576	-0.252
Retaining Walls	Coastal Brackish Marsh	--	--	--
	Eucalyptus Woodland	--	--	--
	Riverine (Earthen)	--	--	--
	Riverine (Concrete)	0.008	0.008	0.000
	Urban/Developed	0.907	0.907	0.000
Setback Floodwalls	Coastal Brackish Marsh	--	--	--
	Eucalyptus Woodland	--	--	--
	Riverine (Concrete)	0.003	0.003	0.000
	Urban/Developed	0.932	0.932	0.000
Allen Park	Riparian Woodland	--	1.239	1.239
	Riparian Veg. (Woodland & Herb)	--	0.174	0.174
	Riparian Herbaceous	--	0.008	0.008
	Riverine (Concrete)	0.661	--	-0.661
	Riverine (Earthen)	--	--	--
	Urban/Developed	0.760	--	-0.760
Fish Transition Grading	Riparian Woodland	0.433	0.053	-0.380
	Riparian Veg. (Woodland & Herb)	--	0.473	0.473
	Riverine (Concrete)	0.094	0.030	-0.064
	Riverine (Earthen)	--	--	--
	Urban/Developed	0.120	0.091	-0.029

Alternative J: Bypass/Allen Park Riparian Corridor/Top-of-bank Floodwall

Alternative J would include a bypass culvert to convey flood flow from the upstream portion of Unit 4 downstream to the Allen Park Riparian Corridor identical to Alternative F. The Allen Park Riparian Corridor would be the same as Alternative F, except setback walls around the park would have a 2-foot maximum height with a closure structure at the north park entrance.

Downstream of the Allen Park Riparian Corridor, Project actions would include floodwall construction near the Granton Park neighborhood and at College Avenue Bridge extending downstream approximately 933 feet. Effects to biological resources in Unit 4 continuing downstream through Allen Park Riparian Corridor would be identical to Alternative F. Effects from the top-of-bank floodwalls along the concrete channel would be limited to short sections on the left bank and impacts would have a lower magnitude than described for other alternatives. Because stream channels are linear features, habitat length along the stream was also calculated and included in Table 4.6-8. Alternative J would result in an increase of 671 feet of riparian woodland and 238 feet of riparian herbaceous/woodland by removing 909 feet of concrete lined channel.

Summary Impacts to Alternative J

Alternative J has a footprint that would directly affect a total of 4.80 acres, increasing 0.433 acre within riparian woodland, 3.16 acres of urban/developed land, and 1.21 acres of riverine (concrete-lined channel), see Table 4.6-7. A total of 2.08 acres would result in long term or permanent habitat modification. Approximately 2.08 acres of riverine (concrete-lined channel) would become a combination of riparian/herbaceous woodland, transitional freshwater marsh, and tidal marsh habitats, with native streambeds. A net loss of 4.66 acres of urban/developed and 2.27 acres riverine (concrete-lined channel) would occur. An increase of 1.35 acres riparian woodland, 0.21 acre of riparian/herbaceous woodland, and 0.52 acre of riparian herbaceous habitat would occur as a result from the Allen Park Riparian Corridor.

Table 4.6-9 reports a summary of habitat change for action alternatives. Impact BIO-1 (impacts to special-status species) would be ***less than significant*** in the short term, and ***beneficial*** in the long term. Impact BIO-2 (impacts to sensitive habitat) would be ***less than significant*** because riparian woodland is a valuable, scarce habitat and this alternative would leave riparian woodland vegetation intact in Unit 4 and increase quality habitat in the long-term. The Impact BIO-3 (impacts to protected wetlands) would be ***less than significant*** to downstream wetlands and could create wetland habitat. Impact BIO-4 (impede wildlife movement) would be ***less than significant*** because fish passage would be improved through a large portion of the Project area. Although floodwalls would decrease wildlife movement between the stream and upland in localized areas, connectivity would improve from the upstream extent of the fish ladder to the downstream end of Allen Park Corridor. The effect from Impact BIO-5 (conflict with local policy) is considered ***less than significant*** because removal of trees would result in creation of improved habitat and in the long term, more desirable tree species.

TABLE 4.6-7 ALTERNATIVE J POTENTIAL HABITAT IMPACTS

Activity	Affected Habitat	Project Footprint (acres)	Future Condition (acres)	Habitat Change (acres)
Summary of Project Area	Coastal Brackish Marsh	--	--	--
	Eucalyptus Woodland	--	--	--
	Riparian Herbaceous	--	0.521	0.521
	Riparian Vegetation (Woodland & Herb)	--	0.208	0.208
	Riparian Woodland	0.433	1.782	1.349
	Riverine (Concrete)	1.206	0.455	-0.751
	Riverine (Earthen)	--	--	--
	Tidal Marsh	--	--	--
	Transitional Freshwater Marsh	--	--	--
	Urban/Developed	3.163	1.836	-1.327

TABLE 4.6-7 ALTERNATIVE J POTENTIAL HABITAT IMPACTS				
Activity	**Affected Habitat**	**Project Footprint (acres)**	**Future Condition (acres)**	**Habitat Change (acres)**
Top of Bank Floodwalls	Coastal Brackish Marsh	--	--	--
	Eucalyptus Woodland	--	--	--
	Riparian Woodland	--	--	--
	Riparian Herbaceous	--	0.521	0.521
	Riparian Vegetation (Woodland & Herb)	--	0.105	0.105
	Riverine (Earthen)	--	--	--
	Riverine (Concrete)	0.53	0.425	-0.105
	Urban/Developed	2.266	1.745	-0.521
Allen Park	Riparian Woodland	--	1.257	1.257
	Riparian Vegetation (Woodland & Herb)	--	0.102	0.102
	Riparian Herbaceous	--	--	--
	Riverine (Concrete)	--	--	-0.582
	Riverine (Earthen)	--	--	--
	Urban/Developed	0.777	--	-0.777
Fish Transition Grading	Riparian Woodland	0.433	0.525	0.092
	Riparian Vegetation (Woodland & Herb)	--	0.001	0.001
	Riverine (Concrete)	0.094	0.03	-0.064
	Riverine (Earthen)	--	--	--
	Urban/Developed	0.12	0.091	-0.029

Table 4.6-8 display a summary of linear feet for stream corridor habitat that would result from each alternative. Table 4.6-9 displays a summary in acres of habitat change that would result from each action alternative.

TABLE 4.6-8 SUMMARY OF STREAM CORRIDOR HABITAT BY ALTERNATIVE						
Affected Habitat (linear feet)	**Alt A**	**Alt B**	**Alt F**	**Alt G**	**Alt J**	**No Action**
Riparian Woodland	854	1,098	2,702	1,451	2,696	2,025
Riverine (Concrete-Lined Channel)	5,125	2,449	1,620	1,620	4,296	5,205
Urban/ Developed	153	153	153	153	153	153
Riparian Vegetation (Woodland & Herb)	1,251	2,075	1,300	2,551	238	--
Transitional Freshwater Marsh	--	1,144	1,144	1,144	--	--
Tidal Marsh	--	464	464	464	--	--
Riverine (Earthen-Lined Channel)	72	72	72	72	72	72
Total	7,455	7,455	7,455	7,455	7,455	7,455

TABLE 4.6-9 SUMMARY OF HABITAT CHANGE					
Habitat	Alternative A (acres)	Alternative B (acres)	Alternative F (acres)	Alternative G (acres)	Alternative J (acres)
Coastal Brackish Marsh	--	-0.01	-0.01	-0.01	--
Eucalyptus Woodland	-0.12	-0.38	-0.38	-0.38	--
Riparian Herbaceous	+0.68	+0.49	+0.57	+1.25	+0.52
Riparian Veg. (Woodland & Herb)	+0.47	+2.66	+2.38	+2.84	+0.21
Riparian Woodland	-1.34	-1.03	+1.34	-0.02	+1.35
Riverine (Concrete)	+0.01	-1.32	-2.27	-2.27	-0.75
Riverine (Earthen)	--	+0.00	+0.00	+0.00	--
Tidal Marsh	--	+1.20	+1.20	+1.20	--
Transitional Freshwater Marsh	--	+2.06	+2.06	+2.06	--
Urban/Developed	+0.30	-3.66	-4.88	-4.66	-1.33

Mitigation Measures

Impact BIO-5 would require mitigation for Alternatives A, B, and G.

- **Impact BIO-5:** Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.

Construction would require removal of a substantial number of trees (not yet quantified). Trees would not be replanted at the Project area due to vegetation requirements near floodwalls (15 feet inland for top-of-bank floodwalls and 15 feet on either side for setback floodwalls) per USACE and Marin County requirements. Town of Ross Policy 1.2 seeks to protect and expand the tree canopy of Ross. Removal of riparian trees in Unit 4 as well as landscape trees in Units 2 and 3 would conflict with this policy. Alternatives A, B, and G would remove up to 0.4 acre of riparian woodland with substantial native trees and canopy in Unit 4. All alternatives would remove tree canopy along newly constructed floodwall downstream of the fish ladder. Therefore, the following mitigation measure would be implemented.

- **Mitigation BIO-1:** USACE and Marin County will plant trees in another area, as agreed in compliance with the Town of Ross and Marin County policies, to replace those trees removed during project construction. All trees to remain during construction within the grading area shall be protected and trimmed if necessary to ensure their trunks and/or limbs are not disturbed during construction. To mitigate for tree removal:

    For each tree to be removed, the Flood Control District shall plant a replacement tree of the same species or a suitable native species substitute, at a rate of one planting per tree removed or such other mitigation ratio requirements to be obtained from Marin County and/or Town of Ross recommendations (for heritage or protected trees), and ensure that replacement trees are planted within or in the vicinity of the Project sites to the maximum extent practicable, as follows:

        1) Trees shall be replaced within the first year after the completion of construction or as soon as possible after construction is completed.

        2) Selection of replacement sites and installation of replacement plantings shall be supervised by an arborist or biologist with experience in restoration. Irrigation of tree

plantings during the initial establishment period shall be provided as deemed necessary by an arborist or biologist.

Impacts to local policies or ordinances protecting biological resources for tree preservation would be ***less than significant*** with mitigation***.***

Effects to Special-Status Species and Selected Species Habitat

The following discussion addresses impacts to special-status species and selected species habitat, applicable to all action alternatives. For Alternatives A, B, and G Impacts BIO-1, BIO -2, and BIO-4 would be ***significant and unavoidable***. The no action alternative would be ***significant*** for BIO-1, BIO-2, and BIO-4.

AMMs would be required for every action alternative. AMM BIO-1, pre-construction surveys, and AMM-BIO-6, monitoring, and AMM-BIO-14, salmonid monitoring are key measures for protecting special-status species. If species are found, AMMs require that protocol specific to the species be followed and that the CFDW or NMFS be contacted for further guidance to minimize impact. AMMs would minimize impacts from construction for Impacts BIO-1, BIO-2, and BIO-4. Direct impacts from construction would not be significant; however, permanent or long-term effects from Alternatives A, B, and G would remain ***significant and unavoidable***.

Construction activities proposed for all action alternatives could adversely affect special-status species during construction; however, AMMs would minimize the risk of impacts to the extent possible. Temporary impacts anticipated for initial construction activities could result from disturbing sediments during floodwall construction, channel grading/widening, or bank/bench excavation activities.

Following Project construction and stabilization of disturbed soil, anadromous salmonid upstream passage would be improved by removal of the existing fish ladder and regrading of this reach to allow better access to the upper watershed (applies to all action alternatives). Alternatives A, B, and G include 5- to 9-foot tall top-of-bank floodwalls upstream of the existing fish ladder location. Most impacts would occur upstream of the Lagunitas Road Bridge where floodwalls would result in loss of riparian woodland that currently shades the creek and keeps water temperatures suitable for salmonids. Presence of continuous top-of-bank floodwalls would also reduce natural instream habitat for salmonids through Unit 4. This significant impact would be avoided by Alternatives F and J, which include a bypass culvert for this reach that results in no loss of riparian woodland in Unit 4, and that would reduce floodwater erosion of streambanks by diverting high flows.

Action alternatives F, G, and J include benefits associated with Allen Park Riparian Corridor that would remove 950 feet of concrete channel below the fish ladder and create a floodplain that would be revegetated with native riparian species. Allen Park Riparian Corridor would benefit migrating salmonids by providing resting areas and refugia from high flows, and would allow increased seepage of cool groundwater into the creek. The widening of the floodplain by the College of Marin (Alternatives B, F, and G) would also benefit migrating salmonids by providing refugia from high flows in Corte Madera Creek and increasing groundwater inflow. The no action alternative (Alternative I) would allow the existing fish ladder to further deteriorate, making it even more difficult for upstream migrating steelhead to ascend the ladder and gain access to upstream spawning and rearing habitat. The no action alternative would have a ***significant impact*** to the steelhead population of Corte Madera Creek. A summary of the benefits and adverse impact of the Project alternatives to anadromous salmonids (steelhead and coho salmon) are shown in Table 4.6-10.

Central California Steelhead

In-channel construction would take place during the dry season, between June 15 and October 15, when adults and most juveniles are unlikely to be present and would avoid interfering with adult spawning migrations or the outmigration of smolts. Implementation of the limited operating period would minimize the risk of individual steelhead being killed, injured, or displaced. This is particularly true for summer construction work downstream of the existing fish ladder where the concrete-lined channel offers little or no shelter for juvenile salmonids and water temperature becomes too warm to sustain salmonids. Construction activities in Corte Madera Creek upstream of the fish ladder, especially in the natural channel upstream of the Lagunitas Road Bridge, would require fish capture and relocation. This activity of fish removal is necessary but is regarded as a ***potentially significant impact*** to a protected species such as steelhead and coho salmon, because handling these fish is a form of harassment and mortality can occur from electrofishing.

TABLE 4.6-10 COMPARISON OF ANADROMOUS SALMONID IMPACTS BY PROJECT ALTERNATIVE[1]

Project Alternative	Beneficial Effects Features/Action	No Significant Effect/Action	Significant Adverse Effects Features/Action	Fisheries Assessment for Alternative
Alternative I	No Action		Fails to repair or remove deteriorating fish ladder	Adversely impacts adult steelhead/coho
Alternative A	Removes fish ladder	College Ave bridge culverts; Setback walls	Floodwalls in Unit 4	Adversely impacts salmonids by removing riparian woodland shade and increasing stream temperatures. Beneficial Project feature by removal of fish ladder.
Alternative B	Removes fish ladder; College of Marin widening	Bench excavation; College Ave bridge culverts; Setback walls	Floodwalls in Unit 4	Adversely impacts salmonids by removing riparian woodland shade and increasing stream temperatures. Beneficial Project feature by removal of fish ladder.
Alternative F	Removes fish ladder; Allen Park riparian corridor; Unit 4 bypass culvert; College of Marin widening	Bench excavation; College Ave bridge culverts; Setback walls	None	No negative features. Has 4 Project features beneficial to steelhead and coho salmon.

TABLE 4.6-10 COMPARISON OF ANADROMOUS SALMONID IMPACTS BY PROJECT ALTERNATIVE[1]				
Project Alternative	**Beneficial Effects Features/Action**	**No Significant Effect/Action**	**Significant Adverse Effects Features/Action**	**Fisheries Assessment for Alternative**
Alternative G	Removes fish ladder; Allen Park riparian corridor; College of Marin widening	Bench excavation; College Ave bridge culverts; Setback walls	Floodwalls in Unit 4	Adversely impacts salmonids by removing riparian woodland shade and increasing stream temperatures. Adversely impacts salmonids by removing riparian woodland shade and increasing stream temperatures. Beneficial Project feature by removal of fish ladder.
Alternative J	Removes fish ladder; Allen Park riparian corridor; Unit 4 bypass culvert	Top-of-bank floodwall	None	No negative features. Has 3 Project features beneficial to salmonids.

1. This impact assessment applies to both steelhead and coho salmon, although there is no viable population of coho salmon in Corte Madera Creek at present.

Permanent modifications are designed to benefit Central California steelhead by replacing an ineffective fish ladder with a smooth transition to facilitate fish passage and improve steelhead migration. The approximately 950 feet of regraded stream channel would be designed in consultation with NMFS to ensure adequate features, such as sufficient resting pools. Culverts would be installed with screens to prevent fish entrapment, which would also be designed in accordance with NMFS Fish Screening Criteria for Anadromous Salmonids (NMFS 1997, in USACE 2010). Alternatives A, B, and G include construction activities upstream of the Lagunitas Road Bridge that would change existing natural steelhead habitat in Unit 4. Unintentional introduction of sediment into the water from erosion or runoff and increased turbidity caused by construction activities could affect steelhead feeding rates and growth, increase mortality, cause behavioral avoidance, and reduce macroinvertebrate prey populations. The unintended introduction of petrochemicals associated with construction equipment (ex: refueling events, equipment servicing, and rupture of hydraulic lines from non-mobile construction equipment) could injure or kill steelhead and their macroinvertebrate prey populations. Temporary impacts could include loss of habitat, food sources, and cover during construction.

Coho Salmon

Within the Project area, the needs of any coho salmon that attempt to access Corte Madera Creek would be virtually the same as the access requirements for steelhead. Removal of the fish ladder and regrading this reach for anadromous salmonid passage would benefit coho salmon as well as steelhead. Alternatives F and J would be ***less than significant*** for coho salmon whereas Alternatives A, B, and G would be a ***significant impact*** to coho salmon as removal of shade trees would heat waters of the creek to levels stressful or unsuitable for salmonids.

Nesting Migratory Birds

Project construction could temporarily and permanently disturb nesting or foraging activities for protected nesting birds, including raptors and non-listed birds protected by the Migratory Bird Treaty Act. The Project would permanently remove bird habitat through tree removal activities. Alternatives A, B, and G would require removal of as much as 1.3 acres of riparian woodland, while Alternatives F and J would avoid this impact. Minimal tree removal would occur along Sir Francis Drake Boulevard. Most tees along this boulevard would be retained in Alternatives A and J.

The Project area provides regionally important nesting habitat for bird species that may be disturbed by construction activities to the point of not nesting in some otherwise suitable areas. Nesting birds are protected under the Migratory Bird Treaty Act. Direct impacts resulting from construction activity could include injury or mortality of individuals (e.g., destruction of active nests). Indirect impacts, such as disturbance of nesting birds outside the footprint, are also expected. Loss of active nests or chicks would be a significant impact.

Timing construction outside of the nesting season (approximately February 1 through August 31) would eliminate direct impacts to nesting birds. Construction activities occurring during the nesting season would require preconstruction surveys by a biologist to determine the presence of active nests and establish species-specific buffers around active nests until the young have fledged (AMM-BIO-1: Conduct Preconstruction Surveys). No construction would be allowed within the nest buffers. Removing vegetation within the Project area prior to the breeding season would reduce direct impacts to these species by preventing nesting within the construction footprint. AMMs would reduce impacts to nesting birds to ***less than significant.***

Western Pond Turtle

The Project alternatives could result in the loss and disturbance of western pond turtle and its habitat. Threats to California populations of western pond turtles include habitat loss and nesting failure. The Project is not likely to contribute to either permanent habitat loss or nesting failure as no suitable nesting habitat exists within the Project area and impacts to aquatic habitat used by the species would be temporary. AMMs would reduce the risk of impacts to western pond turtles to ***less than significant.***

Pallid Bat and Hoary Bat

Project alternatives could result in the disturbance of suitable roosting and nesting sites for CDFW SSC pallid and hoary bat species, specifically trees overhanging the creek. Disruption of suitable roosting and nesting sites would potentially have a temporary negative effect on bats. Permanent impacts would include loss of bat habitat from tree removal activities. Tree removal would be conducted in accordance with the Marin Countywide Plan and the Town of Ross General Plan regulations. AMMs would reduce the risk of impacts to bat species to the extent possible.

Table 4.6-11 summarizes impacts to biological resources.

TABLE 4.6-11 BIOLOGICAL RESOURCES IMPACT CONCLUSIONS

Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
BIO-1: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the NMFS, USFWS, and CDFW.	AMM-BIO-1 AMM-BIO-2 AMM-BIO-3 AMM-BIO-4 AMM-BIO-5 AMM-BIO-6 AMM-BIO-7 AMM-BIO-8 AMM-BIO-9 AMM-BIO-10 AMM-BIO-11 AMM-BIO-12 AMM-BIO-13 AMM-BIO-14 AMM-BIO-15	A, B, G	S	None Available	SU
		F, J	LTS	--	--
		No Action	S	--	--
BIO-2: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the NMFS, USFWS, and CDFW.		A, B, G	S	None Available	SU
		F, J	LTS	--	--
		No Action	S	--	--
BIO-3: Have a substantial adverse effect on federally protected wetlands as defined by Section 404 of the CWA (including, but not limited to, marsh, vernal pool, coastal, etc.) through direct removal, filling, hydrological interruption, or other means.		All Action Alternatives	LTS	--	--
		No Action	NI	--	--
BIO-4: Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.		A, B, G	S	None Available	SU
		F, J	LTS	--	--
		No Action	S	--	--
BIO-5: Conflict with any local policies or ordinances protecting biological resources, such as a tree preservation policy or ordinance.		A, B, G	S	MM-BIO-1	LTS
		F, J	LTS	--	--
		No Action	NI	--	--

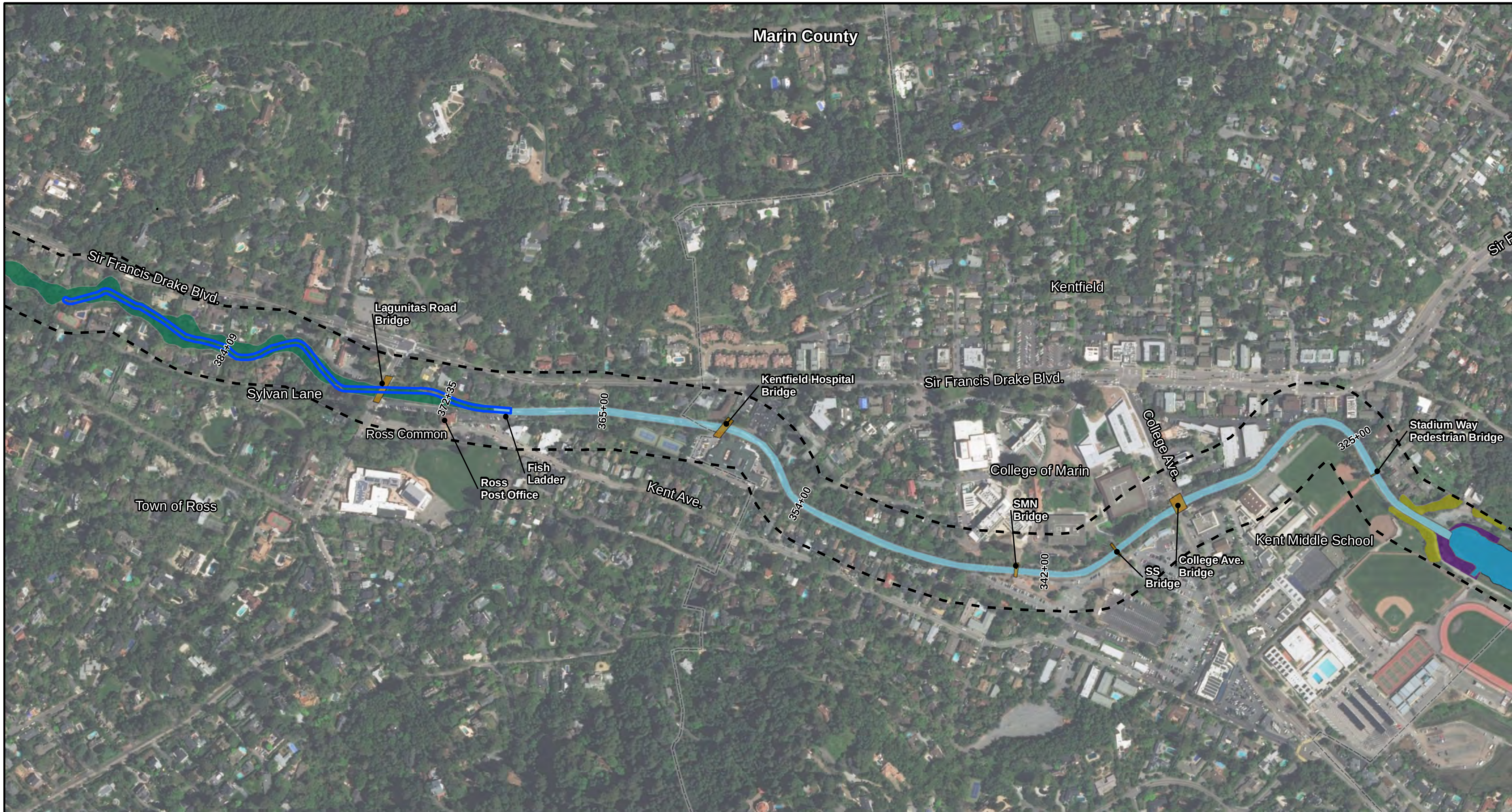
AMM = avoidance and minimization measure
LTS = less than significant
NI = no impact
S = significant
SU = significant and unavoidable

4.6.3.4 Cumulative Impacts

The foreseeable projects considered in the cumulative impacts analysis are shown in Table 4-2. Foreseeable projects most likely to have cumulative effects with the current Project include bridge replacements and development of flood diversion and storage basins upstream of the Project area, and rehabilitation of Sir Francis Drake Boulevard. The bridge replacements would likely not result in measurable impacts to water quality whereas fish passage would either be improved or not affected and would not result in cumulative effects. Bridge replacement would cause temporary disturbance to the stream and likely require dewatering of the channel and potentially relocating steelhead. This would be a temporary impact and unlikely to have a cumulative impact. The San Anselmo Flood Risk Reduction Project EIR found that development of the Nursery Site FDS basin in the upper San Anselmo Creek basin could have a significant impact on special status fish, amphibians, birds, bats, and sensitive habitats, but that these impacts could all be reduced to less than significant with application of specified mitigation measures. It is likely that the development of other flood diversion and storage basins under the Ross Valley Flood Protection and Watershed Program would have similar effects, but that these could also be reduced to less than significant with application of similar mitigation measures. Overall, the Ross Valley Watershed Program is intended to improve aquatic and riparian habitat, and is expected to have a net benefit on these resources. Therefore, these closely-related projects would not be expected to have adverse impacts to biological resources that could combine with those of the Project in a cumulative manner.

The Sir Francis Drake Boulevard Rehabilitation EIR similarly found that that project could have a significant impact on special status species and sensitive habitats, but that these impacts could all be reduced to less than significant. The residual impacts would not be expected to combine with biological resources impacts of the project to cause a significant cumulative impact.

In summary, while Alternatives A, B, and G would result in significant impacts to sensitive habitat and special status species, the cumulative projects identified in Table 4-2 would not have significant impacts of this kind, and would not combine with Project impacts in a cumulative manner. Alternatives F and J would result in improved conditions for biological resources and would not contribute to adverse cumulative impacts.



Habitat Type (Atkins, 2011)

- Coastal Brackish Wash
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Existing Features

- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
All non-shaded area within "Habitat Boundary" is considered "Urban/Developed".

0 250 500 1,000 Feet

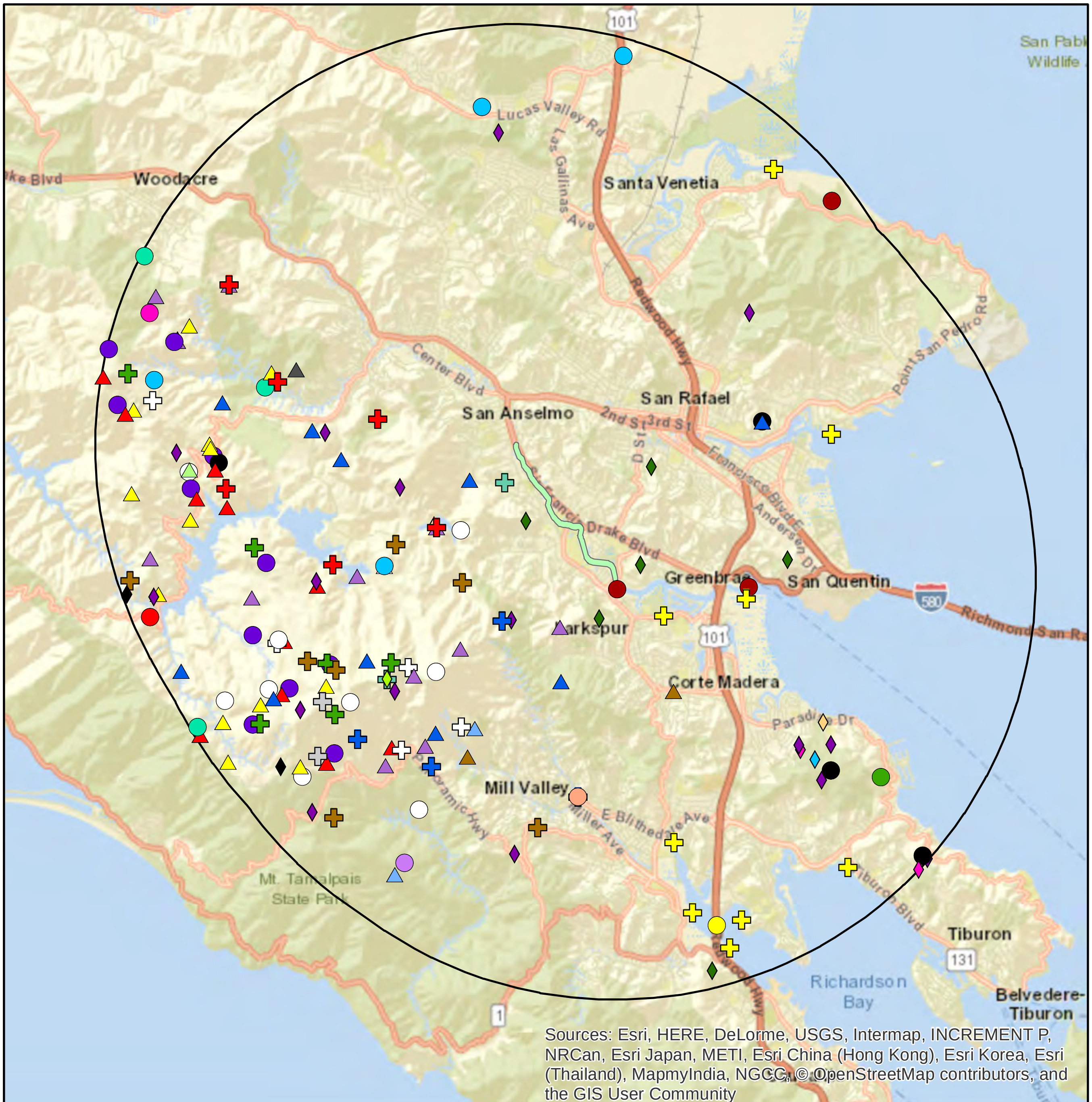
Date: 10/4/2018

Coordinate System: GCS_North American_1983
Projection: Lamber Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 1
Baseline Existing Habitat

Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Plants

- bent-flowered fiddleneck
- coastal triquetrella
- congested-headed hayfield tarplant
- dark-eyed gilia
- Diablo helianthella
- hairless popcornflower
- Marin checkerbloom
- Marin checker lily
- Marin County navarretia
- Marin knotweed
- Marin manzanita
- Marin western flax
- marsh microseris
- Mason's ceanothus
- minute pocket moss
- Mt. Tamalpais bristly jewelflower
- Mt. Tamalpais manzanita
- Mt. Tamalpais thistle
- Napa false indigo
- North Coast semaphore grass
- Point Reyes checkerbloom
- Point Reyes salty bird's-beak
- San Francisco Bay spineflower
- Santa Cruz microseris
- Santa Cruz tarplant
- small groundcone
- Tamalpais jewelflower
- Tamalpais lessingia
- Tamalpais oak
- thin-lobed horkelia
- Thurber's reed grass
- Tiburon buckwheat
- Tiburon mariposa-lily
- Tiburon paintbrush
- two-fork clover
- western leatherwood
- white-rayed pentachaeta
- Project Area
- Project Area 5 mile buffer

Figure 4.6-2a
CNDDB Plant Map
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

0 1 2 Miles

Date: 10/4/2018

Geographic Coordinate System: GCS_North_American_1983
Projectio: Transverse Mercator
Datum: North American 1983
Sources: USACE 2015; CNDDB September 2018; ESRI Data Server 2012.

Burleson Consulting, Inc.

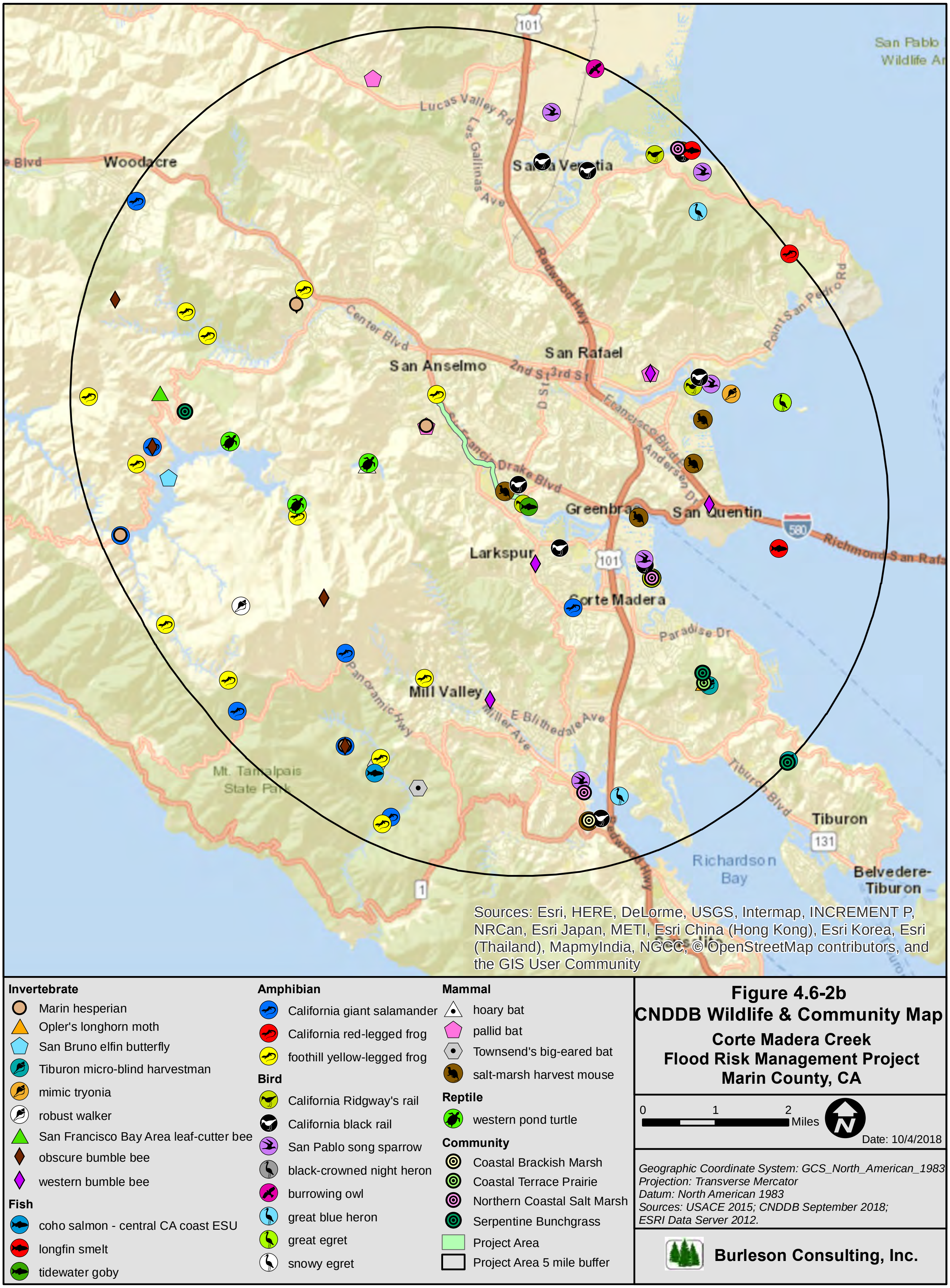
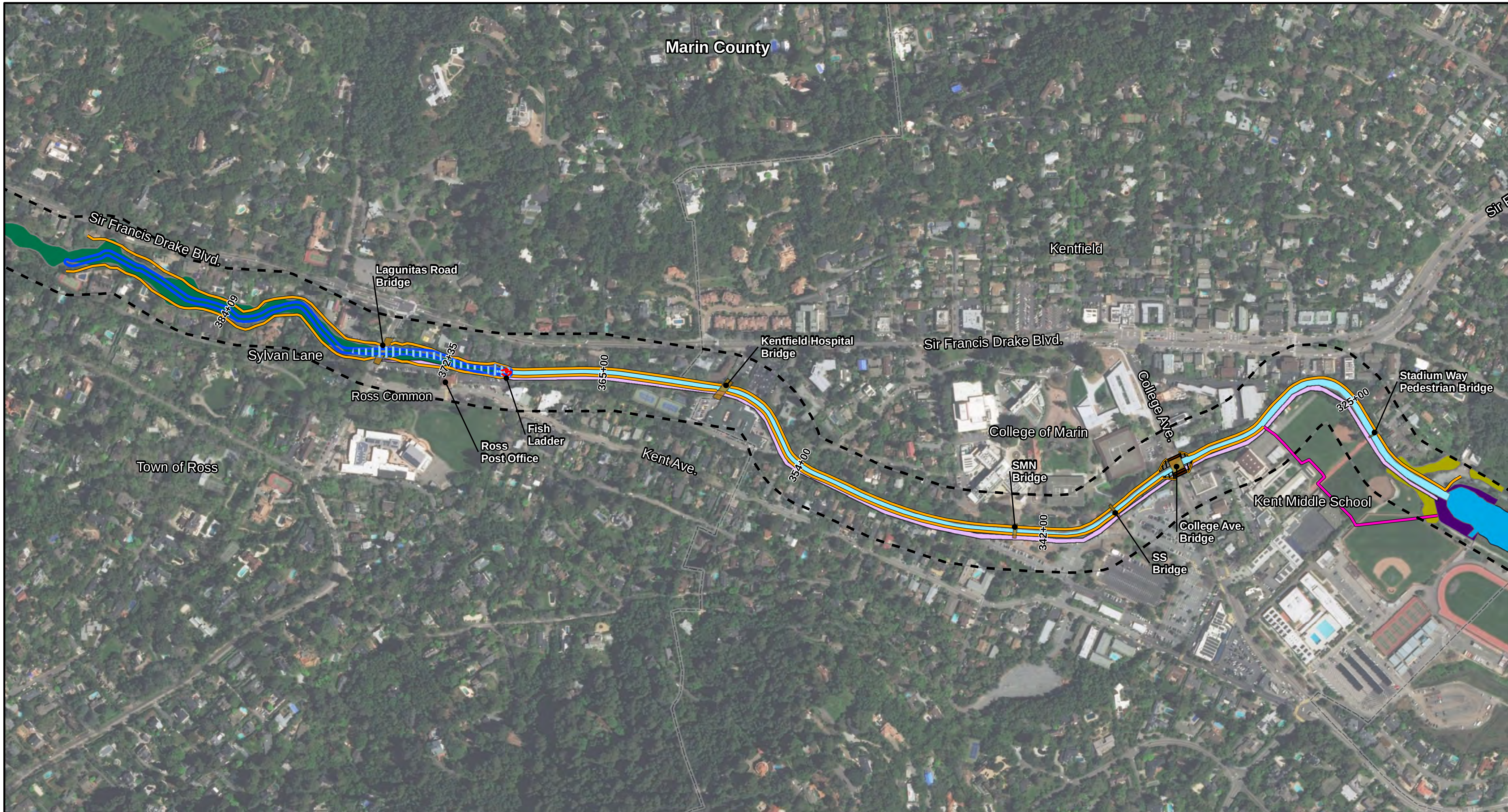


Figure 4.6-2b
CNDDB Wildlife & Community Map
Corte Madera Creek
Flood Risk Management Project
Marin County, CA
Woodacre
Santa Venetia
San Anselmo
San Rafael
Greenbrae
San Quentin
Larkspur
Corte Madera
Mill Valley
Tiburon
Belvedere-Tiburon
Richardson Bay
Mt. Tamalpais State Park
San Pablo Wildlife Ar
Lucas Valley Rd
Las Gallinas Ave
Redwood Hwy
Point San Pedro Rd
Center Blvd
2nd St
3rd St
D St
Francisco Blvd
Andersen Dr
Sir Francis Drake Blvd
Paradise Dr
Richmond San Rafa
Panoramic Hwy
E Blithedale Ave
Miller Ave
Tiburon Blvd
101
580
131
1
Sources: Esri, HERE, DeLorme, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), MapmyIndia, NGCC, © OpenStreetMap contributors, and the GIS User Community
Invertebrate
Marin hesperian
Opler's longhorn moth
San Bruno elfin butterfly
Tiburon micro-blind harvestman
mimic tryonia
robust walker
San Francisco Bay Area leaf-cutter bee
obscure bumble bee
western bumble bee
Fish
coho salmon - central CA coast ESU
longfin smelt
tidewater goby
Amphibian
California giant salamander
California red-legged frog
foothill yellow-legged frog
Bird
California Ridgway's rail
California black rail
San Pablo song sparrow
black-crowned night heron
burrowing owl
great blue heron
great egret
snowy egret
Mammal
hoary bat
pallid bat
Townsend's big-eared bat
salt-marsh harvest mouse
Reptile
western pond turtle
Community
Coastal Brackish Marsh
Coastal Terrace Prairie
Northern Coastal Salt Marsh
Serpentine Bunchgrass
Project Area
Project Area 5 mile buffer
0 1 2 Miles
Date: 10/4/2018
Geographic Coordinate System: GCS_North_American_1983
Projection: Transverse Mercator
Datum: North American 1983
Sources: USACE 2015; CNDDB September 2018; ESRI Data Server 2012.
Burleson Consulting, Inc.



Habitat Type (Atkins, 2011)

- Coastal Brackish Wash
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative A

- Floodwalls
- Setback Floodwalls
- Fish Passage Transition Grading
- Grading for Culverts
- College Ave Culverts
- Fish Ladder Removal

Existing Features

- Unit 4 Approximate Creek Boundary
- Bridges
- Existing Bike Lane

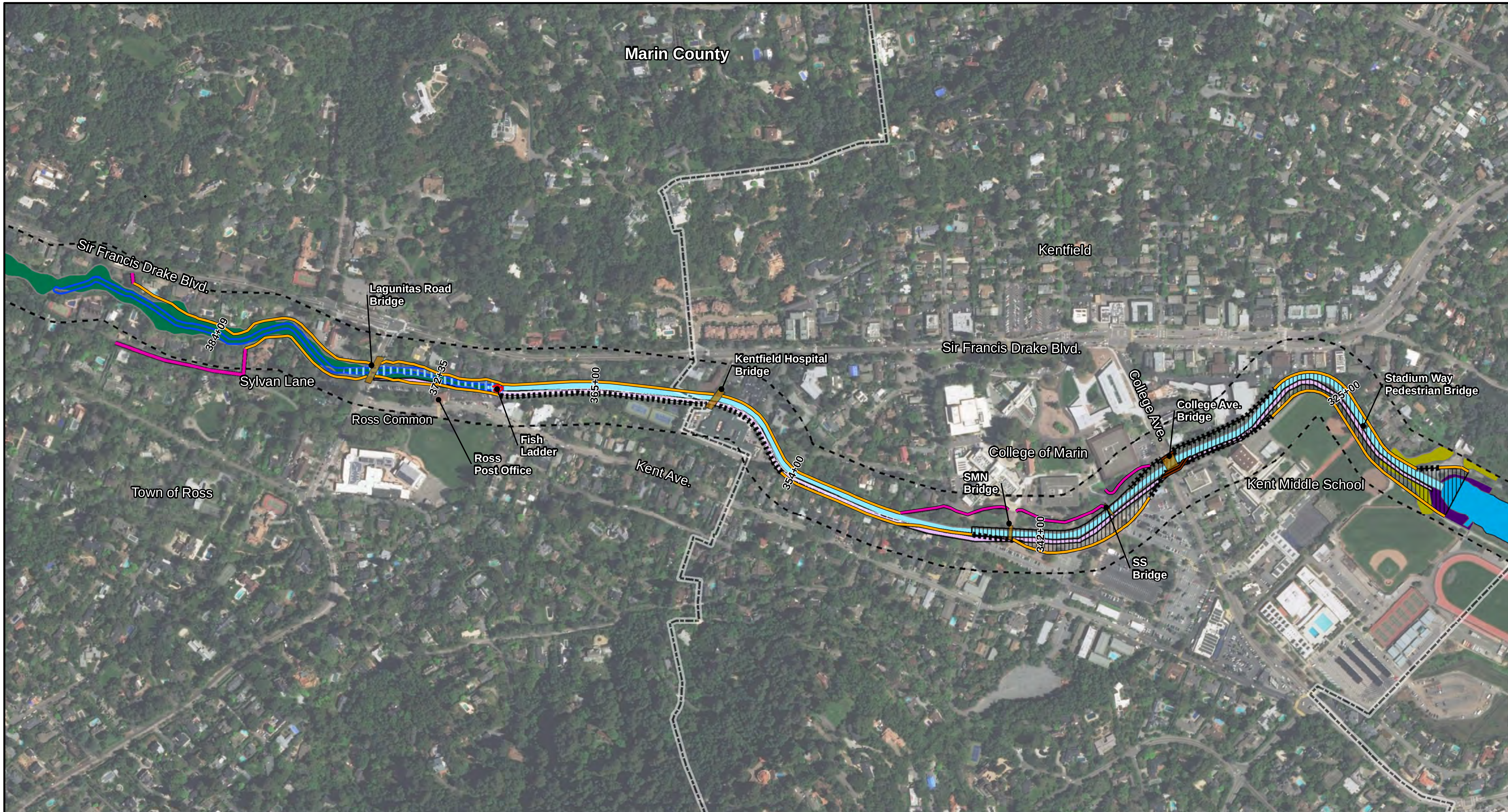
0 250 500 1,000 Feet

Date: 10/4/2018

Geographic Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Figure 4.6-3a
Alternative A - Existing Habitat Overview
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Types (Atkins, 2011)
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative B
- Retaining Walls
- Floodwalls
- Setback Floodwalls
- Bench Excavation
- Fish Passage Transition Grading
- College Ave Culverts
- Fish Ladder Removal
- Grading

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges
- Existing Bike Lane

0 250 500 1,000 Feet

Date: 10/4/2018

Geographic Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Figure 4.6-3b
Alternative B - Existing Habitat Overview
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

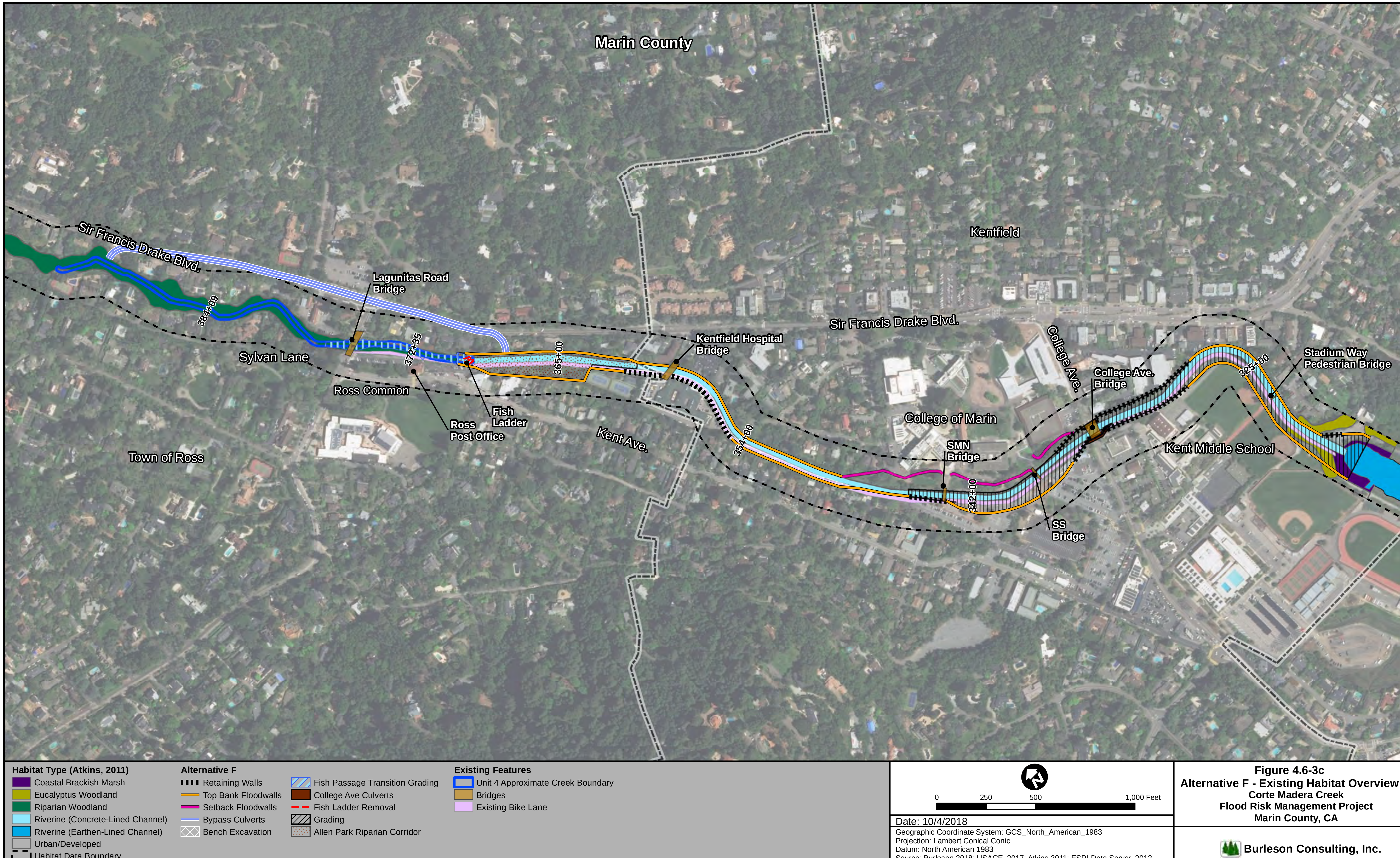
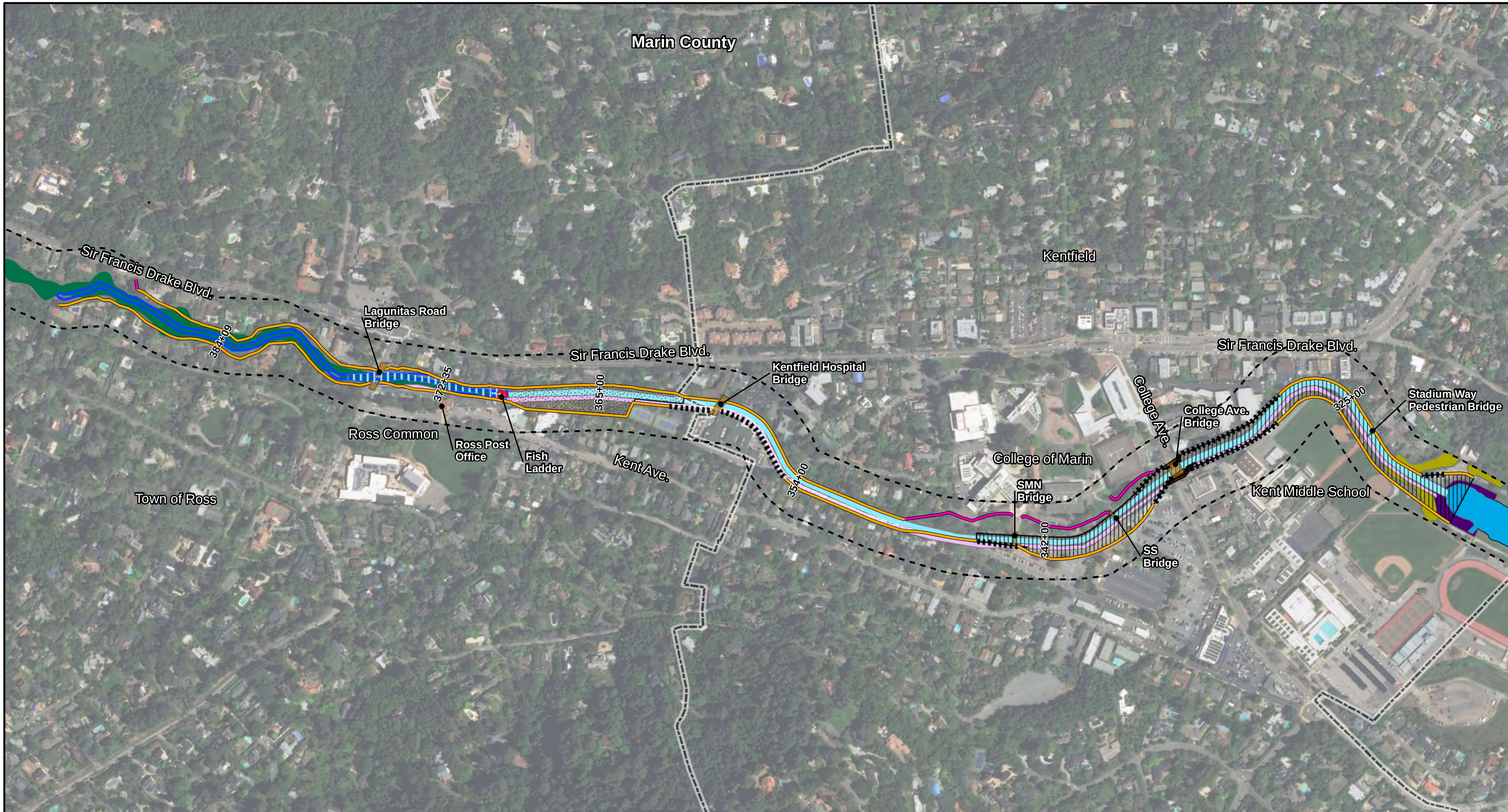


Figure 4.6-3c
Alternative F - Existing Habitat Overview
Corte Madera Creek
Flood Risk Management Project
Marin County, CA



Habitat Type (Atkins, 2011)

- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative G

- Retaining Walls
- Floodwalls
- Setback Floodwalls
- Bench Excavation
- Fish Passage Transition Grading
- College Ave Culverts
- Fish Ladder Removal
- Grading
- Allen Park Riparian Corridor

Existing Features

- Unit 4 Approximate Creek Boundary
- Bridges
- Existing Bike Lane

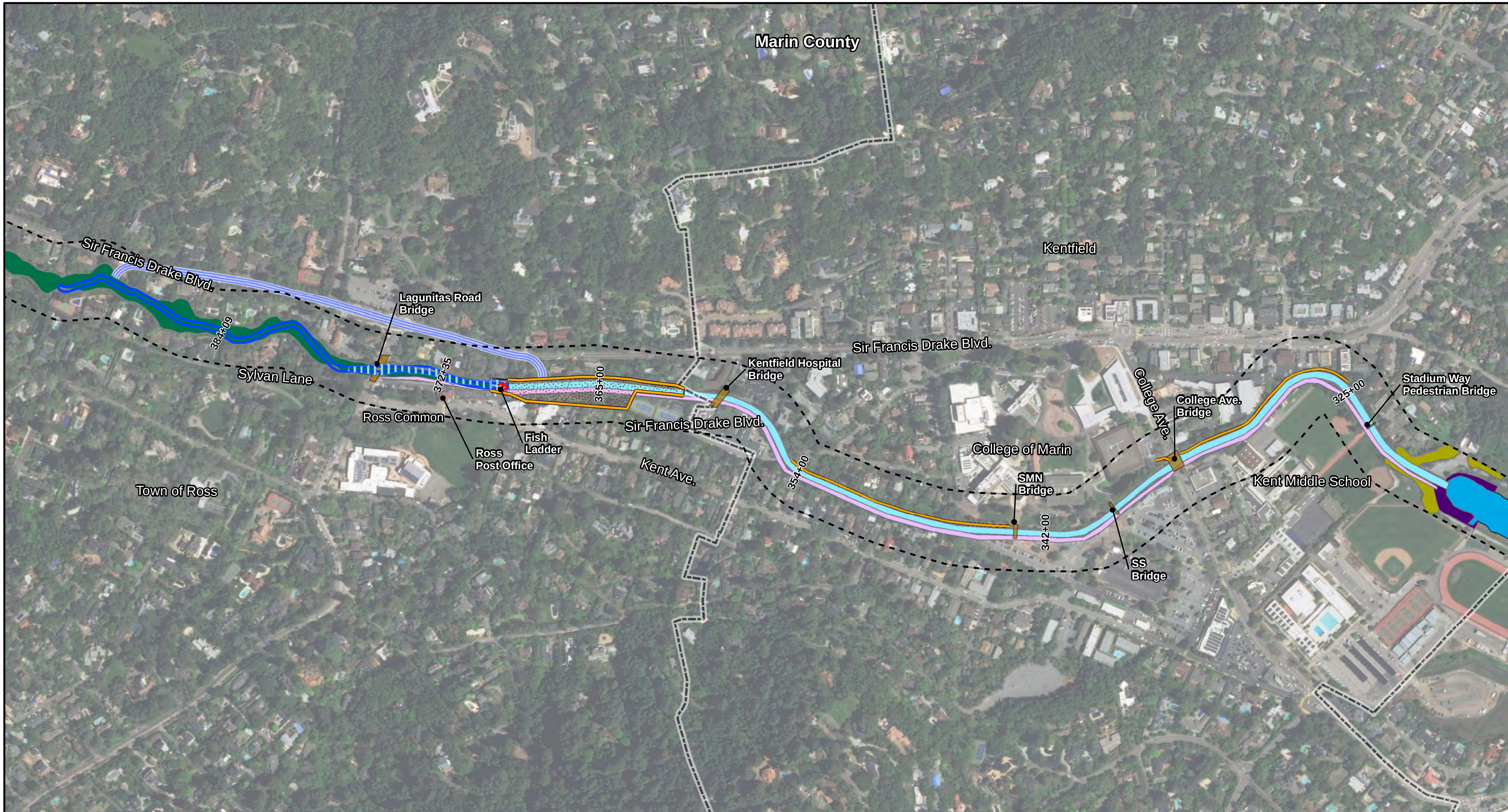
0 250 500 1,000 Feet

Date: 10/4/2018

Geographic Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Figure 4.6-3d
Alternative G - Existing Habitat Overview
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Type (Atkins, 2011)
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative J
- Floodwalls
- Bypass Culverts
- Fish Passage Transition Grading
- Fish Ladder Removal
- Allen Park Riparian Corridor

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges
- Existing Bike Lane

0 250 500 1,000 Feet

Date: 10/4/2018

Geographic Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Figure 4.6-3e
Alternative J - Existing Habitat Overview
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

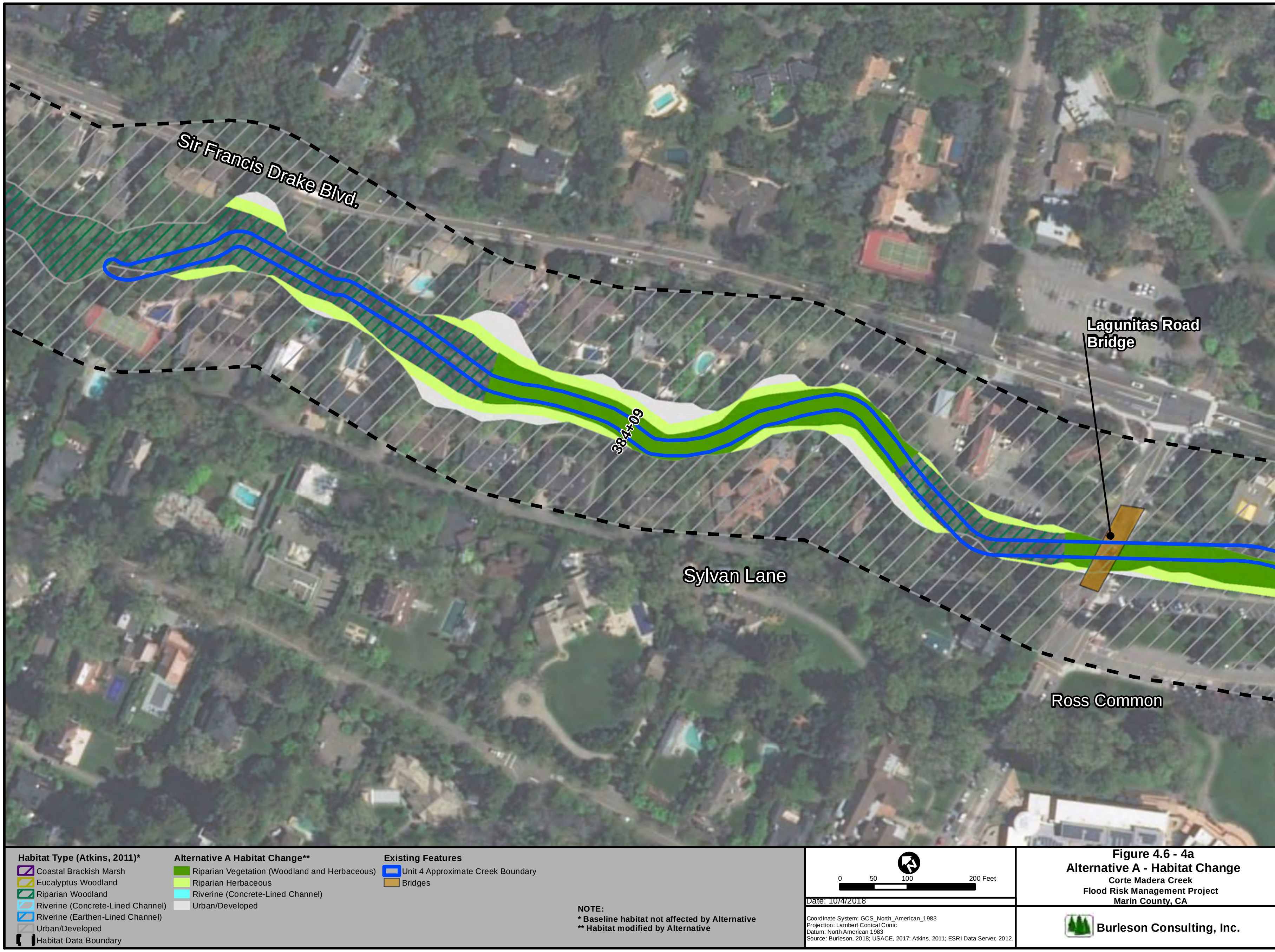
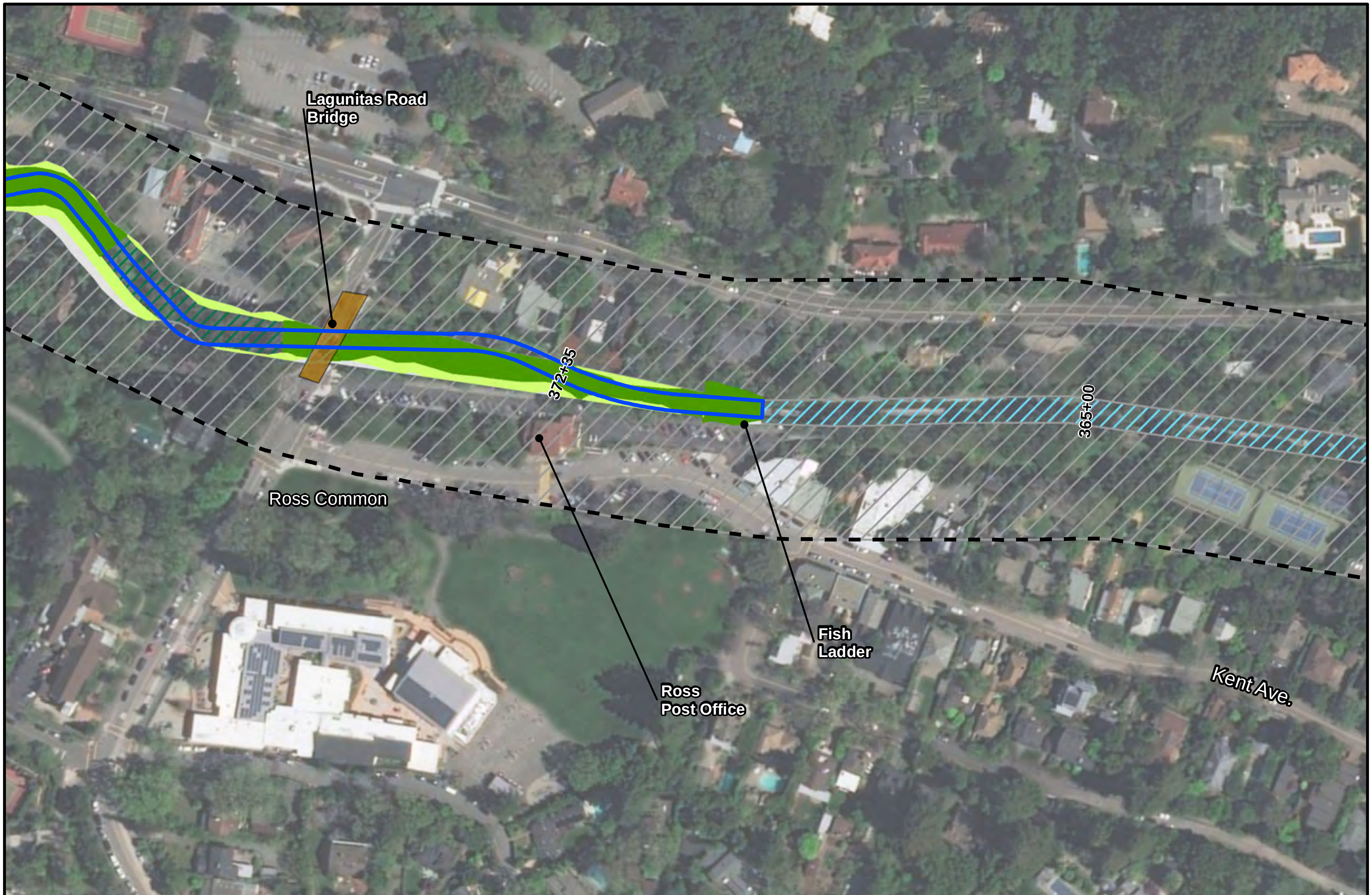


Figure 4.6 - 4a
Alternative A - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA



Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative A Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Herbaceous
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

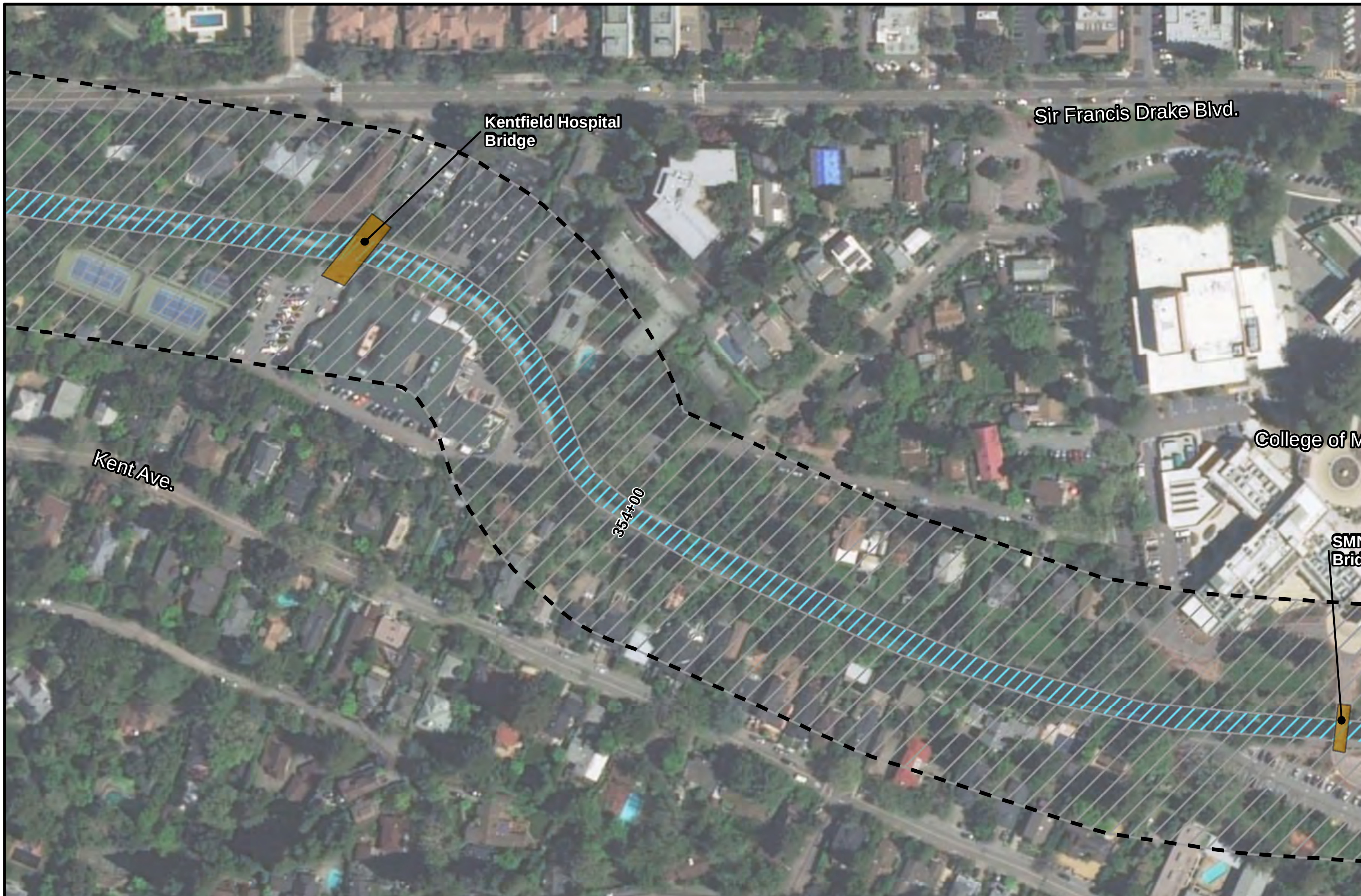
0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 4b
Alternative A - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative A Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Herbaceous
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

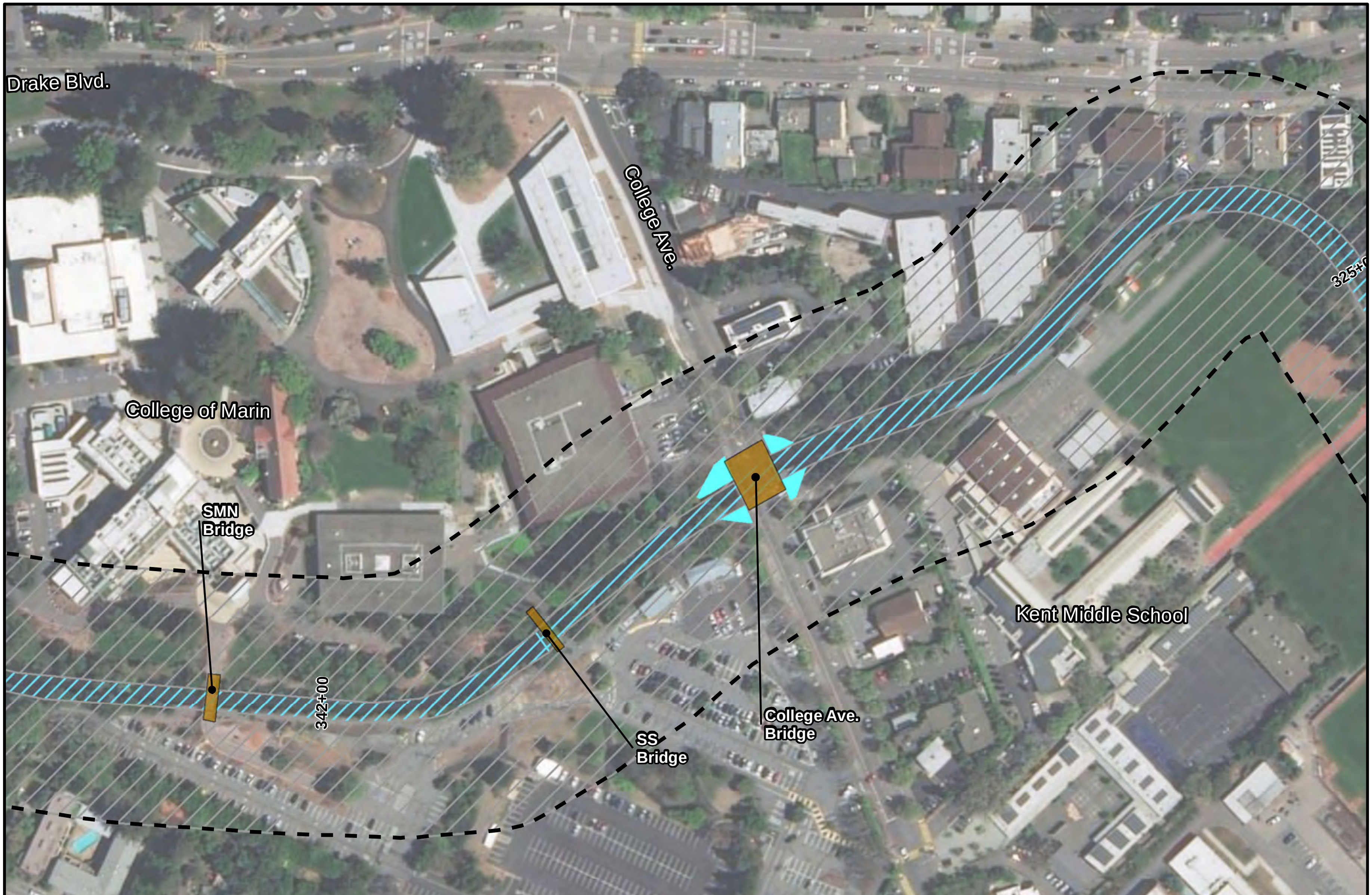
0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 4c
Alternative A - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative A Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Herbaceous
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

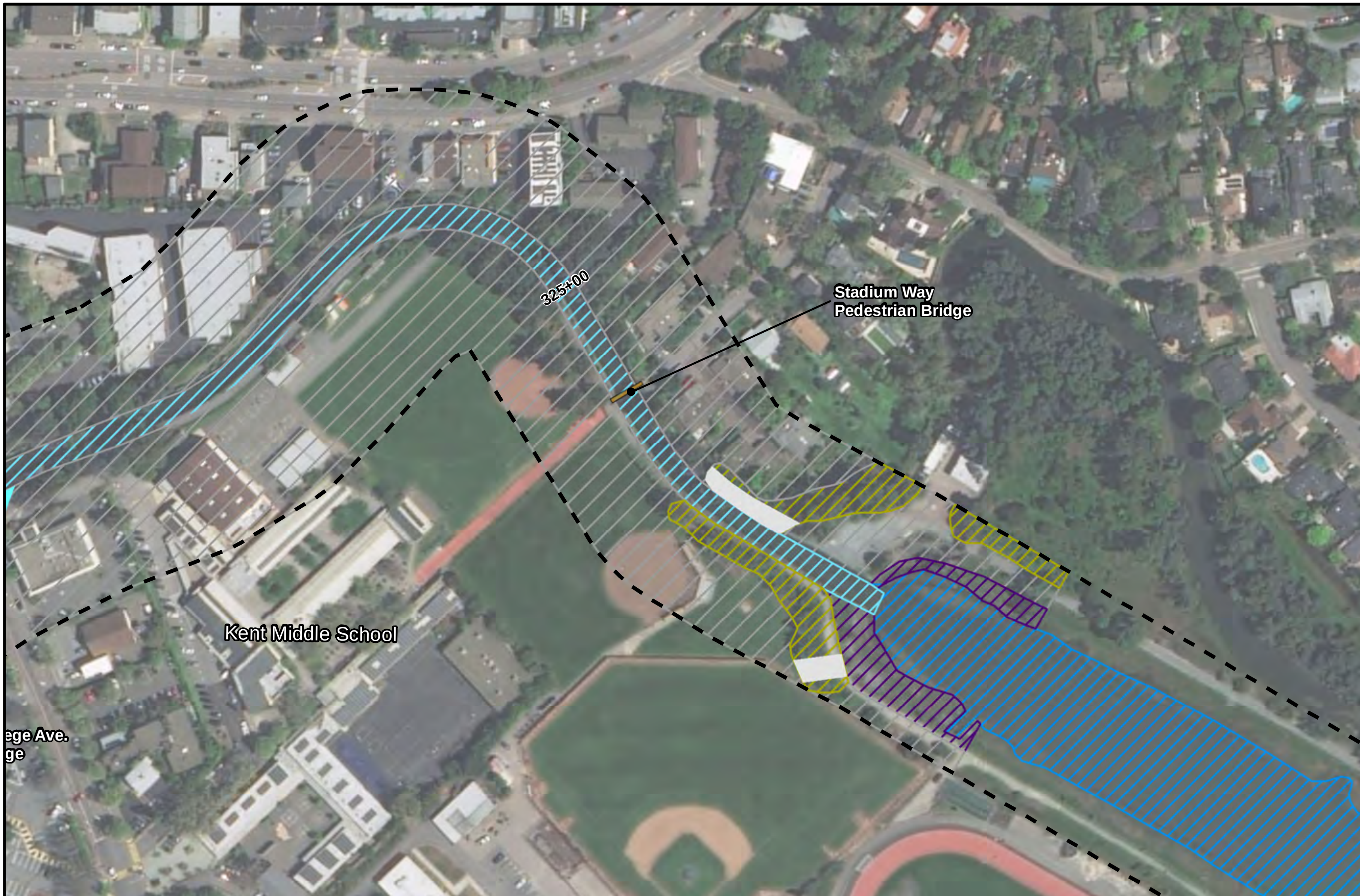
0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 4d
Alternative A - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative A Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Herbaceous
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 4e
Alternative A - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

Habitat Types (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative B Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Herbaceous
- Tidal Marsh
- Transitional Freshwater Marsh
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

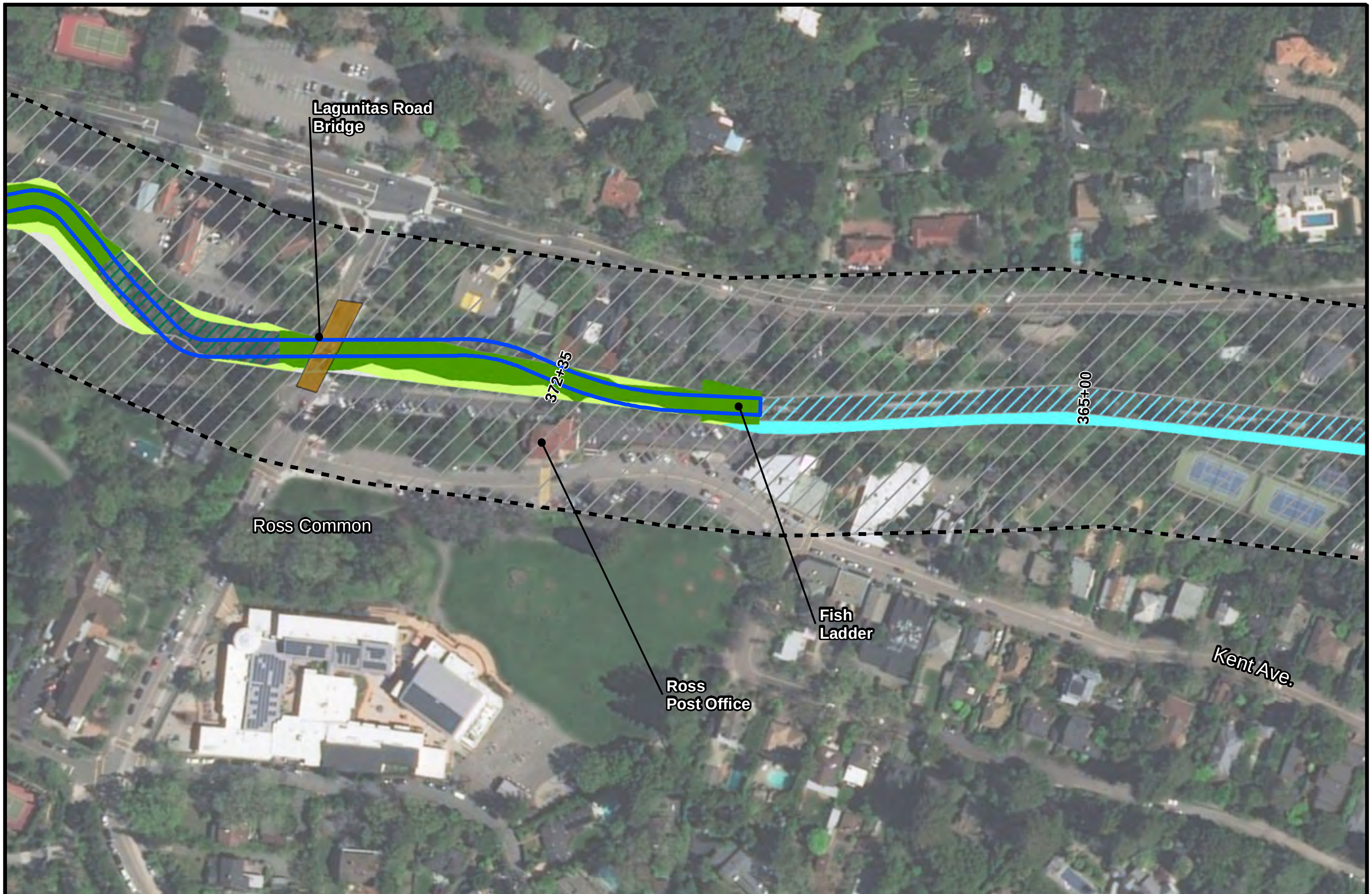
0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 5a
Alternative B - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Types (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative B Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Herbaceous
- Tidal Marsh
- Transitional Freshwater Marsh
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

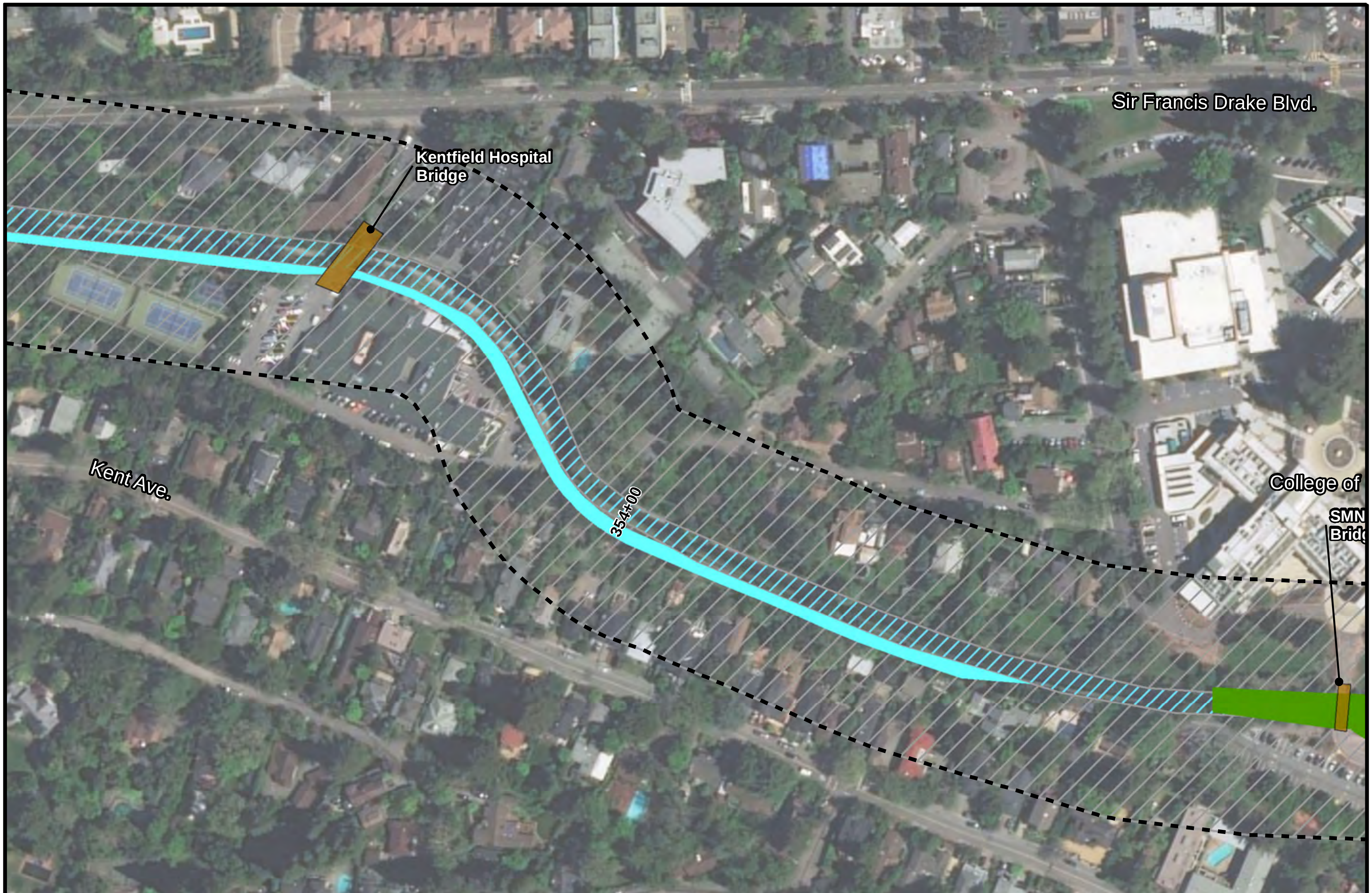
0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 5b
Alternative B - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Types (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative B Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Herbaceous
- Tidal Marsh
- Transitional Freshwater Marsh
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 5c
Alternative B - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

Habitat Types (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative B Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Herbaceous
- Tidal Marsh
- Transitional Freshwater Marsh
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

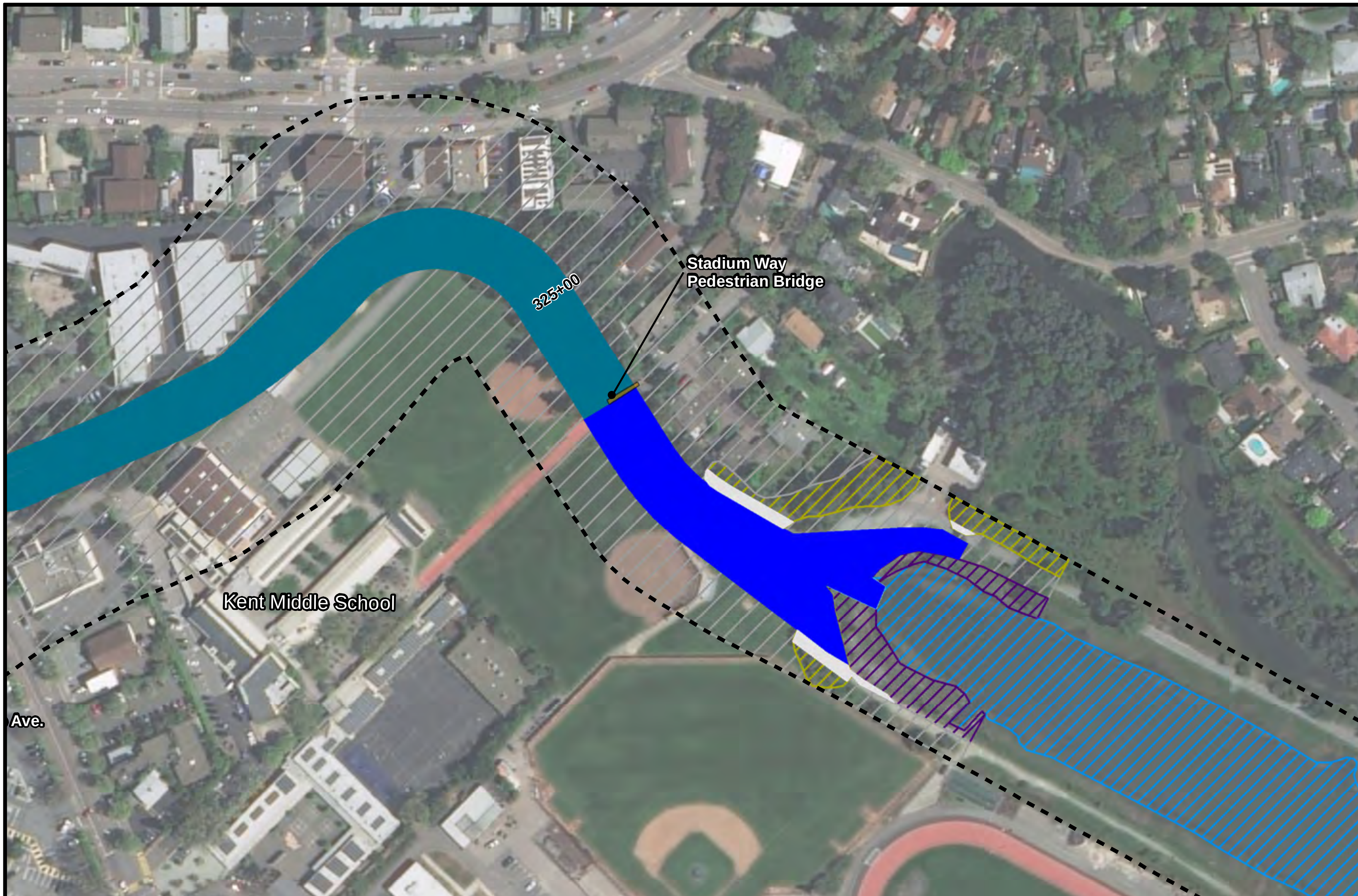
0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 5d
Alternative B - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Types (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative B Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Herbaceous
- Tidal Marsh
- Transitional Freshwater Marsh
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

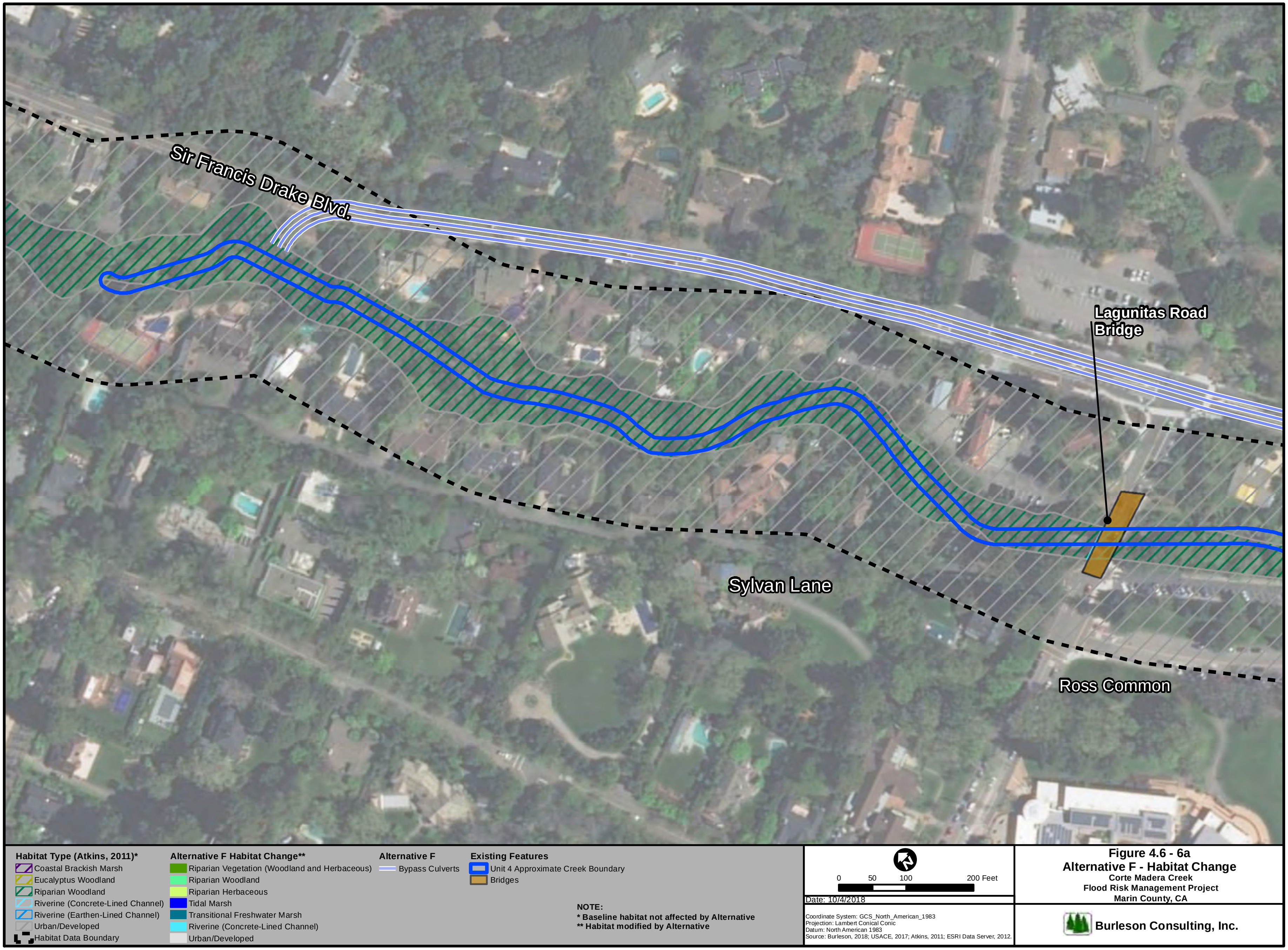
0 50 100 200 Feet

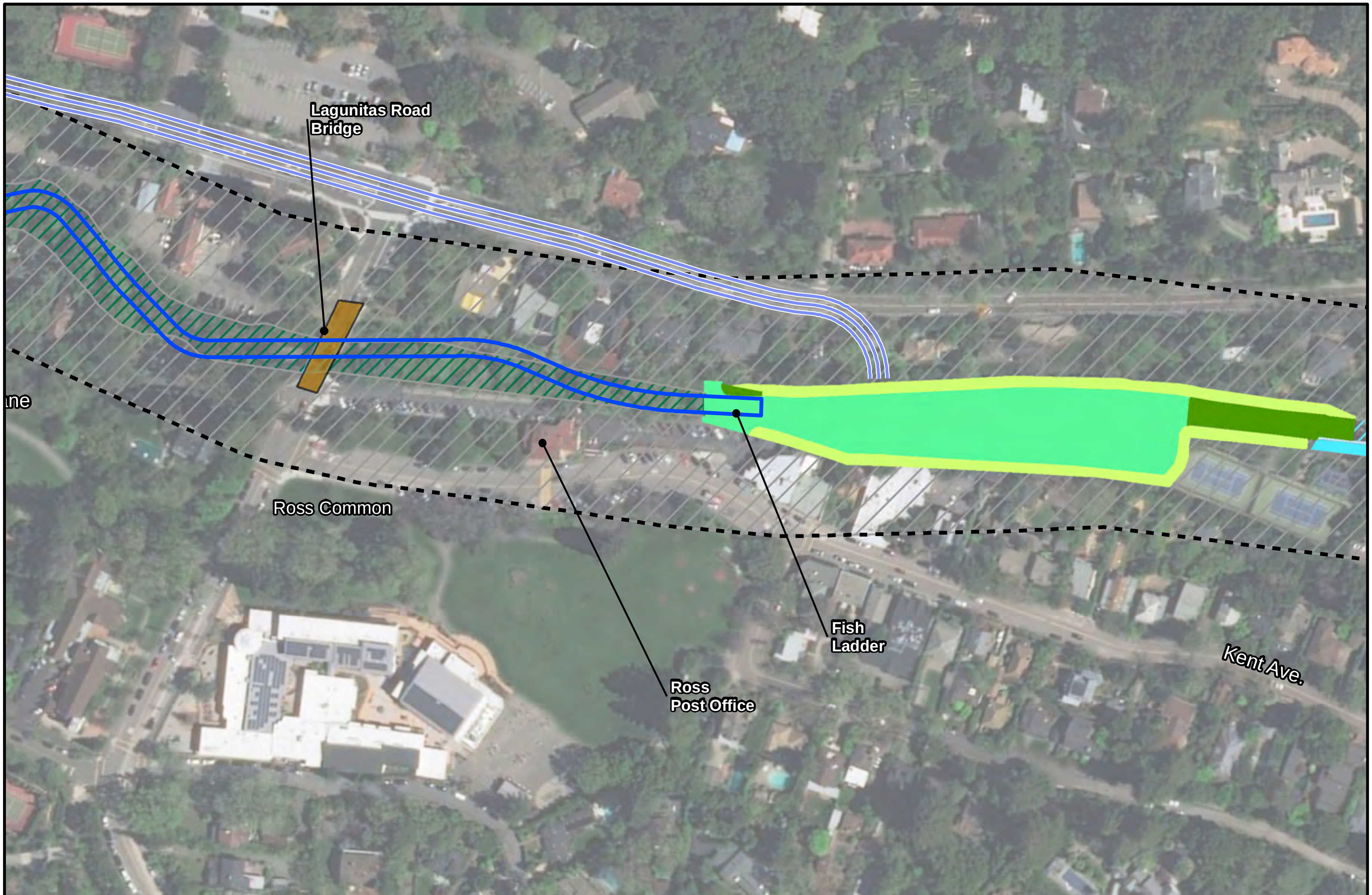
Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 5e
Alternative B - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.


Sir Francis Drake Blvd.
Lagunitas Road Bridge
Sylvan Lane
Ross Common
Habitat Type (Atkins, 2011)*
Coastal Brackish Marsh
Eucalyptus Woodland
Riparian Woodland
Riverine (Concrete-Lined Channel)
Riverine (Earthen-Lined Channel)
Urban/Developed
Habitat Data Boundary
Alternative F Habitat Change**
Riparian Vegetation (Woodland and Herbaceous)
Riparian Woodland
Riparian Herbaceous
Tidal Marsh
Transitional Freshwater Marsh
Riverine (Concrete-Lined Channel)
Urban/Developed
Alternative F
Bypass Culverts
Existing Features
Unit 4 Approximate Creek Boundary
Bridges
NOTE:
* Baseline habitat not affected by Alternative
** Habitat modified by Alternative
0 50 100 200 Feet
Date: 10/4/2018
Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.
Figure 4.6 - 6a
Alternative F - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA
Burleson Consulting, Inc.



Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative F Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Woodland
- Riparian Herbaceous
- Tidal Marsh
- Transitional Freshwater Marsh
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Alternative F
- Bypass Culverts

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
* Baseline habitat not affected by Alternative
** Habitat modified by Alternative

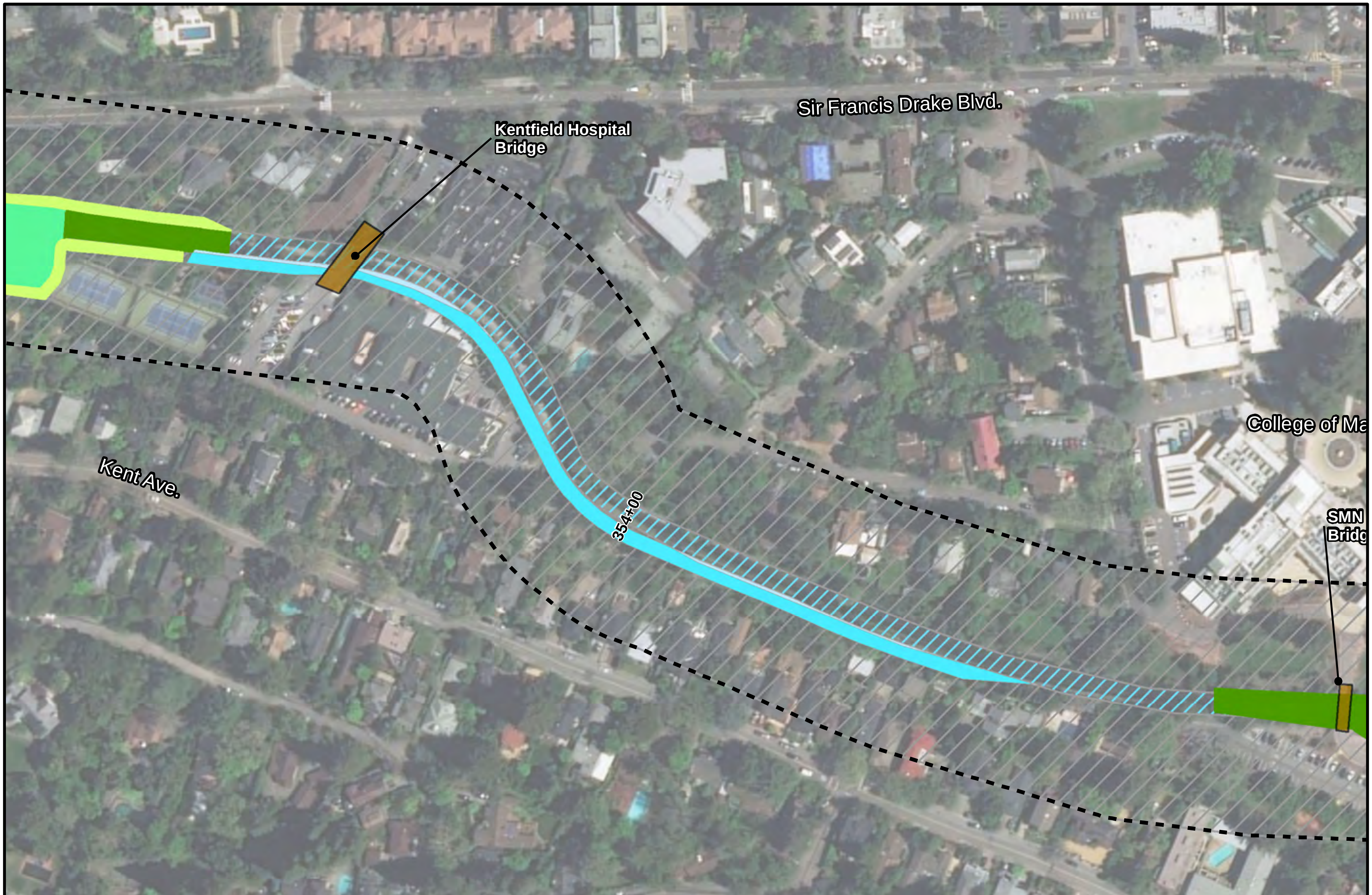
0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 6b
Alternative F - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative F Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Woodland
- Riparian Herbaceous
- Tidal Marsh
- Transitional Freshwater Marsh
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Alternative F
- Bypass Culverts

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
* Baseline habitat not affected by Alternative
** Habitat modified by Alternative

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 6c
Alternative F - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative F Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Woodland
- Riparian Herbaceous
- Tidal Marsh
- Transitional Freshwater Marsh
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Alternative F
- Bypass Culverts

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

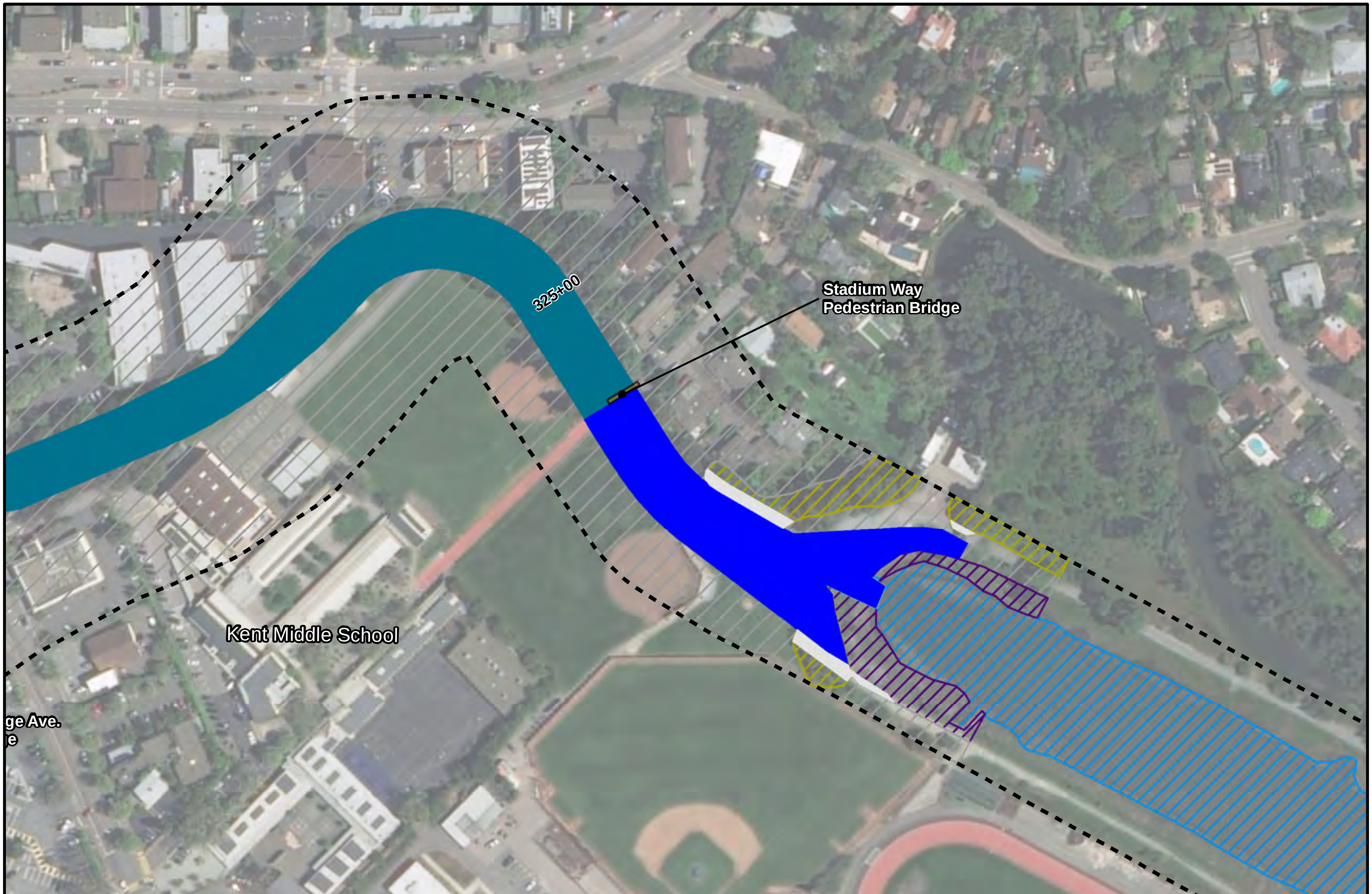
0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 6d
Alternative F - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative F Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Woodland
- Riparian Herbaceous
- Tidal Marsh
- Transitional Freshwater Marsh
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Alternative F
- Bypass Culverts

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 6e
Alternative F - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative G Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Herbaceous
- Riparian Woodland
- Tidal Marsh
- Transitional Freshwater Marsh
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

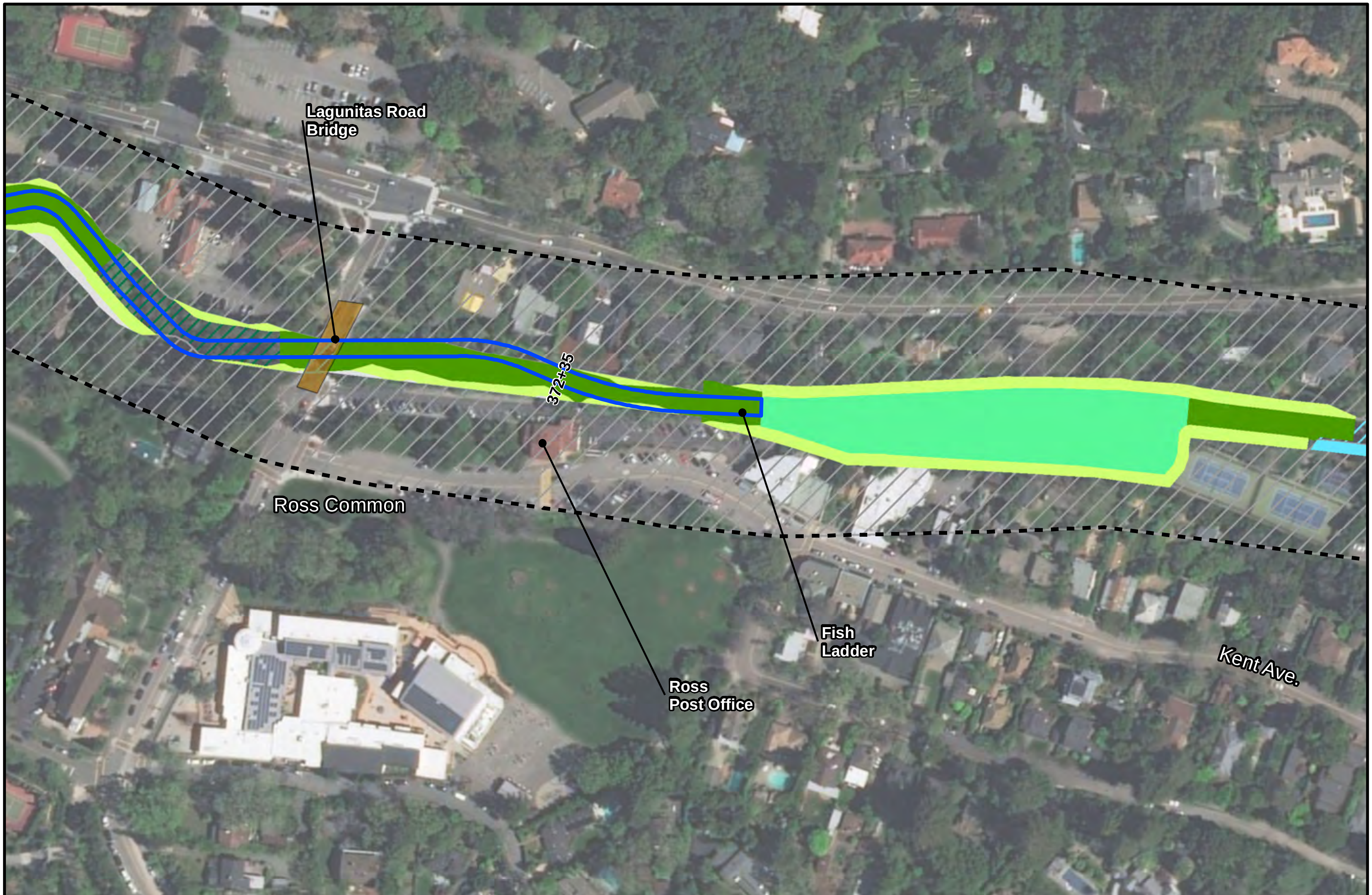
0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 7a
Alternative G - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative G Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Herbaceous
- Riparian Woodland
- Tidal Marsh
- Transitional Freshwater Marsh
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

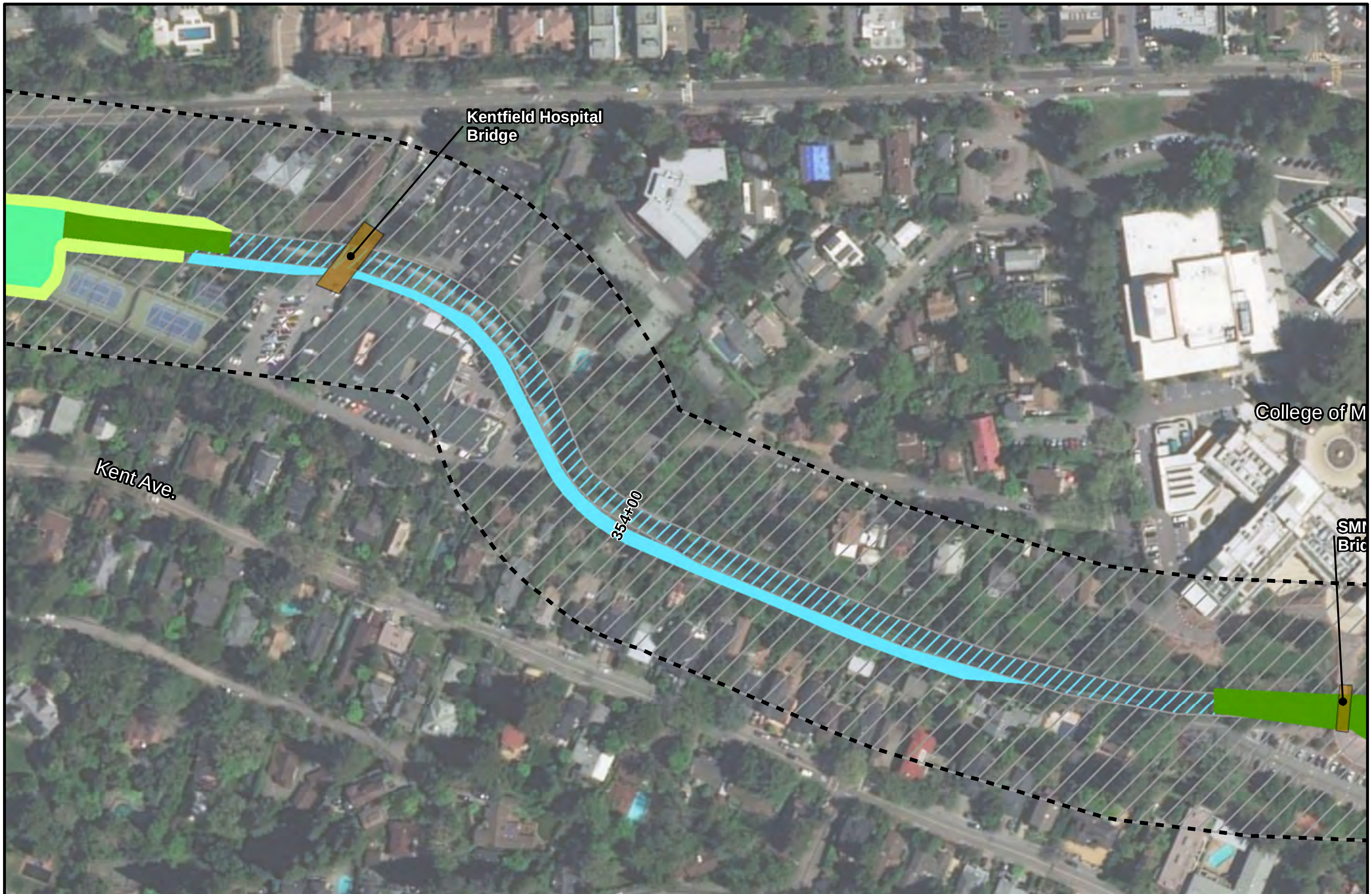
0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 7b
Alternative G - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative G Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Herbaceous
- Riparian Woodland
- Tidal Marsh
- Transitional Freshwater Marsh
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 7c
Alternative G - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative G Habitat Change**
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Herbaceous
- Riparian Woodland
- Tidal Marsh
- Transitional Freshwater Marsh
- Riverine (Concrete-Lined Channel)
- Urban/Developed

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

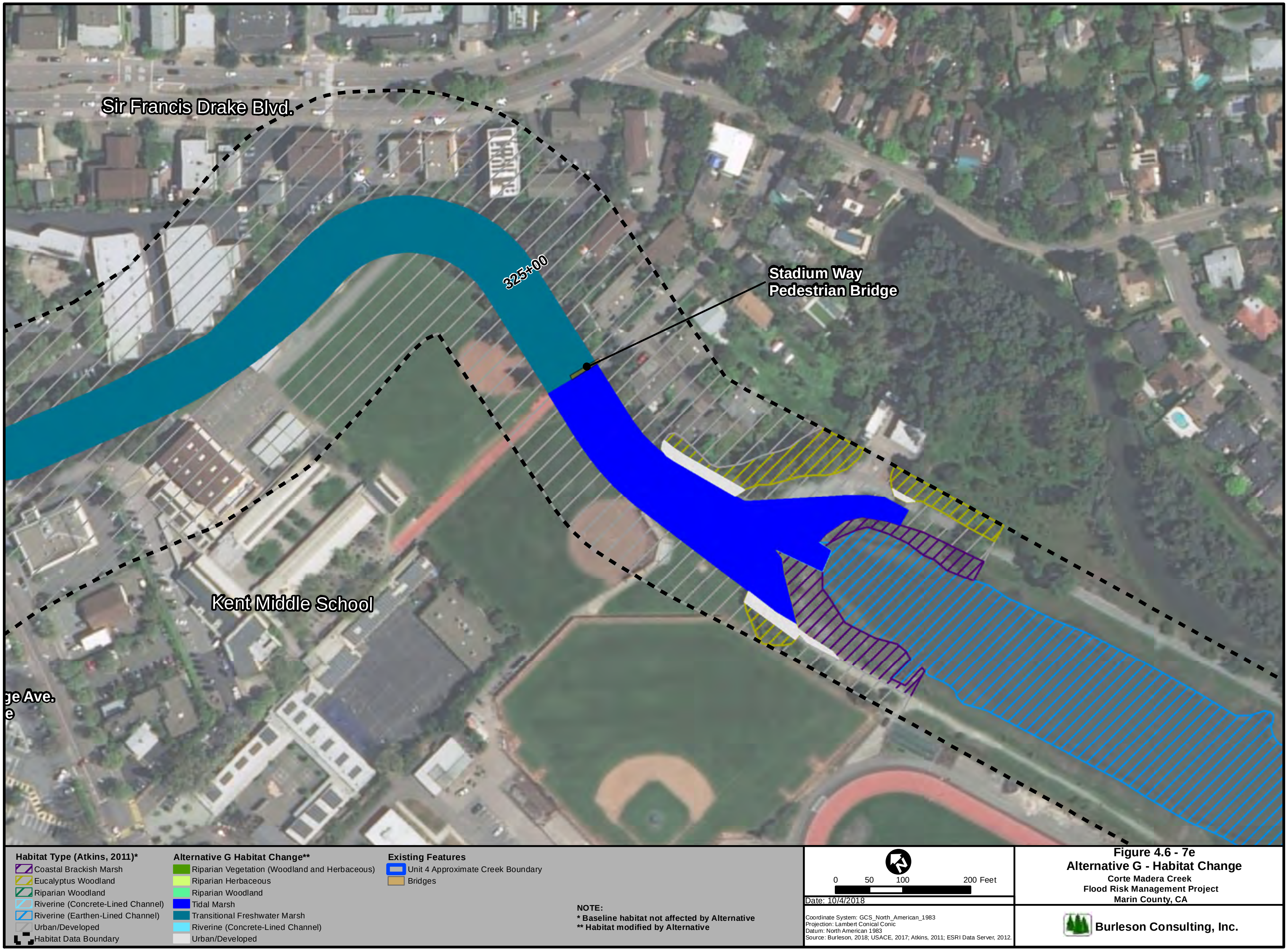
0 50 100 200 Feet

Date: 10/4/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 7d
Alternative G - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.


Sir Francis Drake Blvd.
325+00
Stadium Way
Pedestrian Bridge
Kent Middle School
ge Ave.
e
Habitat Type (Atkins, 2011)*
Coastal Brackish Marsh
Eucalyptus Woodland
Riparian Woodland
Riverine (Concrete-Lined Channel)
Riverine (Earthen-Lined Channel)
Urban/Developed
Habitat Data Boundary
Alternative G Habitat Change**
Riparian Vegetation (Woodland and Herbaceous)
Riparian Herbaceous
Riparian Woodland
Tidal Marsh
Transitional Freshwater Marsh
Riverine (Concrete-Lined Channel)
Urban/Developed
Existing Features
Unit 4 Approximate Creek Boundary
Bridges
NOTE:
* Baseline habitat not affected by Alternative
** Habitat modified by Alternative
0 50 100 200 Feet
Date: 10/4/2018
Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.
Figure 4.6 - 7e
Alternative G - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA
Burleson Consulting, Inc.

Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative J Habitat Change**
- Riparian Herbaceous
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Woodland

Alternative J
- Bypass Culverts

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

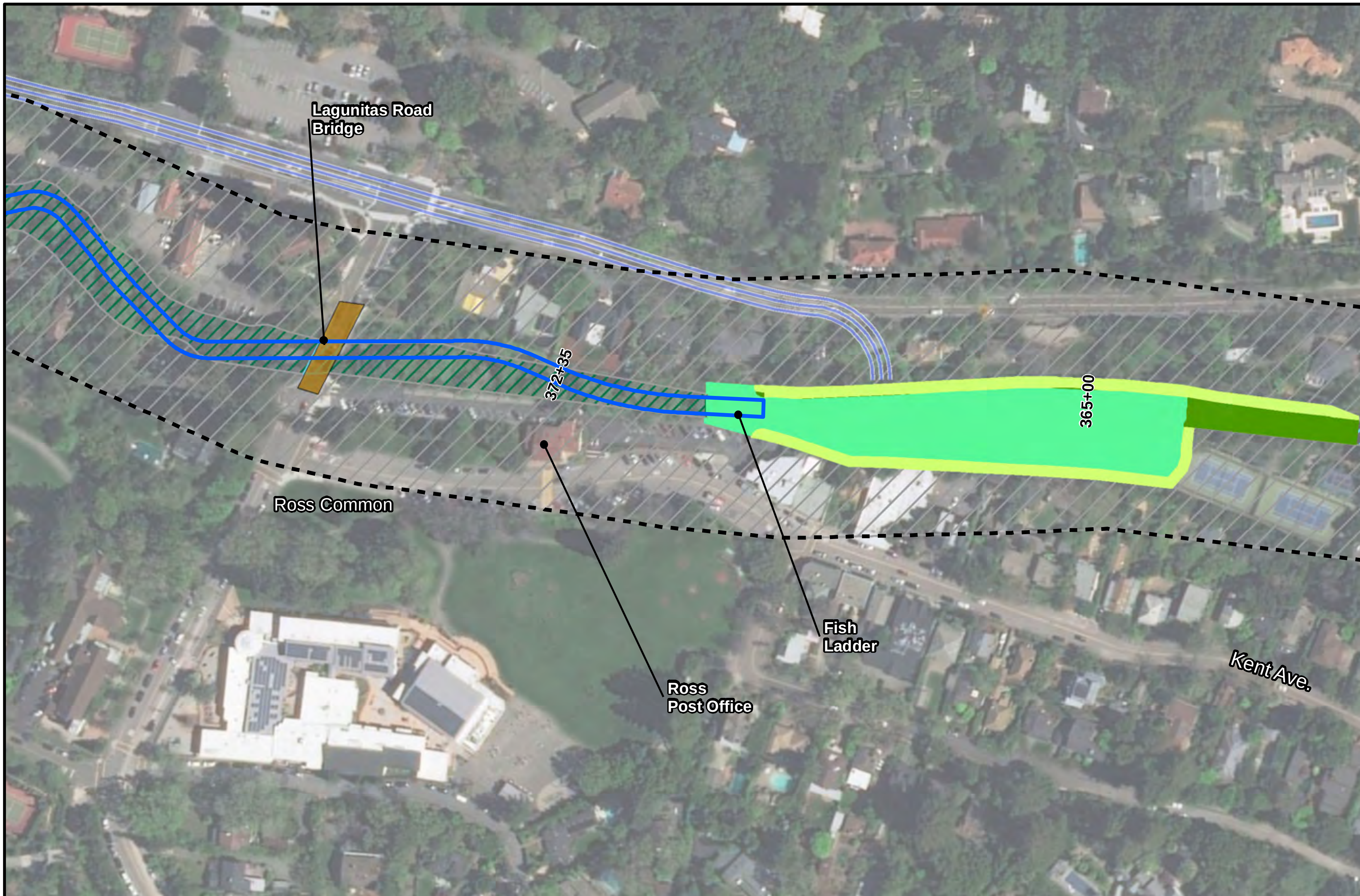
0 50 100 200 Feet

Date: 10/3/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 8a
Alternative J - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative J Habitat Change**
- Riparian Herbaceous
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Woodland

Alternative J
- Bypass Culverts

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

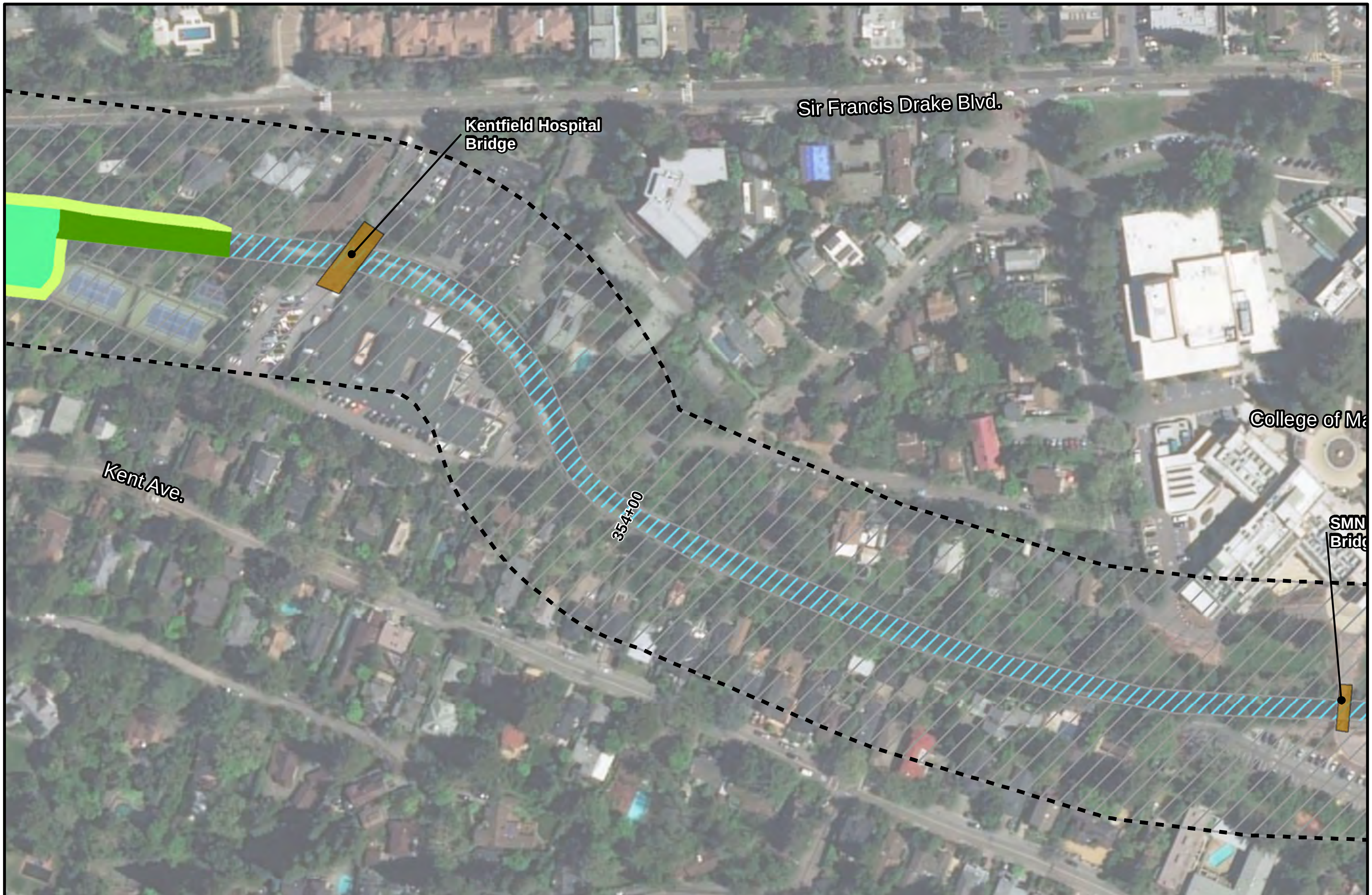
0 50 100 200 Feet

Date: 10/3/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 8b
Alternative J - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative J Habitat Change**
- Riparian Herbaceous
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Woodland

Alternative J
- Bypass Culverts

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

0 50 100 200 Feet

Date: 10/3/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 8c
Alternative J - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative J Habitat Change**
- Riparian Herbaceous
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Woodland

Alternative J
- Bypass Culverts

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

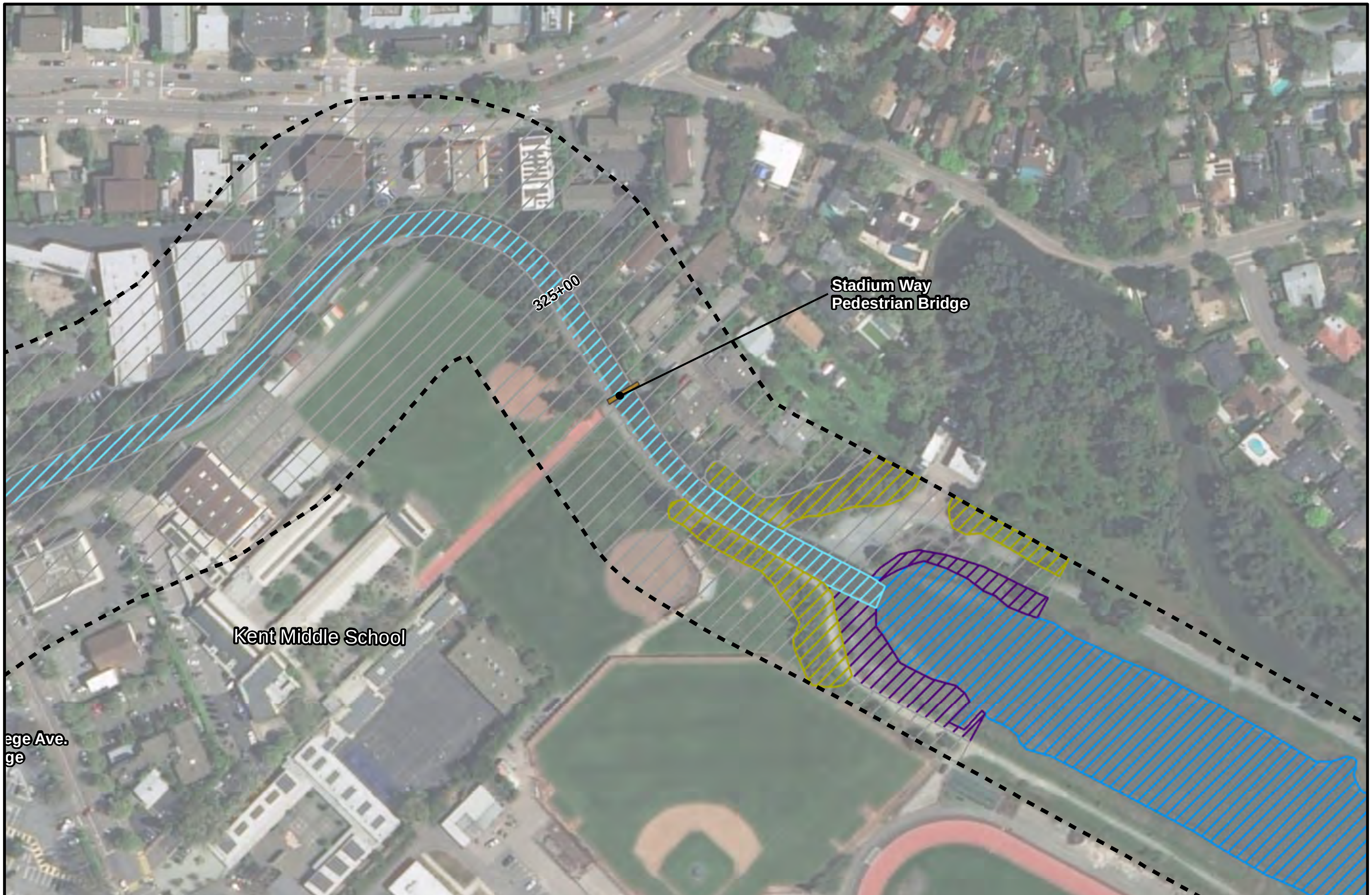
NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

Date: 10/3/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 8d
Alternative J - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.



Habitat Type (Atkins, 2011)*
- Coastal Brackish Marsh
- Eucalyptus Woodland
- Riparian Woodland
- Riverine (Concrete-Lined Channel)
- Riverine (Earthen-Lined Channel)
- Urban/Developed
- Habitat Data Boundary

Alternative J Habitat Change**
- Riparian Herbaceous
- Riparian Vegetation (Woodland and Herbaceous)
- Riparian Woodland

Alternative J
- Bypass Culverts

Existing Features
- Unit 4 Approximate Creek Boundary
- Bridges

NOTE:
*** Baseline habitat not affected by Alternative**
**** Habitat modified by Alternative**

0 50 100 200 Feet

Date: 10/3/2018

Coordinate System: GCS_North_American_1983
Projection: Lambert Conical Conic
Datum: North American 1983
Source: Burleson, 2018; USACE, 2017; Atkins, 2011; ESRI Data Server, 2012.

Figure 4.6 - 8e
Alternative J - Habitat Change
Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

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4.7 Cultural Resources

This section describes the historic and prehistoric archaeological setting of the study area and evaluates the potential for the Project alternatives to result in a significant adverse impact on cultural resources. Information to complete this section has been gathered from many different archaeological reports, records, and articles regarding cultural resources within the San Francisco Bay Area. In addition, a pedestrian survey of the study area was conducted (USACE 2010) and a records search at the Northwestern Information Center of the California Historical Resources Information System (Northwestern Information Center File No.: 16-0601) was conducted by a qualified archaeologist in January 2017.

4.7.1 Regulatory Setting

This section discusses regulatory information that applies to cultural resources. Additional regulatory information appears in Chapter 9 Environmental Compliance.

4.7.1.1 Federal

Federal laws that are applicable to cultural resources are listed below. Details regarding these laws and how the project will comply with them are provided in Chapter 9.

- Archaeological Resources Protection Act
- National Historic Preservation Act

  Consultation was initiated with the State Historic Preservation Office (SHPO) pursuant of Section 106 of the National Historic Preservation Act, implementing regulations for 36 CFR § 800.3 on September 12, 2016. A second letter was sent on September 26, 2018 to address the State Historic Preservation Office's comments with documentation requested from the first consultation letter. The consultation packages contained documents describing the project description, area of potential effects maps, record searches, enclosures of the baseline report, and tribal correspondence (Appendix M.1). USACE is currently awaiting comments from the most recent letter sent.

  USACE initiated the Section 106 process for Unit 3 and 4 of the Corte Madera Creek Flood Risk Management Study by defining an Area of Potential Effect map for cultural resources. In accordance with 16 U.S. Code § 470hh the Area of Potential Effect maps contain confidential, proprietary, or privileged information exempt from public disclosure and is not included in the EIS appendices.

- Native American Graves Protection and Repatriation Act

4.7.1.2 State

- Assembly Bill No. 52

  The bill requires a lead agency to begin consultation with a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project, if the tribe requested to the lead agency, in writing, to be informed by the lead agency of proposed projects in that geographic area and the tribe requests consultation, prior to determining whether a negative declaration, mitigated negative declaration, or environmental impact report is required for a project.

  Tribal correspondence began on September 12, 2016 with the Federated Indians of Graton Rancheria and the Cultural Committee Chair. Another letter requesting consultation was sent on

September 26, 2018 (Appendix M.4). The identified Native American tribes that USACE will consult with were obtained through the Native American Heritage Commission with a Local Government Tribal Consultation List Request form sent on September 12, 2016 (Appendix M.5).

4.7.1.3 Local

- Marin County Code

  Marin County Code §22.20.040 (D) addresses potential accidental discovery of archeological and historical resources during construction. This Code section states that, in the event that archaeological or historic resources are discovered during any construction, construction activities shall cease, and the Community Development Agency shall be notified so that the extent and location of discovered materials may be recorded by a qualified archaeologist, and disposition of artifacts may occur in compliance with State and Federal law. The disturbance of an Indian midden may require the issuance of an Excavation Permit by the Department of Public Works, in compliance with Marin County Code §5.32 (Excavating Indian Middens).

Marin Countywide Plan

The Marin Countywide Plan is made up of several elements that shape the manner in which development, including flood control projects, occur within the county. These elements include: Natural Systems and Agriculture, Socioeconomic (which includes public safety), Community Development, Noise, and Built Environment. As the Project is located within unincorporated portions of the county, the policies of the countywide plan that are germane to the Project include, but are not limited to:

- **Policy HAR-1.1** Preserve Historical Resources. Identify archaeological and historical resource sites;
- **Policy HAR-1.2** Document Historical Information. Provide documents, photographs, and other historical information whenever possible to be catalogued in the Anne T. Kent California Room in the Marin County Free Library.
- **Policy HAR-1.3** Avoid Impacts to Historical Resources. Ensure that human activity avoids damaging cultural resources.

Town of Ross General Plan 2007–2025

Similar to the Marin Countywide Plan, the Town of Ross's General Plan 2007–2025 includes several applicable policies and direction with respect to social and physical resources. As the Project is located within the Town of Ross, the policies of the General Plan that are germane to the Project include, but are not limited to:

- **Policy 1.1** Protection of Environmental Resources. Protect environmental resources such as hillsides, ridgelines, creeks, drainage ways, trees, tree groves, threatened and endangered species habitat, riparian vegetation, cultural places, and other resources.
- **Policy 4.5** Archaeological Resources. Implement measures to preserve and protect archaeological resources. Whenever possible, identify archaeological resources and potential impacts on such resources. Provide information and direction to property owners in order to make them aware of these resources. Require archaeological surveys, conducted by an archaeologist who appears on the Northwest Information Center's list of archaeologists qualified to do historic preservation fieldwork in Marin County, in areas of documented archaeological sensitivity. Develop design review standards for projects that may potentially impact cultural resources.

4.7.2 Prehistoric, Ethnographic, and Historic Context

The Project is located within the Town of Ross and unincorporated areas of Marin County. The project location is situated in the larger archaeological San Francisco Bay Region, which includes the counties of Sonoma, Napa, Marin, Contra Costa, San Francisco, Alameda, San Mateo, Santa Clara, and the southwest portion of Solano County. Human occupation in the region extends possibly as far back as 10,000 B.C. (Moratto 1984, in USACE 2010), with complex hunter-gatherer societies developing around 2000 B.C. (Milliken *et al*. 2007, in USACE 2010). This description of the cultural resources setting begins with the prehistoric, then ethnographic and finally historic contexts of the study area.

Prehistoric Context

While there has been less archaeological research in Marin County as compared to other portions of the San Francisco Bay Region, research conducted in nearby areas (primarily Sonoma County) is germane to the prehistoric setting of the study area. This chronology is taken primarily from Basgall *et al*. (2006, in USACE 2010) with other reference material cited as appropriate.

The Paleo-Indian Occupation dates from approximately 10,000 to 8000 B.C. There is scant evidence of this time period in areas surrounding Marin County, and none in Marin County itself. The cultural system in place during this time period is uncertain, but it has been suggested that the economic focus was on hunting with minimal to no reliance on vegetal resources (Fredrickson 1984, in USACE 2010).

The Lower Archaic Period follows the Paleo-Indian Occupation, lasting from approximately 8000 to 3000 B.C. There is little evidence of human occupation in Marin County for this time period. Evidence in the form of artifacts common to this time period have been found in nearby areas, such as at Duncan's Landing and Bodega Bay. Further south of Marin County, there are indications of millingstone dominant archaeological assemblages starting circa 4500 B.C., which implies that a more diversified subsistence pattern including various vegetal resources had replaced the earlier focus on hunting. The scarcity of sites dating to this period along bayshore margins may be attributable to rising sea levels and inundation. The earliest radiometric dates of artifacts found in Marin County fall near the end of this time period, around 3500 B.C. This date was obtained at archaeological site CA-MRN-17, located at De Silva Island.

The Early Period, the next interval in the chronology, dates from approximately 3000 to 350 B.C. Occupational intensity increased during this period, with larger numbers of archaeological components identified at a greater number of locations. During the early part of this period, there was an emphasis of gathering food resources from marshes and seed-rich grasslands. Millingstones and handstones were common during this period, indicating that a more generalized gathering subsistence pattern, which began during the Lower Archaic Period, continued during the Early Period. Other artifacts that are associated with this time period include large, concave-base dart points, lanceolate bifaces, perforated charmstones, mortars and pestles, grooved and notched netweights, and a variety of distinctive bead and ornament types. Burials during this period tend to be in flexed position with no apparent concern for orientation. Across the region, archaeological components dating to this period tend to be artifactually diverse and temporally disjunctive, implying that there may have been multiple cultural traditions and adaptive strategies in place across the landscape. One of the better-analyzed sites in the county is CA-MRN-152, the Pacheco site, located in the northeastern portion of the county.

The Middle Period followed the Early Period and lasted from approximately 350 B.C. to A.D. 800. A proliferation of sites dating to this period implies growing populations and increased attention to new habitat types (Hylkema 2002, in USACE 2010). Major semi-permanent villages appeared in several marsh/lacustrine areas in the region, including San Francisco, San Pablo, and Bodega bays and Laguna de

Santa Rosa. Archaeobotanical studies indicate that the range of exploited food resources expanded even further from previous periods. This finding implies that the gathering of a variety of resources intensified to keep up with a growing population. Artifacts associated with this period include round-bottom mortars, shaped pestles, numerous crude stone sinkers, net mesh gauges, heavy projectile points, finely made stone drills, quartz crystals with pitch, and a large variety of bone artifacts such as tubes, head scratchers, needles, awls, chisels, and daggers. An increased number of mortars and pestles indicate that acorns became a very important food resource. Burials consist of primary interment, usually with high numbers of grave-associated artifacts and beds of red ochre. There are several archaeological sites with components dating to this period in Marin County along the coast of San Pablo Bay, including CA-MRN-115, CA-MRN-168, CA-MRN-254, CA-MRN-524, and CA-MRN-601. Other sites dating to this period include CA-MRN-27 (near Tiburon), CA-MRN-26, and CA-MRN-255/H.

The final interval in the cultural chronology is the Late Period, dating from A.D. 800 to 1800. This period is characterized by even greater resource intensification than earlier periods, greater sedentism, and increased social elaboration. Other changes include a population shift away from lakes and estuaries to riparian contexts in the oak woodlands. In woodland areas, populations could focus on collecting and storing acorns, which during this period became the primary subsistence resource. Hinterlands were visited more often during this period, and hunting of terrestrial mammals became more important as the economic focus shifted away from baysides to uphill settings. An increase in social complexity is evidenced by an increased number of non-utilitarian artifacts. All these changes are generally seen as indicative of the entrance of Coast Miwok groups into the area. The early part of this period is characterized by flat-based show mortars, shaped pestles, and small triangular-bodied, serrated obsidian projectile points. Bone artifacts include hairpins, awls, and needles, though fewer than in previous periods. Cremations are introduced, but primary inhumations are also still found; burials are often accompanied by "killed" mortars. The latter part of this period occurs just before European contact. Characteristic artifacts of the latter part of the period include flanged pestles, small serrated and nonserrated obsidian arrow points, banjo and triangular shaped shell pendants, and tubular bird bone artifacts including pyro-incised tubes, whistles, and beads. Cremations with grave-associated artifacts became the common burial form. Near the terminal portion of this period, historic period artifacts include spikes, porcelain trade beads, and glass. Several sites with archaeological components dating to this period have been identified along San Antonio Creek, including CA-MRN-196, CA-MRN-371, and CA-MRN-374. In addition, six sites have been documented in the Gallinas Valley, and two sites near the city of Novato, CA-MRN-502 and CA-MRN-530.

Ethnographic Context

The study area lies within the traditional territory of the Coast Miwok people. Miwok is a Penutian language with three groups within California: the Lake Miwok, located to the south of Clear Lake; the Eastern Miwok, located in the Sierra Nevada foothills; and the Coast Miwok, located on the North Bay and adjacent to the coast. The Coast Miwok, in turn, have been divided into two major dialect groups, the western or Bodega, and the southern or Marin (Kelly 1978, in USACE 2010). The study area lies more specifically within the territory of the Habasto group, the nearest ethnographic village of which was named *Awani-wi*, which was located near Mission San Rafael (Milliken 1995, in USACE 2010).

The Coast Miwok lived in an area with diverse terrain and varied food resources. Some animal foods such as deer and crab were available year-round, but in general, subsistence practices followed an annual cycle. During the spring, food resources included small fish, greens, pinole seeds, blue dick bulbs, and other marsh and bay resources. The economic focus shifted to upland areas for hunting and gathering various vegetal resources, especially seeds and buckeye, during the summer. Acorns and hazelnuts were collected in the fall and stored for the winter. Salmon and trout were gathered during the winter runs. Other winter resources included geese, mud hens, and stored foods.

Conical grass-covered dwellings with slightly excavated central hearths were the most common type of housing. Tule or sedge mats were used to cover the floor. Each such dwelling accommodated from six to ten nuclear or extended family members. During most of the year, the Coast Miwok appear to have resided in small camps close to resource gathering sites. As winter approached, they would return inland to the winter village which was commonly located next to a stream and acorn supply (Basgall *et al.* 2006, in USACE 2010). This village usually consisted of a maximum of ten houses and contained more substantial structures such as a large earth oven, dance house, and one or possibly two sweathouses. Both the sweathouse and the dance house were semi-subterranean pole and stick structures covered in brush, grass, and earth (Kelly 1978, in USACE 2010).

Coast Miwok groups lived in a number of small autonomous political entities comprised of intermarried families of some two to four hundred people (Milliken 1995, in USACE 2010). These groups were often led by a male headman, called a capitán by the Spanish. This tribal leader’s role was limited and the office was not necessarily inherited; the tribal leader acted as more of an advisor and coordinator, settling internal disputes and organizing labor for communal ceremonies and hunts. Women also held important leadership roles, organizing and overseeing numerous activities, particularly ceremonial festivals such as the Acorn Dance, sünwele dance, and certain aspects of the Bird Cult (Kelly 1978, in USACE 2010). Local groups interacted with neighboring groups through trade, feasts, seasonal ceremonial dances, and marriage. Both sexes acted as doctors.

The material culture of the Coast Miwok reflects a balance between what was locally available and what could be obtained through trade. As common to most California groups, basketry was a well-developed art among the Coast Miwok and baskets were used for multiple functions. Twined baskets were most often used for cooking, storage, seed processing, as burden baskets, and other utilitarian functions. Coiled baskets, produced with the aid of bone awls, were more often used for decorative and ceremonial functions, commonly being adorned with woodpecker and duck feathers, abalone and clamshell pendants. Other textiles included nets for fishing and rabbit skin blankets or capes. Ground stone milling equipment was essential for processing the multitude of plant and seed resources utilized by the Coast Miwok. Obsidian, obtained through trade, was a preferred source for arrow sized projectile points and butchering knives, while green chalcedony was preferred for general utility knives (Basgall *et al.* 2006, in USACE 2010; Kelly 1978, in USACE 2010). Animal bone was used to make various implements from hide scrapers, fishhooks, and needles to labrets and bird bone whistles. Olivella and abalone shell was most often used to make beads and pendants, while clamshell was used to make disk-shaped beads to be used as currency throughout Central California in later times.

The Coast Miwok were visited by Sir Francis Drake in 1579 and by Sebastian Rodriquez Cermeno in 1595. Exploration of the Petaluma River again brought Europeans into Coast Miwok territory in 1775; however, extended encounters with European settlers did not occur until the following year with the establishment of the Presidio of San Francisco and Mission San Francisco de Asís (Hoover *et al.* 2002, in USACE 2010). In 1817, Mission San Raphael Arcángel was established within Marin County and the local Native Americans began to be recruited there. By the 1820s, a large percentage of Coast Miwok were associated with the missions. European-carried diseases had taken their toll on Native American populations since contact, but an outbreak of smallpox in 1837 was particularly severe for the Native Americans in Marin, Sonoma, Napa, and Solano counties. This outbreak, originating from Fort Ross, caused the death of an estimated 60,000 to 70,000 Native Americans (Basgall *et al.* 2006, in USACE 2010).

Historic Context

The Town of Ross is located in what was once the 8,877-acre Mexican land grant Rancho Punta de Quentin Canada de San Anselmo. This grant was given to Captain Juan B.R. Cooper in 1840 and later sold to James Ross in 1857 (Town of Ross 2007). James Ross, for whom the Town of Ross is named, was a Scotsman from Australia who made his fortune in the wholesale liquor business (Jose Moya de Pino Library *et al.* 2009, in USACE 2010). After purchasing the lands for $50,000, he moved there with his wife, Annie Ross, and their three children. Their home was located at 111 Redwood Drive (Jose Moya de Pino Library *et al.* 2009, in USACE 2010). Ross sold timber from his lands and established a trading post at the mouth of Corte Madera Creek named Ross Landing (now Kentfield Corners), which is located at the intersection of Sir Francis Drake Boulevard and College Avenue. From the trading post, packet schooners made runs to and from San Francisco three times a week. In 1862, James Ross died and his wife was forced to sell a portion of the land holdings. The remaining 297 acres that she had retained are located in the jurisdictional boundary of the Town of Ross today.

In 1863, Annie Ross, James Ross' eldest daughter named for her mother, married George Austin Worn. The following year, the couple created an estate they named Sunnyside. The first building constructed on the estate was the Octagon House, which is today home to the Jose Moya del Pino Library and the Ross Historical Society (Jose Moya de Pino Library *et al*. 2009, in USACE 2010). The Worns were also interested in horticulture. Many of the plants they brought back from their travels around the world form the foundation of the gardens at the current Marin Art and Garden Center, which was established on the Sunnyside grounds in 1945. The magnolia tree that stands in the middle of the Center's lawn was also planted by the Worns in the 1860s.

In 1873, the North Pacific Railroad acquired a right-of-way to run a steam railroad through Ross Valley, and in 1882, Annie Ross, James Ross's widow, deeded 1.4 acres of land to the railroad with the stipulation that the station they built be named in the memory of her husband and son (Jose Moya de Pino Library *et al.* 2009, in USACE 2010). Soon after, the first post office was opened in the area in 1887. Now that the valley had an established route of transportation and communication, many prosperous families from San Francisco began to set up country estates in the area. In 1908, the first Ross firehouse was erected, and the Town of Ross was incorporated.

One of the first actions of the new Town was to improve transportation routes throughout the city by paving streets and erecting streetlights. One of the first ordinances passed was a provision that trees could not be cut down without prior Town approval (Town of Ross 2007). Other civic improvements included the construction of five reinforced concrete bridges. These bridges were built by John Buck Leonard, a civil engineer and pioneer of reinforced concrete bridge construction. Today, they are the only remaining cluster of Leonard's work in the State of California (RPOA 2008). The Lagunitas Road Bridge is probably the most famous example of these bridges. In 1986, all five bridges were found eligible for nomination to the National Register of Historic Places (Jose Moya de Pino Library *et al*. 2009, in USACE 2010). Other Town of Ross landmarks from the early twentieth century include the Lagunitas Country Club, founded in 1903; the St. Anselmo Catholic Church, dedicated in 1908; St. John's Episcopal Church, constructed in 1911; Ross Grammar School, erected in 1911; and Ross Common, given to the Town of Ross in 1911 by Annie Ross Worn (Jose Moya de Pino Library *et al*. 2009, in USACE 2010). In the 1920s, the Town of Ross voted to spend $100,000 to purchase the Shotwell estate. Upon this land the town built the present Ross Town Hall and Fire Station in 1927 (Town of Ross 2007).

With the completion of the Golden Gate Bridge in 1937, Marin County became more accessible and the population of the Town of Ross began to increase. However, low-density development, environmental, and historical ordinances allowed the Town to preserve most of its historic, rural characteristic. Today, the Town of Ross is still primarily a residential center comprised of landscaped streets and gardens, resting under a leafy canopy. This lush idyllic atmosphere is unique in Marin County and would not have been possible without the foresight and an environmental proclivity of the Town's founding leaders (Town of Ross 2007).

4.7.3 Affected Environment

4.7.3.1 Archaeological Resources

This section describes the archaeological resources in the vicinity of the study area.

Records Search Results

A confidential records search for the study area was conducted on January 5, 2017, at the Northwestern Information Center in Rohnert Park (Appendix M.3 NWIC Records Search). The search radius included a 500-foot corridor on either side of the Corte Madera Creek centerline in the study area. The search identified six prehistoric archaeological sites and five historic-era sites within the corridor. The record search also noted that nine previous archaeological surveys have included some portion of the study area and another 15 have been completed within the corridor. Additionally, there have been another 18 reports within or encompassing the Project area; however, these reports are incomplete or unmapped and so contribute little information of value regarding our understanding of cultural resources within the Project area (Appendix M.3).

Each of the 11 known cultural resources is briefly described below.

Site CA-MRN-71 was first identified in 1907 by Nels Nelson. It was revisited in 1978 by Ed Kandler who described the site as a large, well-developed shell midden with several prehistoric artifacts visible on the surface. The site is located east of Murphy Creek, a tributary to Corte Madera Creek, and south of Bridge Road, running adjacent to Kent Avenue. The site is approximately 350 feet west of Corte Madera Creek and outside of the study area.

Site CA-MRN-72/H was first identified in 1907 by Nels Nelson. It was also revisited in 1978 by Ed Kandler. Nelson described the site as a large shell mound with numerous prehistoric artifacts and human remains. He noted that much of the site had been carried off the previous summer for grading and garden purposes. In 1978, Kandler noted that the site was extremely large, and well developed. He also noted a historic-era structure that may be significant (i.e., eligible for listing on the NRHP or California Register of Historical Resources). The site is located north of site CA-MRN-71, near the town limits of Ross, south of the intersection of Brookwood Road and Redwood Drive and runs adjacent to Murphy Creek. The site is approximately 400 feet west of Corte Madera Creek and outside of the study area.

Site CA-MRN-73 was first identified in 1907 by Nels Nelson. The site is described as a small shell midden. Nelson thought the midden may have been out of context, recently brought in from another location. The site was revisited in 1992 by M. Ribeiro for the College of Marin. The reported area of the site is currently covered by residential structures and yards, and no evidence of the site was identified. The site is, or was, in the vicinity of Brookwood Lane in the town of Ross near the western boundary of CA-MRN-72 and outside of the study area.

Site CA-MRN-311 was first identified in 1911 by Nels Nelson, who described the site as sizeable mound located on private land between Ross and San Anselmo. The site was re-recorded by students from the College of Marin. They noted that the site was large and had residences and ornamental plantings over part of it. The students noted two projectile points, chert and obsidian flakes, charcoal and shell fragments. Two auger holes were excavated to a depth of 119 centimeters without encountering sterile soils. The site crosses Corte Madera Creek approximately 700 feet northwest of proposed project improvements, outside of the study area.

Site CA-MRN-406 was first identified in 1972 by Jackson. The site underwent very limited subsurface testing in 2009 by H. Blind for a construction project for the College of Marin. Jackson described the site as a large, creekside habitation site with numerous prehistoric artifacts and human remains, but little shell content. During the limited subsurface testing, prehistoric artifacts were encountered in some units, though they could not identify any discrete midden areas; very little shell was identified. The site is located on the Kentfield Campus of the College of Marin, approximately 150 feet east of Corte Madera Creek, and is within the study area.

Site P-21-1327 is the Lagunitas Road Bridge, one of the first concrete bridges designed strictly on the cantilever principal, making possible a shallow depth in the carry girders. The bridge is carried by fie haunched, continuous reinforced concrete T-beams on solid wall piers and end diaphragm abutments. It has three spans with a total length of 77.5 feet and width of 27.8 feet. It was one of five bridges built by the Town of Ross in 1909 and designed by John B. Leonard, and is within the study area. The Lagunitas Road Bridge was reconstructed in 2010 and would not be altered under the Project.

Site P-21-1329 is the Shady Lane Bridge over Ross Creek. It has a deck arch construction with a timber sidewalk added to the left side of the deck. The three spans create a 42.8 feet long by 20 feet wide roadway. This was the third of the five bridges built by the Town of Ross in 1909 and designed by John B. Leonard; this bridge is outside, but adjacent to the study area.

Site P-21-1330 is the Sir Francis Drake Boulevard Bridge over San Anselmo Creek. It is a reinforced concrete deck arch span with a total length of 63 feet, with Toddlike rails of concrete. This was the second of the five bridges built by the Town of Ross in 1909 and designed by John B. Leonard. The site crosses Corte Madera Creek approximately 700 feet northwest of the Project improvements, outside of the study area.

Site P-21-1331 is the Winship Bridge, and carries Winship Road over Corte Madera Creek. It is an earth-filled, reinforced concrete bridge 91 feet long, composed of two arches with spans of 40 feet and 28 feet. Rails are reinforced concrete planters. Four metal light standards at the corners are embossed with the Westinghouse logo. This was built after the five Leonard bridges in Ross. The Winship tract was a development being represented, in 1912, by Chadwick & Sykes, Contracting Engineers. At that time, they were trying to get the Town of Ross to accept their roadways as “public highways.” The Winship Bridge no doubt dates from this general period. The site crosses Corte Madera Creek more than 1,000 feet north of proposed project improvements, outside of the study area.

Site P-21-2635 is the site of the Ross Town Hall, Ross Fire House, and Ross Public Works building. The Town Hall and Fire House were built in 1927 and designed by John White, one of the Bay Area’s preeminent architects after the city appropriated funds for the land. The Town Hall and Fire House were designed in the Spanish/Mission Revival style with smooth stucco-faced exterior walls and appropriate design elements. The Town Hall and Fire House appear eligible for listing on the NRHP under Criteria A and C for their association with city planning and municipal government and for their architecture. The Ross Town Hall and Firehouse are located near the northern end of the study area, but are situated just outside of it to the west.

Site P-21-2794 was identified in 1978 during a flood control survey of Corte Madera Creek. At the time, it was described as a weakly developed shell midden near the Ross Fire Station. An augering program in 1979 sampled the area between Corte Madera Creek and Sir Francis Drake Boulevard and resulted in the recovery of additional shell fragments, two flakes, and some dietary faunal remains at depths of up to

100 centimeters. It was discovered that midden near Sir Francis Drake Boulevard had been redeposited. The site lies along the eastern bank of Corte Madera Creek, within the study area.

Pedestrian Survey Results

A pedestrian survey was conducted of the study area on 5 and 6 April 2010 along both the east and west banks of Corte Madera Creek. For areas of possible ground disturbance, the inspection generally extended from either creek bank for 30 meters; however, heavy residential development, in some areas of the study area required a decreased inspection area. Vegetation cover was dense in most areas, with vines and grasses severely limiting ground visibility; in other areas, imported gravels on a bike path also limited ground visibility. Prehistoric artifacts, features, or middens were not observed during the pedestrian survey. Shell fragments were observed near the fence line adjacent to the College of Marin near site CA-MRN-406, which, as mentioned above, is considered within the study area.

4.7.4 Environmental Consequences

There are three resources which could be impacted by construction of the proposed Project: CA-MRN-406, a prehistoric occupation and burial site; P-21-1327, the Lagunitas Road Bridge; P-21-2974, a prehistoric shell midden site; and as-yet unknown cultural resources uncovered during Project construction.

4.7.4.1 Avoidance and Minimization Measures

P-21-1327, the Lagunitas Road Bridge, was replaced by the Town of Ross under a separate project and is not considered eligible for the historic register. The following AMMs would be implemented as part of the Project design and would avoid or minimize adverse effects by limiting impacts to both known and as-yet unknown cultural resources:

- **AMM-CUL-1: Avoid Cultural Resources -** Prior to construction, implement a program of subsurface testing where project construction and known sites overlap to determine the potential for impacts.

4.7.4.2 Methodology for Impact Analysis and Significance Thresholds

The potential for archaeological and built environment resources within the Study Area was evaluated by completing background research and field surveys which incorporated the expected work areas and staging locations for construction equipment at different points along the Project area. Effects of the Project alternatives were considered significant if they met any of the following criteria:

- **Impact CUL-1:** Cause a substantial adverse change in the significance of a unique archaeological resource or a historical resource as defined in CEQA Guidelines Section 15064.5 or 36 CFR 800.5 of Section 106 of the NRHP.
- **Impact CUL-2**: Disturb any human remains, including those interred outside of formal cemeteries.
- **Impact CUL-3:** Cause a substantial adverse change in the significance of a tribal cultural resource, defined in Public Resources Code Section 21074 as either a site, feature, place, cultural landscape that is geographically defined in terms of the size and scope of the landscape, sacred place, or object with cultural value to a California Native American tribe, and that is:

    i. Listed or eligible for listing in the California Register of Historical Resources, or in a local register of historical resources as defined in Public Resources Code Section 5020.1(k), or,
    ii. Determined by the lead agency, in its discretion and supported by substantial evidence, to be significant pursuant to criteria set forth in subdivision (c) of Public Resources Code Section 5024.1. In applying the criteria set forth in subdivision (c) of Public Resources Code Section

5024.1, the lead agency shall consider the significance of the resource to a California Native American tribe.

4.7.4.3 Effects and Mitigation

No Action Alternative

In the no action alternative, existing conditions throughout the study area would remain unchanged. The risk of flooding, which the Project seeks to eliminate, would persist as well; however, any new impacts to cultural resources would be consistent with previous impacts from previous flood events. The no action alternative would have ***no impact*** on cultural resources.

Action Alternatives

This section describes the effects on cultural resources resulting from construction and operations and maintenance of the action alternatives. Potential impacts to cultural resources would be expected to be the same for Alternatives A, B, F, and G and less for Alternative J.

During construction, the Project may contribute to the following impacts:

- **Impact CUL-1:** Cause a substantial adverse change in the significance of a unique archaeological resource or a historical resource as defined in CEQA Guidelines Section 15064.5 or 36 CFR 800.5 of Section 106 of the NRHP.
- **Impact CUL-2**: Disturb any human remains, including those interred outside of formal cemeteries.
- **Impact CUL-3**: Cause a substantial adverse change in the significance of a tribal cultural resource.

Site CA-MRN-406 (Alternatives A, B, F, G, and J)

Site CA-MRN-406 is a large, habitation and burial site approximately 150 feet east of Corte Madera Creek near the College of Marin. The full extent of the site, particularly the subsurface component, is unknown, and the site has not been evaluated for its eligibility to the NRHP or California Register of Historical Resources. Alternatives A, B, F, G, and J each include construction activities between Stations 344+00 and 339+00 in the vicinity of the site. Activities on the left bank from Station 344+00 to 339+00 would include construction of top-of-bank or setback floodwalls that could potentially impact the site. Alternative A would construct top-of-bank floodwalls as a continuation of existing concrete channel walls, whereas Alternatives B, F, and G would construct setback floodwalls that would require more extensive grading. Alternative J would construct top-of-bank floodwalls at Granton Park downstream to station 344+00, but would otherwise not construct in the vicinity of the site.

If site CA-MRN-406 is eligible to the NRHP or California Register of Historical Resources or if human remains are encountered during project construction, impacts CUL-1 and CUL-2 would be potentially ***significant.***

To reduce these impacts, the following mitigation would be implemented:

- **Mitigation CUL-1:** Halt work if archaeological or historic resources are discovered during any construction

Archaeological resources are anticipated to be fully delineated prior to construction. However, despite the effort to identify archaeological resources, the inadvertent discovery of unknown archaeological resources cannot be entirely discounted. Impacts on previously unknown archaeological resources during construction from ground-disturbing activities would be potentially significant. In the event that archaeological resources are uncovered during project-related ground disturbing activities, compliance with Marin Development Code Section 22.20.040 (D) (outlined in Local Regulations) would reduce those impacts to a less-than-significant level.

For Alternatives A, B, F, G, and J, this impact would be ***less than significant*** with mitigation.

- **Mitigation CUL-2:** Halt Work, Notify Coroner

If human remains are uncovered, compliance with Section 15064.5 (e) (1) of the CEQA Guidelines and PRC Section 7050.5 is required. All project-related ground disturbances within 100 feet of the find shall be halted until the county coroner has been notified. If the coroner determines that the remains are Native American, and the find is on federally-owned land, then the provisions of NAGPRA shall apply. If not on federal land, then treatment of the remains shall be conducted in accordance with Section 15064.5 (e).

For Alternatives A, B, F, G, and J, this impact would be ***less than significant*** with mitigation**.**

Site P-21-1294 (Alternatives A, B, F, G, and J)

Site P-21-2794 is a shell midden site that spans the area between Sir Francis Drake Boulevard and Corte Madera Creek from Station 380+00 to 377+00. The full extent of the site, particularly the subsurface component, is unknown, and the site has not been evaluated for its eligibility to the NRHP or California Register of Historical Resources. Alternatives A, B, F, G, and J would each include construction activities between Stations 380+00 and 377+00 in the vicinity of the site. Top-of-bank floodwalls would be constructed on the left bank from Station 380+00 to 377+00 under Alternatives A, B, and G that could potentially impact the site. A bypass culvert would be constructed in this area for Alternatives F and J beneath Sir Francis Drake Boulevard that could also potentially impact this site.

If site P-21-1294 is eligible to the NRHP or California Register of Historical Resources or if human remains are encountered during project construction, impacts CUL-1 and CUL-2 are potentially ***significant.***

To reduce these impacts, the following mitigation would be implemented:

- **Mitigation CUL-1:** Halt work if archaeological or historic resources are discovered during any construction
- **Mitigation CUL-2:** Halt Work, Notify Coroner

For Alternatives A, B, F, G, and J, this impact would be ***less than significant*** with mitigation**.**

Previously Unidentified Cultural Resources (All Action Alternatives)

The Project is located in an environment conducive to prehistoric exploitation; as demonstrated by the two prehistoric sites already identified within the Project area. There is the potential for further discoveries to be made during construction. In the event archaeological deposits are discovered during project activities, all work within 50 feet of the discovery shall halt immediately.

If a newly discovered site is eligible to the NRHP or California Register of Historical Resources or if human remains are encountered during project construction, impacts CUL-1 and CUL-2 are potentially ***significant.***

To reduce these impacts, the following mitigation would be implemented:

- **Mitigation CUL-1:** Halt work if archaeological or historic resources are discovered during any construction
- **Mitigation CUL-2:** Halt Work, Notify Coroner

For Alternatives A, B, F, G, and J, this impact would be ***less than significant*** with mitigation.

Tribal Cultural Resources

USACE initiated Tribal correspondence on September 12, 2016 with the Federated Indians of Graton Rancheria and the Cultural Committee Chair. Another letter requesting consultation was sent on September 26, 2018 (Appendix M.4). The identified Native American tribes that USACE will consult with were obtained through the Native American Heritage Commission with a Local Government Tribal Consultation List Request form sent on September 12, 2016 (Appendix M.5). Based on the background research, there are no tribal cultural resources in the Project area and therefore the Project would have no impact on tribal cultural resources and no mitigation measure would be necessary. If archaeological resources or human remains are documented during construction activities, impacts to tribal cultural resources could be potentially significant. Mitigations CUL-1 and CUL-2 would apply to archaeological resources and human remains that are considered tribal cultural resources. For Alternatives A, B, F, G, and J, this impact would be ***less than significant*** with mitigation.

Table 4.7-1 summarizes the impacts to cultural resources.

TABLE 4.7-1 CULTURAL IMPACT CONCLUSIONS

Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
CUL-1: Cause a substantial adverse change in the significance of a unique archaeological resource or a historical resource as defined in CEQA Guidelines Section 15064.5 or 36 CFR 800.5 of Section 106 of the NRHP.	AMM-CUL-1	All Action Alternatives	S	M-CUL-1	LTS
		No Action	NI	--	--
CUL-2: Disturb any human remains, including those interred outside of formal cemeteries.	AMM-CUL-1	All Action Alternatives	S	M-CUL-2	LTS
		No Action	NI	--	--
CUL-3: Cause a substantial adverse change in the significance of a tribal cultural resource.	AMM-CUL-1	All Action Alternatives	S	M-CUL-1 M-CUL-2	LTS
		No Action	NI	--	--

AMM = avoidance and minimization measure
LTS = less than significant
NI = no impact
S = significant

4.7.4.4 Cumulative Impacts

Impacts related to cultural resources are generally site-specific, and they depend on the specific localized resources affected and their potential to be found in the area. They are not typically additive or cumulative in nature. The mitigation measures specified above would reduce impacts of the Project on known cultural resources in the Project area to less than significant, and the residual impact would not be expected to combine with similar impacts elsewhere in the area in a cumulative manner.

All identified cumulative projects in Table 4-2 that are within or in close proximity to the Project area that involve ground disturbance have the potential to combine with the impacts of the Project to result in cumulative impacts to unknown buried archaeological resources, human remains, or tribal cultural resources. However, the Marin County Development Code and other regulations (including the California Public Resources Code and the California Health and Safety Code) list actions that must be taken upon encountering prehistoric or historic-era archaeological resources or other cultural resources. If such resources are encountered during construction and are determined to be significant, they would be avoided if feasible. If avoidance is not feasible, they would be appropriately treated in accordance with the requirements of those regulations. Similarly, if human remains are uncovered during construction, the County Coroner would be contacted and if the remains were found to be Native American the most likely descendent would be notified and the remains would be appropriately treated Compliance with these requirements would reduce impacts associated with potential inadvertent discoveries during construction to a less-than significant level. These measures reduce to insignificant the potential for a cumulative impact on previously undiscovered cultural resources.

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4.8 Aesthetics

This section describes the existing visual conditions of the study area and addresses aesthetic resources that could be affected by the proposed alternatives. The descriptions presented in this section are based on observations conducted during pedestrian surveys (March 9, 2010, July 23, 2010 USACE) and (November 6, 2015 and November 16, 2017 PDT Site Notes) of the study area and also include relevant information presented in the Lagunitas Road Bridge Replacement Project Draft EIR and the Town of Ross General Plan. These descriptions are accompanied by representative photographs.

4.8.1 Regulatory Setting

This section discusses regulatory information that applies to aesthetic resources. Additional regulatory information appears in Chapter 9 Environmental Compliance.

4.8.1.1 Federal

The USACE policy states that aesthetic resources be protected along with other natural resources. Planning guidance specifies that the federal objective of water-related resource planning is to contribute to the National Economic Development (NED) consistent with protecting the nation's environment. Established USACE goals include: 1) preservation of unique and important aesthetic values; and 2) restoration and maintenance of the natural and human-made environment in terms of variety, beauty, and other measures of quality (USACE 2000c).

4.8.1.2 State

California State Scenic Highway Program. California's Scenic Highway Program was created by the Legislature in 1963 to preserve and protect scenic highway corridors from change that would diminish the aesthetic value of lands adjacent to highways. State laws governing the Scenic Highway Program are found in the Streets and Highways Code, Section 260 et seq. A highway may be designated as "scenic" based on the expanse of the natural landscape that can be seen by travelers, the scenic quality of that landscape, and the extent to which development intrudes upon the traveler's enjoyment of the view. A Scenic Corridor is described as the land generally adjacent to and visible from such a highway and is usually limited by topography and/or jurisdictional boundaries. In addition to State Highways, County roads are also eligible for scenic designation.

No designated State Scenic Highways are located within Marin County, although roadways throughout Marin offer views of the County's and the region's scenic resources. Two segments of Highway 101 in Marin County are eligible for inclusion on the list of State Scenic Highways: the segment opposite San Francisco/State Route 1 in Marin City and the segment near State Route 37/Ignacio in Novato.

No other state regulations other than CEQA were identified as relevant to aesthetics analysis for this Project.

4.8.1.3 Local

City and county general plans include policies for protection of scenic resources, such as hillsides, natural areas, landmarks, and historic districts. Such policies may restrict new development in areas that maintain scenic vistas. Applicable policies of the Town of Ross and Marin County are described below.

Marin Countywide Plan

The Project is located within unincorporated portions of the county. Policies of the countywide plan relevant to the Project include:

- **Policy EH-3.2 Retain Natural Conditions:** Ensure that flow capacity is maintained in stream channels and floodplains, and achieve flood control using biotechnical techniques instead of storm drains, culverts, riprap, and other forms of structural stabilization.
- **Policy OS-1.1 Enhance Open Space Stewardship:** Promote collaborative resource management among land management agencies. Monitor resource quality. Engage the public in the stewardship of open space resources.
- **Policy OS-1.2 Protect Open Space for Future Generations:** Ensure that protected lands remain protected in perpetuity, and that adequate funding is available to maintain it for the benefit of residents, visitors, wildlife, and the environment.

Town of Ross General Plan 2007–2025

Similar to the Marin Countywide Plan, the Town of Ross' General Plan 2007–2025 includes several applicable policies and direction with respect to social and physical resources. As the Project is located within the Town of Ross, the policies of the General Plan relevant to the Project include:

- **Policy 3.5 View Protection:** Preserve views and access to views of hillsides, ridgelines, Mt. Tamalpais and Bald Hill from the public right-of-way and public property. Ensure that the design look and feel along major thoroughfares maintains the "greenness" of the Town.
- **Policy 4.3 Town Bridges:** Maintain and protect bridges as an important part of Ross' heritage. If a bridge must be rebuilt or retrofitted, it should be done in a way that is compatible with its historic look.

4.8.2 Affected Environment

4.8.2.1 Terminology

Aesthetic resource definitions follow.

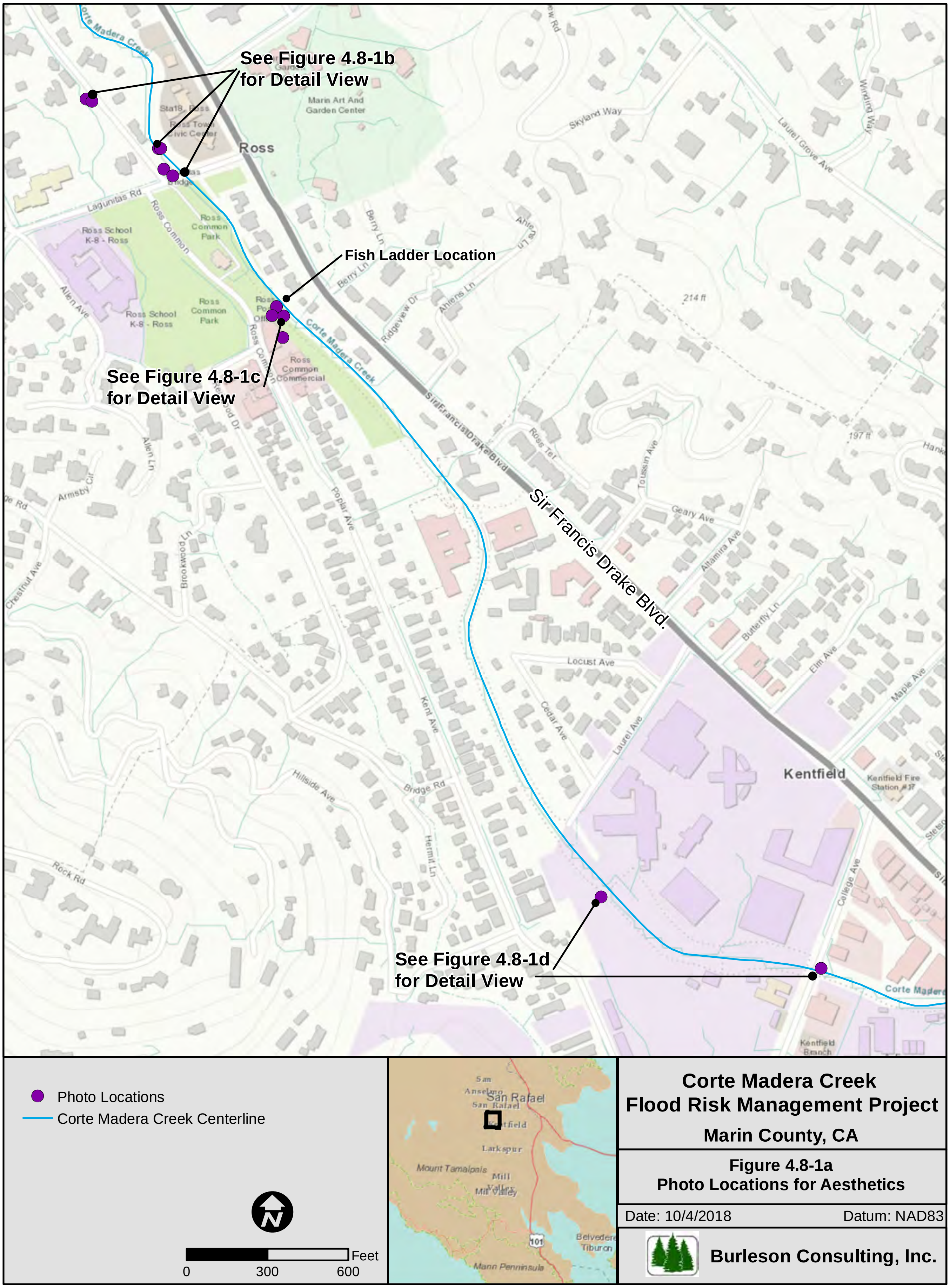
a) Aesthetic Quality: This term refers to the essential attributes of landscape that, when viewed by people, elicit psychological and physiological benefit to individuals and, therefore, to society in general.
b) Scenic Resources: This term refers to attributes, characteristics, and features of views that provide varying responses from, and varying degrees of benefits to, humans.
c) Scenic Integrity: Scenic integrity is the state of natural preservation or, conversely, the absence of disturbance created by human activities or alteration. Integrity is stated in degrees of deviation from the existing landscape character and that which would be anticipated for a system in its natural state.
d) Viewshed: A viewshed is defined as the total visible area from a single observer position, or the total visible area from multiple observer positions.
e) Scenic Receptor: Scenic receptor broadly refers to any human that views the study area. In conducting evaluations of potential impacts on aesthetic resources, the term specifically refers to those receptors that may be especially sensitive to changes in existing view of the study area. Typically, local residents, and users of public spaces such as parks, trails, or designated scenic roadways with views of the creek.

4.8.2.2 Regional/Local Setting

The surrounding ridge-tops and upper slopes of the watershed are generally wooded and undeveloped whereas the valley floor where the Project is located is densely developed. The communities surrounding the Project area have maintained a small town feel that blends with the landscape. The visual character of Corte Madera Creek within the project is uniform throughout Unit 4, the uppermost section, while visual character of the channelized portions of Units 2 and 3 is also uniform. This section describes and illustrates various representative viewsheds within the study area from key vantage points beginning at the upstream end of Unit 4 and extending downstream through the concrete-lined channel portion of the study area that corresponds with Units 2 and 3. Photographs of the various viewsheds from the Project are identified by location in Figures 4.8-1a through 4.1-d and are presented in Photos 4.8-A through 4.8-L. Table 4.8-1 lists the photos and corresponding view identifier shown on Figures 4.8-1b through 4.8-1d.

TABLE 4.8-1 PHOTO VIEW GUIDE

Description	Photo	Figure
Lagunitas Road Bridge	Photo 4.8-A	4.8-1b
Looking downstream from Lagunitas Road Bridge	Photo 4.8-B	4.8-1b
Left Bank Corte Madera Creek at Sylvan Lane	Photo 4.8-C	4.8-1b
1 Sylvan Lane on right bank	Photo 4.8-D	4.8-1b
Sylvan Lane looking north	Photo 4.8-E	4.8-1b
Sylvan Lane looking south	Photo 4.8-F	4.8-1b
Denil fish ladder from right bank	Photo 4.8-G	4.8-1c
Denil fish ladder from downstream	Photo 4.8-H	4.8-1c
Concrete channel downstream of fish ladder	Photo 4.8-I	4.8-1c
North entrance to Allen Park	Photo 4.8-J	4.8-1c
From SMN Bridge looking downstream	Photo 4.8-K	4.8-1d
From College Avenue Bridge looking downstream	Photo 4.8-L	4.8-1d



See Figure 4.8-1b for Detail View
Fish Ladder Location
See Figure 4.8-1c for Detail View
See Figure 4.8-1d for Detail View
Sir Francis Drake Blvd.
Ross
Kentfield
Marin Art And Garden Center
Ross School K-8 - Ross
Ross Common Park
Corte Madera Creek
Photo Locations
Corte Madera Creek Centerline
0
300
600
Feet
San Rafael
Larkspur
Mount Tamalpais
Mill Valley
Corte Madera Creek
Flood Risk Management Project
Marin County, CA
Figure 4.8-1a
Photo Locations for Aesthetics
Date: 10/4/2018
Datum: NAD83
Burleson Consulting, Inc.

A Photo Locations

Creek Centerline

0 50 100 Feet

Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Figure 4.8-1b
Photo Locations for Aesthetics

Date: 10/4/2018 Datum: NAD83

Burleson Consulting, Inc.

Ⓐ Photo Locations

Creek Centerline

Fish Ladder Removal Location

N

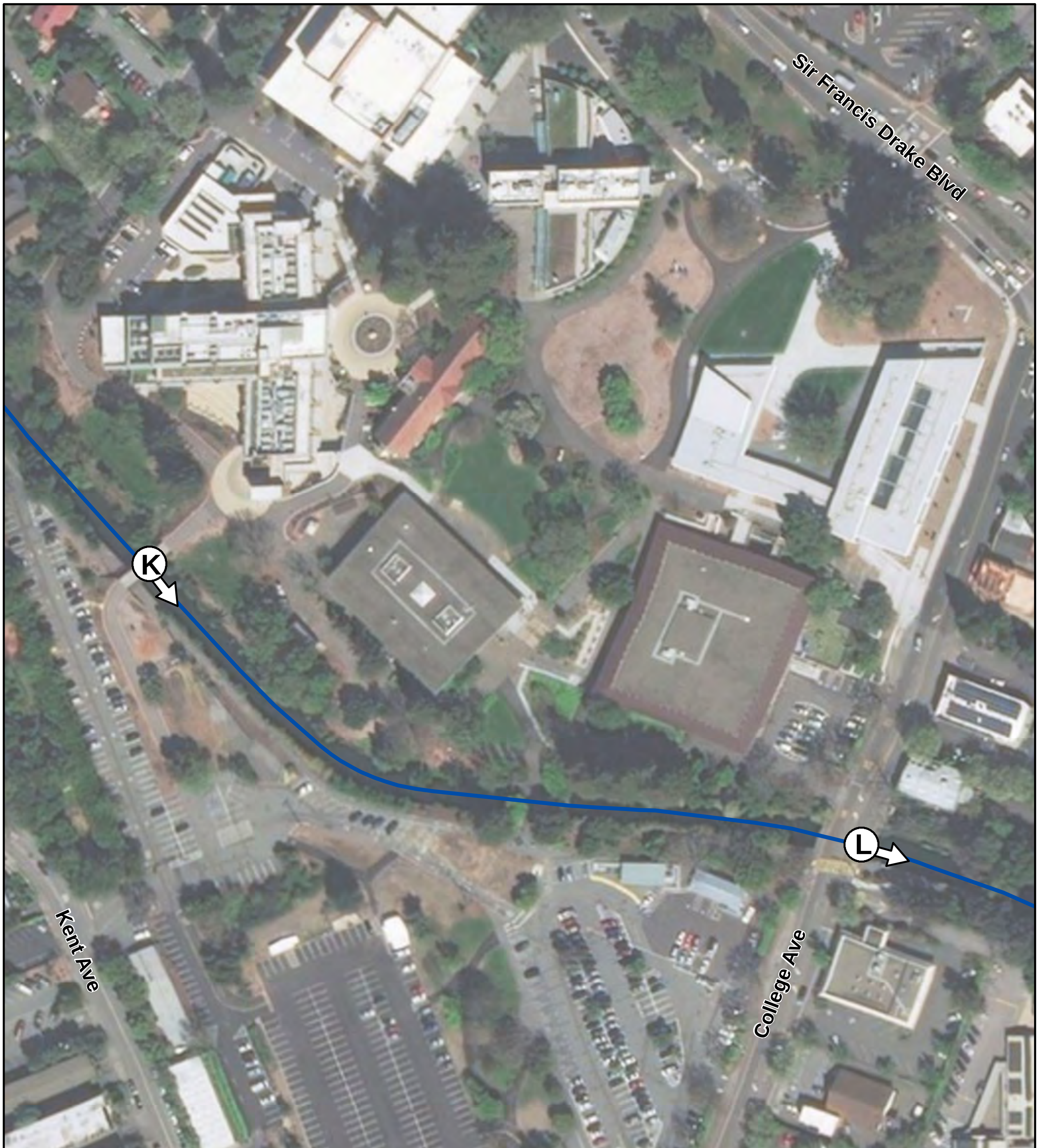
0 50 100 Feet

Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Figure 4.8-1c
Photo Locations for Aesthetics

Date: 10/4/2018 Datum: NAD83

Burleson Consulting, Inc.



Ⓐ Photo Locations

Creek Centerline

Feet

0 100 200

Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Figure 4.8-1d
Photo Locations for Aesthetics

Date: 10/4/2018 Datum: NAD83

Burleson Consulting, Inc.

4.8.2.3 Existing Visual Setting of Unit 4

Within Unit 4, Corte Madera Creek has natural channel characteristics with vegetated banks and a gravel streambed although many human-made features and disturbances are present. Structural elements include concrete bridge abutments and piers at Lagunitas Road Bridge. Photos 4.8-A and 4.8-B, taken from Lagunitas Road Bridge, show the bridge structure and unvegetated depositional gravel bar along the right bank.

Photo 4.8-A. Photo of Lagunitas Road Bridge Looking East

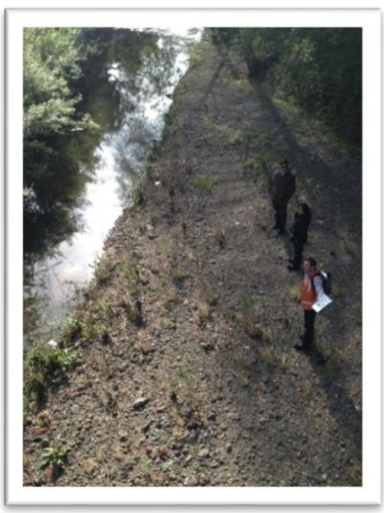


Photo 4.8-B. View of Corte Madera Creek from Lagunitas Road Bridge Looking Downstream

Bank retaining structures, including rock gabions, railroad ties, sand concrete bags, and concrete current deflectors are present on the right bank upstream of Lagunitas Road Bridge and the left bank downstream of Lagunitas Road Bridge. Unit 4 has a relatively undisturbed appearance (compared to Units 2 and 3) characterized by predominantly native riparian vegetation and native material streambed. The viewshed from Lagunitas Road Bridge includes the majority of Unit 4. Photo 4.8-C is a direct view of the left bank of the creek as seen from the single-family residence located at 1 Sylvan Lane, just north of the bridge. Photo 4.8-D provides a direct view of the aforementioned residence and instream flood wall.

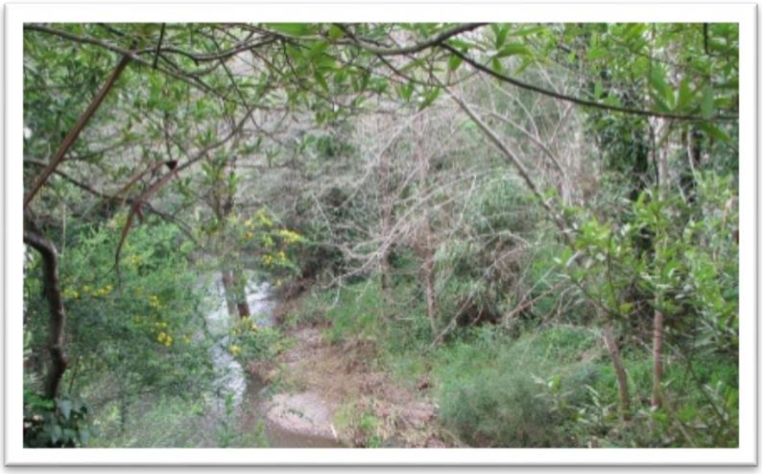


Photo 4.8-C. Left Bank in Unit 4 Looking Upstream

Photo 4.8-D. Residence 1 Sylvan Lane on Right Bank of Corte Madera Creek

Trees form a dense canopy that couple with abundant understory vegetation to produce a calm and visually pleasing environment in the creek. The scenic integrity of this section of the creek is somewhat disrupted by the presence of Lagunitas Road Bridge, resident-constructed floodwalls and gabion structures, the Ross Town Hall upstream of the Lagunitas Road Bridge, and residences along the left bank between the bridge and fish ladder. Sylvan Lane runs parallel to the creek on the right bank upstream of Lagunitas Road Bridge. Sylvan Lane is quiet, narrow, wooded, and aesthetically pleasing. Photos 4.8-E and 4.8-F show Sylvan Lane looking north and south within the Project area.

Photo 4.8-E. Sylvan Lane Looking North

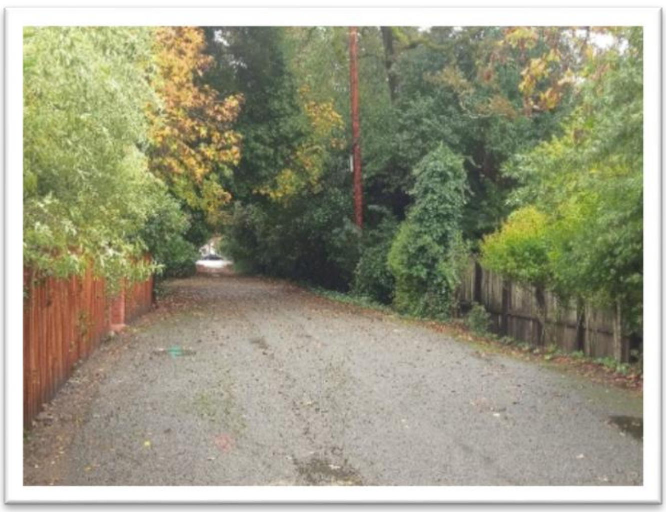


Photo 4.8-F. Sylvan Lane Looking South

A variety of homeowner-constructed bank stabilization structures are present on the right bank upstream of Lagunitas Road Bridge and at various locations on the left bank downstream of the bridge. These structures include sand and concrete bag retaining walls, plank and railroad tie walls, gabion walls, log walls, and concrete current deflectors. Downstream of the bridge, these structures are generally located below the upper bank terraces and do not obstruct the view of the creek by local residents because these improvements are within the incised channel on the left bank. They are, however, clearly visible from public areas, including public parking lots and recreational trail on the top of the right bank.

Despite the presence of human-made modifications on this segment of the creek, Unit 4 is regarded as having high scenic quality and integrity by residents of the area and members of the general public to whom views of the creek are easily accessible from Lagunitas Road Bridge, the Post Office, Ross Town Hall, recreational path along the right bank, Station Park (immediately south of Lagunitas Road on the left bank of Corte Madera Creek), and Allen Park (immediately south of Unit 4 adjacent to the creek). Unit 4 ends at the Denil fish ladder.

Photos 4.8-G and 4.8-H show the Denil fish ladder that is currently non-functional and acts as a fish passage barrier. Note the abrupt change in the aesthetic quality at the fish ladder as the stream bed changes from a native streambed substrate to a concrete lined channel.

Photo 4.8-G. Denil Fish Ladder from the Right Bank

Photo 4.8-H. Below Denil Fish Ladder Looking Upstream

4.8.2.4 Existing Visual Setting of Units 2 and 3

Within the study area, Units 2 and 3 of Corte Madera Creek are characterized by a trapezoidal concrete-lined drainage channel, extending upstream from near Bon Air Road to the southern end of the Town of Ross Post Office parking lot adjacent to the existing fish ladder. Photo 4.8-G shows the concrete channel downstream from the fish ladder. The concrete channel is 33 feet wide with vertical walls and a v-shaped channel bottom. The channel consists of long straight sections, several subtle bends, and three tight curves. Aesthetic quality of this section is considered much lower than the more natural condition of Unit 4 upstream. A constructed resting pool, 4 feet long and 13 feet wide is visible in the channel bottom of Photo 4.8-I.

Photo 4.8-I. Concrete Channel Downstream of the Fish Ladder taken from the Right Bank

Allen Park is located downstream of the Ross Post Office adjacent to the creek. A bicycle-pedestrian path travels through the park. Photo 4.8-J shows the northern entrance of Allen Park.

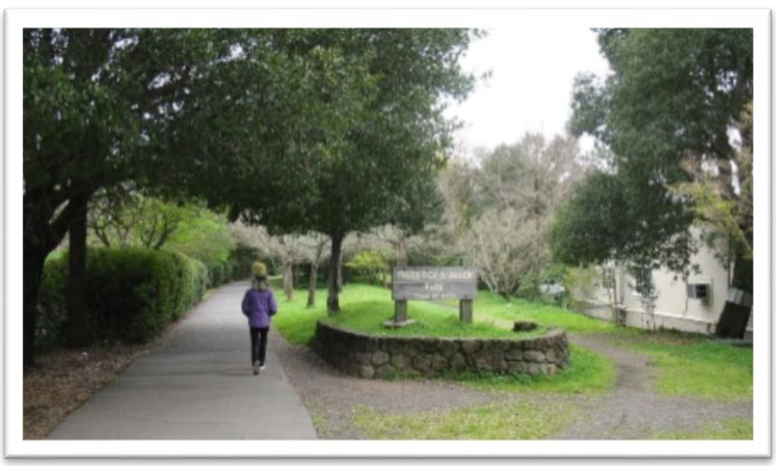


Photo 4.8-J. North Entrance to Allen Park

Along Units 2 and 3, views of the creek are dominated by the concrete-lined drainage channel and steel fencing that runs atop the walls of the channel. These views are somewhat softened by vegetation growing along the tops of the channel walls that is quite dense in some locations, especially where the creek borders Ross Common Park; however, the overall appearance of the creek in Units 2 and 3 is characterized as highly modified with low aesthetic quality and scenic integrity. Photo 4.8-K shows the concrete channel looking south from the SMN pedestrian bridge at the College of Marin. The bicycle-pedestrian path can be seen to the right in the photo.

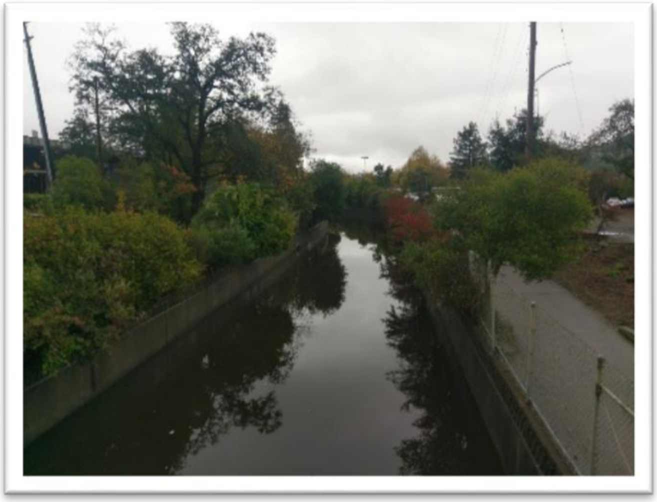


Photo 4.8-K. Looking Downstream from SMN Bridge

Photo 4.8-L shows the view from College Avenue Bridge looking downstream in Unit 2. The concrete channel, fencing, bicycle-pedestrian pathway, and vegetation are visible.

Photo 4.8-L. Looking Downstream from College Avenue Bridge

4.8.3 Environmental Consequences

4.8.3.1 Avoidance and Minimization Measures

The following AMMs would be implemented as part of the Project design and would avoid or minimize adverse effects associated with aesthetic resources:

- **AMM-AES-1: Aesthetic Treatment of Structures -** Incorporate color, texture, patterns, and/or imagery to the surfaces of concrete wall structures to improve their appearance and integrate them into their surrounding environment and may also include structural components such as wall caps, columns, and end treatments.

- **AMM-BIO-3: Minimize Disturbance to Existing Vegetation -** Disturbance to existing vegetation shall be limited to the project area. Existing ingress and egress points shall be used, and staging and material storage areas shall be confined to the paved areas as much as possible.
- **AMM-BIO-4: Minimize Footprint -** The amount of disturbance within the project area shall be reduced to the absolute minimum necessary to accomplish the proposed project.
    - Topsoil from the creek banks shall be removed, stockpiled, covered, and encircled with silt fencing to prevent loss or movement of the soil into Corte Madera Creek. All disturbed soils shall undergo erosion control treatment prior to the rainy season and after construction is terminated.
    - Treatment typically includes temporary seeding with native species and sterile straw mulch. All topsoil shall be replaced in a manner as close as possible to pre-disturbance conditions.
    - All construction-related holes in the ground will be covered to prevent entrapment of California red-legged frogs or foothill yellow-legged frogs.
- **AMM-BIO-15: Night Lighting during Construction** - During nighttime work for project construction, night lighting shall be used only in the area actively being worked on and focused on the direct area of work.

4.8.3.2 Methodology for Impact Analysis and Significance Thresholds

The factors used to analyze the potential impacts of the Project must consider a wide variety of perspectives to determine significance of impacts to aesthetic values. Because additional mitigation measures for Impacts AES1-1 and AES-2 are not feasible beyond the existing AMMs, significant impacts were determined to be significant and unavoidable.

The Project would pose a significant impact to aesthetics resources if it would:

- **Impact AES-1:** Substantially degrade the existing visual character or quality of the study area and its surroundings.
- **Impact AES-2:** Have a substantial adverse effect on a scenic vista.
- **Impact AES-3:** Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway.
- **Impact AES-4:** Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.

This analysis considers whether floodwalls and other flood control measures such as setback and top-of-bank floodwalls would disrupt or reduce the aesthetic quality of the creek for receptors in the area such as residents and people visiting businesses, schools, and public areas. Because construction of floodwalls along the creek would alter existing viewsheds, a contribution to impacts AES-1 and AES-2 is expected. The Project is situated around Corte Madera Creek on the valley floor and the project features would not extend more than 12 feet above ground surface. Impacts to aesthetics would affect local receptors as the current combination of fairly dense trees, buildings, and terrain limit visibility to short distances. The topography and the vegetation surrounding most of the Project area limit the views of Corte Madera Creek to receptors in the vicinity of the creek. Potential impacts to scenic vistas from the Project would be to local views, primarily of the creek.

This analysis does not consider the impacts AES-3 to be relevant to the Project. Specifically, the study area does not include and is not visible from a designated state scenic highway (Caltrans 2018).

4.8.3.3 Effects and Mitigation

This analysis focuses mainly on the proposed construction/modification of floodwalls, removing the Denil fish ladder and new transition, completing bench excavation, removing existing channel walls and concrete streambed in College of Marin Widening, Allen Park Riparian Corridor, and modifications to the bicycle-pedestrian pathway along the creek. Floodwalls are likely to produce the most significant impact to aesthetics in the Project area as they would obscure large segments of Corte Madera Creek from both the public and local residents and require removal of streamside vegetation. The existing aesthetic quality between Units 2 and 3, a concrete-lined channel, versus Unit 4, a natural creek bed, was considered when evaluating impacts. Obscuring the sight of the natural channel in Unit 4 is likely to provoke a more pronounced response than obscuring the less-appealing concrete channel in Units 2 and 3.

In Units 2 and 3, bench excavation and creation of Allen Park Riparian Corridor and College of Marin widening would also alter local views. This impact would be expected to be less than significant in areas where concrete channels remain and would be beneficial in areas where the channel is removed and naturalistic features are installed.

No Action Alternative

In the no action alternative, the current visual character of Corte Madera Creek and the surrounding area would remain unchanged from existing conditions as described in Section 4.8.2. Ongoing operations and maintenance to support existing FRM features would continue, but would not be expected to alter aesthetics within the Project viewshed. Although local land and business owners may implement improvements along the creek that could alter aesthetics, no planned actions are known at this time. No direct or indirect impacts to aesthetics would occur by selecting the no action alternative. There would be ***no impact*** to aesthetics resources.

Impacts Unique to Alternatives F and J

Construction of the bypass (Alternatives F and J) could require nighttime construction that would require up to 4 portable lights. Alternatives A, B, and G would not include construction or operational features which would create additional light or glare in the region and Impact AES-4 is not relevant to these alternatives.

- **Impact AES-4:** Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.

Common to All Action Alternatives

For all alternatives, the Project may contribute to the following impacts:

- **Impact AES-1:** Substantially degrade the existing visual character or quality of the study area and its surroundings.
- **Impact AES-2:** Have a substantial adverse effect on a scenic vista.

The following actions are common to all alternatives.

Floodwall Construction

Floodwalls and retaining walls would be constructed from reinforced concrete material with variable heights up to 11 feet and widths between 12 and 24 inches. Patterns and coloring of floodwalls would be selected to minimize visual impacts that would be finalized during detailed Project design. USACE vegetation guidelines recommend a minimum of 15 feet vegetation-free zone along each side of FRM structures unless real estate is not available. Grass is allowed within this vegetation-free zone and the District would work with USACE to develop the final vegetation plan. All alternatives would include construction of floodwalls with varied lengths and heights. Visual impacts would result from the structures and associated vegetation-free zone. Impacts from floodwalls would vary proportional to height, length, and sensitive receptors. Floodwall heights and lengths are summarized in Table 3-2 for each alternative.

Fish Ladder Removal

The fish ladder would be replaced with a combination of natural stream substrate material and biotechnical bank treatments to create a smooth transition that would meet fish passage criteria in all action alternatives. Activities would occur primarily in the channel leaving most of the riparian vegetation intact. Removal of the fish ladder and construction of a naturalistic channel at this location would be ***beneficial*** to aesthetic quality and scenic integrity (Photos 4.8-G and 4.8-H).

Construction Activities

Actions associated with all construction activities would include general grade changes, tree removal, clearing and grubbing, and other site preparation work as needed throughout. Staging areas have been designated as part of the planning process. Multiple criteria were used to identify these areas. Visual impacts would be temporary and occur during construction and for a short duration after construction while vegetation is reestablished. Construction disturbances resulting from staging areas would be ***less than significant***.

Non-structural Components

All alternatives may also include flood warning systems and floodplain management (risk communication, emergency action plan, training, flood preparedness, evacuation routes, and response). These activities would have ***no impact*** to aesthetics.

Alternative A: Top-of-bank Floodwall, Kent Middle School Setback Floodwall, College Avenue Culverts

The total length of top-of-bank floodwalls would be approximately 13,220 feet for Alternative A. Top-of-bank floodwalls would be constructed along both sides of the creek in Units 2, 3, and 4 with the exception of setback floodwalls on the right bank around Kent Middle School athletic fields. The setback floodwall would have a maximum height of 7 feet and be approximately 1,092 feet long. This wall would block views between the school and athletic fields and would visually stand out from the bicycle-pedestrian pathway. Top-of-bank floodwalls with a maximum height of 8 and 9 feet would be constructed on the right bank and left bank, respectively, in Unit 4 (total 4,450 linear feet), and top-of-bank floodwalls with a maximum height of 11 feet would be constructed between the former fish ladder and Kent Middle School (total 7,500 linear feet).

Trees and other vegetation along the entire floodwall prism would be removed to construct top-of-bank floodwalls, and associated vegetation-free zone. Vegetation could be reestablished, but would be different from existing vegetation and likely less valued by visual receptors. Remaining riparian woodland vegetation would be markedly more fragmented. Floodwalls would substantially alter the view of the creek throughout Units 2, 3, and 4. Many local viewsheds of the creek could become obscured due to the height of the floodwalls. Because Unit 4 has a native material streambed and predominantly riparian vegetation with high aesthetic value, the perceived aesthetic impact to Unit 4 would be higher than to Units 2 and 3.

Culverts would be installed parallel to the creek beneath the road at College Avenue. To accommodate the culverts, both banks would require grading and benching. Culvert openings would be visible, but considered a minor change to aesthetics. The most notable impacts to aesthetic quality would be temporary, occurring during and immediately after construction. Vegetation would be reestablished after construction. The existing aesthetic quality of the stream channel is low based on the concrete channel and fencing along Corte Madera Creek (Figure 4.8-L). Installation of the culvert would likely have a minor impact to aesthetic quality and scenic integrity.

Floodwalls would substantially alter creek views and impact aesthetics. Residents of adjacent properties may consider this an especially acute degradation of the visual character of their homes, as concrete wall structures are generally found to have little aesthetic quality. Although the floodwalls would degrade aesthetic quality, the resulting consequences of the impact would likely not extend beyond loss of local views of the creek and less aesthetically pleasing riparian vegetation along the floodwalls. Alternative A would have the greatest impact to aesthetics of all the action alternatives. After implementation of AMMs, there is no feasible mitigation for aesthetics.

Impacts AES-1 and AES-2 would be ***significant and unavoidable*** for Alternative A.

Alternative B: Top-of-bank Floodwall/Sylvan Lane Setback Floodwall/College of Marin Widening

The total length of top-of-bank floodwalls would be approximately 8,985 feet and length of setback floodwall would be approximately 2,025 feet for Alternative B. Unit 4 would include top-of-bank floodwalls on the left bank with a 741-foot long setback floodwall on the right bank extending around multiple parcels along Sylvan Lane with a maximum height of 7 feet. A 48-foot setback wall would tie into the upstream end of the left bank top-of-bank floodwall. An access road for maintenance would be required for the Sylvan setback floodwall. The setback wall around Sylvan Lane would result in a lower visual impact than Alternative A for Sylvan Lane residences because the setback floodwall would not be located between houses and the creek. The roughly 7-foot high top-of-bank and setback floodwalls, although lower than Alternative A, would have a significant impact on aesthetic resources.

A combination of setback and top-of-bank floodwalls around the College of Marin would blend in better with existing development in the area and likely not be as intrusive as only top-of-bank floodwalls. Setback and top-of-bank floodwalls would alter some views from nearby businesses and along the bicycle-pedestrian path, but not significantly because the area is predominantly urban with concrete features and fencing. Alternative B would remove the concrete channel and result in a native material streambed and widened riparian corridor along the creek in close proximity to College of Marin and Kent Middle School that would likely improve aesthetic quality and scenic integrity. Although there would be temporary disturbance of the channel, the aesthetic quality of the channel is currently poor and most viewers would likely not perceive an impact during construction. As in Alternative A, removal of vegetation including trees along the creek would adversely affect the visual character of the Project area; however, resulting naturalistic features would be a minor impact.

Alternative B would install culverts underneath the College Avenue Bridge identical to Alternative A. The culvert openings would be visible, but considered a minor change to aesthetics. Alternative B would include replacement and improvement of the bicycle-pedestrian path along Units 2 and 3.

Floodwalls would substantially alter creek views and impact aesthetics. Because Unit 4 has a native material streambed and predominantly riparian vegetation with high aesthetic value, the perceived change to Unit 4 would be significant. Many viewsheds of the creek might become obscured due to the height of the floodwalls, but to a lesser extent than in Alternative A. Removal of a portion of concrete channel bed in Units 2 and 3 would likely improve the creek's visual character to a more natural state through the channel near the College of Marin. Revegetation with native plants and natural rock would add aesthetic value within 1 to 2 years. After implementation of AMMs, there is no feasible mitigation for aesthetics.

Impacts AES-1 and AES-2 would be ***significant and unavoidable*** for Alternative B.

Alternative F: Bypass/Allen Park Riparian Corridor/College of Marin Widening

Alternative F would include a bypass to convey flood flow from the upstream portion of Unit 4 downstream to the Allen Park Riparian Corridor. Floodwalls would not be constructed in Unit 4. In Units 2 and 3, the total length of top-of-bank floodwalls would be approximately 6,705 feet and the length of setback floodwalls would be approximately 1,236 feet. The bypass could require tree removal along portions of Sir Francis Drake Boulevard if the Project cannot be contained to the existing roadway. A tree survey would be completed prior to Project implementation if tree removal would be required, as determined during preconstruction engineering design. Revegetation along Sir Francis Drake Boulevard would be completed, and additional tree planting could be required elsewhere to accommodate local policy. The bypass would require relocation of utilities underneath Sir Francis Drake Boulevard, but would not change land use because the aesthetics would be located in new trenches outside of the box culverts. Aesthetics along Sir Francis Drake Boulevard would be temporarily impacted from construction and removal of vegetation. Implementation of AMMs BIO-3 and BIO-4 would limit the level of disturbance and vegetation removal. Photos 4.8-M and 4.8-N show examples of Sir Francis Drake Boulevard vegetation.

The Allen Park Riparian Corridor would involve bench excavation and channel widening and grading to create a widened riparian woodland area and active floodplain. The construction of Allen Park Corridor could require realignment of sewer line, but would not impact aesthetics because the new line would be located below ground and is within the existing footprint of construction for Allen Park Corridor or under pavement. Grading of the park would require removal of trees and other vegetation. The park would be revegetated with native riparian habitat with species similar to those in Unit 4, with a less dense canopy to maintain a "park-like" appearance. Setback walls around the park would have a 1-foot maximum height with a closure structure at the north park entrance while the floodwalls on the left bank would have a maximum height of 1.5 feet. Although trees would be removed and the setback walls would result in a short-term aesthetic impact during and immediately after construction, a more natural stream channel and floodplain would likely benefit scenic integrity in the long term.

Photo 4.8-M. Example of Vegetation on Sir Francis Drake Boulevard

Photo 4.8-N. Hillslope along curve on Sir Francis Drake Boulevard

Downstream of the Allen Park Riparian Corridor, project activities would be similar to Alternative B, with bench excavation and College of Marin Widening, and include replacement and improvement of the bicycle-pedestrian path along Units 2 and 3. This would not be expected to result in a significant aesthetic impact.

Alternative F would install culverts underneath the College Avenue Bridge identical to Alternatives A and B. The culvert openings would be visible, but considered a minor change to aesthetics. Floodwalls would alter the view of the creek at many points in Units 2 and 3. Viewsheds of the creek might become obscured due to the height of the floodwalls, but to a lesser extent than in Alternatives A and B. Removal of a portion of concrete channel would likely improve the creek’s visual character by changing the aesthetics of its shape and the flow of water through the channel in Allen Park Riparian Corridor and near the College of Marin. Revegetation with native plants and natural rock would add aesthetic value within 1 to 2 years. Some features within Units 2 and 3, such as floodwalls, could have a minor adverse impact to aesthetics, while others, such as removal of the concrete channel would have positive effects.

The Unit 4 bypass would result in a much lower impact to visual resources than Alternatives A, B, and G because it would eliminate the need for top-of-bank floodwalls in Unit 4. The bypass would have little impact to visual resources as it would be underground, most of it under Sir Francis Drake Boulevard. The bypass inlet and outlet would be visible, but not obtrusive. The high aesthetic quality of Unit 4 would remain intact. Allen Park Riparian corridor and removal of the concrete channel bed around College of Marin would also improve aesthetics. The AMM BIO-15 would limit light to the active construction areas using a maximum of 4 portable lights. Furthermore, Sir Francis Drake Boulevard is already impacted from headlights of heavy traffic where the portable lights would be used. The use of construction lighting would brighten only a small area at any given time that is already subjected to fairly continuous lighting.

Impacts AES-1, AES-2, and AES-4 would be ***less than significant*** for Alternative F***.***

Alternative G: Top-of-bank Floodwall/Allen Park Riparian Corridor/College of Marin Widening

Alternative G would construct top-of-bank floodwalls In Unit 4 and be identical to Alternative F in Units 2 and 3. Top-of-bank floodwalls would be constructed in Unit 4 similar to Alternative A but have a maximum height of 7 feet. Alternative G would also include replacement and improvement of the bicycle-pedestrian path along Units 2 and 3.

The total length of top-of-bank floodwall construction would be approximately 10,721 feet and the length of setback floodwall construction would be approximately 1,284 feet. The visual impacts to Units 2 and 3 would be identical to Alternative F. Impacts to Unit 4 would be similar to Alternative A, but less severe as the maximum height of the floodwalls would be 7 feet instead of 11 feet.

Alternative G would install culverts underneath the College Avenue Bridge identical to Alternative A. The culvert openings would be visible, but considered a minor change to aesthetics. After implementation of AMMs, there is no feasible mitigation for aesthetics.

Impacts AES-1 and AES-2 would be ***significant and unavoidable*** for Alternative G, primarily in Unit 4.

Alternative J: Bypass/Allen Park Riparian Corridor/Floodwall

Alternative J would include a bypass culvert to convey flood flow from the upstream portion of Unit 4 downstream to the Allen Park Riparian Corridor identical to Alternative F. Floodwalls would not be required in Unit 4.

The Allen Park Riparian Corridor would be the same as in Alternative F, except the setback walls around the park would have a 2-foot maximum height.

Downstream of the Allen Park Riparian Corridor, Project activities would include floodwall construction near the Granton Park neighborhood and at College Avenue Bridge extending downstream approximately 933 feet. Viewsheds of the creek might become obscured due to the height of the floodwalls, but to a lesser extent than other alternatives because floodwalls would only be constructed on portions of the left bank with a maximum height of 6 feet.

Impacts AES-1, AES-2, and AES-4 would be ***less than significant*** for Alternative J.

Comparison of Alternatives

Table 4.8-2 summarizes and compares impacts to aesthetics for each alternative based on type and extent of action. These actions include bench excavation, College of Marin Widening, creation of Allen

Park Riparian Corridor, construction of bypass culverts beneath Sir Francis Drake Boulevard, and a combination of retaining walls, top-of-bank floodwalls, and setback floodwalls. The length and height of floodwalls, and consequently associated impact to visual resources, vary between alternatives. Alternative A would have the greatest impact to visual resources as it would include the highest top-of-bank floodwalls with the greatest length (13,220 feet), and the only channel improvements would be Denil fish ladder removal. Alternative J would have the least impact to visual resources with no Unit 4 floodwalls, relatively low top-of-bank floodwalls with the shortest length (3,811 feet), and would include channel restoration at the fish ladder and Allen Park Riparian Corridor. Although Alternative F would construct more floodwalls than Alternative J, it would include bench excavation and College of Marin Widening that would improve aesthetics along the creek. Alternative B would have higher floodwalls than Alternative G, but would have approximately 1,700 feet less top-of-bank floodwalls. For Alternative B, the setback floodwall near Sylvan Lane would reduce visual impacts compared to walls between residents and the creek in Alternatives B and G. Visual impacts from Alternatives B and G would affect different receptors; however, Alternative G would include more channel improvement due to the Allen Park Riparian Corridor and would result in less aesthetic impact than Alternative B for most receptors. Table 4.8-3 summarizes the impacts to aesthetics***.***

TABLE 4.8-2 CORTE MADERA CREEK COMAPRISON OF AESTHETIC IMPACTS BY ALTERNATIVE

Feature	Effect	A	B	F	G	J
Unit 4 Top-of-bank Floodwall	Significant	●	●		●	
Kent Middle School Setback Wall (max 7 feet height)	Significant	●				
Bench Excavation (Channel Widening)	LTS		●	●	●	
Channel Bypass	LTS			●		●
College Avenue Bridge Culverts	LTS	●	●	●	●	
Retaining Walls	LTS		●	●	●	
Sylvan Setback Wall (max 8 feet height)	LTS		●			
College of Marin Setback Wall (max 4 feet height)	LTS		●	●	●	
College of Marin Widening	Short-term LTS Long-term Beneficial		●	●	●	
Fish Ladder Removal	Beneficial	●	●	●	●	●
Allen Park Riparian Corridor	Beneficial			●	●	●

TABLE 4.8-3 AESTHETIC IMPACT CONCLUSIONS					
Effect	**AMMs**	**Applicable Alternatives**	**Significance**	**Mitigation**	**Significance after Mitigation**
AES-1: Substantially degrade the existing visual character or quality of the study area and its surroundings.	AMM BIO-3 AMM BIO-4	A, B, G	S	None Available	SU
		F, J	LTS	--	--
		No Action	NI	--	--
AES-2: Have a substantial adverse effect on a scenic vista	AMM BIO-3 AMM BIO-4	A, B, G	S	None Available	SU
		F, J	LTS	--	--
		No Action	NI	--	--
AES-3: Substantially damage scenic resources, including, but not limited to, trees, rock outcroppings, and historic buildings within a state scenic highway.	--	N/A	--	--	--
AES-4: Create a new source of substantial light or glare which would adversely affect day or nighttime views in the area.	--	F, J	LTS	--	--
		No Action	NI	--	--

AMM = avoidance and minimization measure
LTS = less than significant
N/A = not applicable
NI = no impact
S = significant
SU = significant and unavoidable

4.8.3.4 Cumulative Impacts

The geographic scope for analysis of potential cumulative aesthetic impacts includes the project and surrounding areas within publicly accessible viewsheds.

Concurrent construction of the Project with other projects proposed in the area (Table 4-2) located within the same viewshed could result in short-term visual impacts during construction. The nearest project to the Corte Madera Creek FRM project is rehabilitation of Sir Francis Drake Boulevard. The EIR for that project finds that it would have only less-than-significant impacts on aesthetics. These impacts would not be expected to combine with the aesthetic impacts of the Project in a cumulative manner.

Other reasonably foreseeable projects within the watershed are bridge replacements, flood diversion and storage basin development, and private developments all located upstream of the project area. These projects are not located in the immediate visual vicinity of the Corte Madera Creek project site and would not contribute to short-term or long-term cumulative aesthetic impacts. Therefore, the project would not make a contribution to a significant aesthetic cumulative impact.

4.9 Recreation

This section describes existing recreational facilities and use within the study area, and the potential for the Project alternatives to adversely affect recreation. Data for this section were developed based on review of regional planning and policy documents, Marin County Parks and Open Space Department and the Town of Ross websites, and personal communication with Town of Ross staff.

4.9.1 Regulatory Setting

This section discusses regulatory information that applies to recreation resources. Additional regulatory information appears in Chapter 9 Environmental Compliance.

4.9.1.1 Federal

The federal government has no laws or requirements for recreation that are applicable to the Project.

4.9.1.2 State

The state has no laws or requirements for recreation that are applicable to the Project.

4.9.1.3 Local

Marin Countywide Plan

The Marin County General Plan (2007) seeks to "establish, maintain, and continue to improve a broad land use management framework using the county's environmental corridors as a basis for local policies and regulation, and to maintain the character of each of the corridors." Under Parks and Recreation, the General Plan states that "parks and recreational amenities are critical to the quality of life, and therefore the economy. Marin County residents and visitors are fortunate to have access to nearly half of the land in the county as parks and open space, including approximately 500 miles of trails through much of this land. City, county, state and national parks offer a wide variety of recreational opportunities, from hiking and sightseeing to soccer, golf, and baseball."

One goal is pertinent to recreational use of land within the study area contained in the Parks and Recreation section of the Marine Countywide Plan are presented below.

- **Policy PK-1.3 – Protect Park Resources from Impacts of Climate Change:** Identify strategies to protect park resources from the effects of climate change, such as violent weather, plant loss or change due to moisture and temperature changes, and sea level rises.

4.9.2 Affected Environment

County and city/town parks in Marin County provide a variety of active recreation amenities, including playing fields, pools, golf courses, tennis and volleyball courts, skate parks, and children's playgrounds. County Service Areas and special districts manage additional park and recreation facilities, as do some school districts.

Marin County

The Marin County Department of Parks and Open Space operates 43 public parks and facilities. Creekside Park, located less than 1 mile outside the study area in Kentfield, is a community park of 25.65 acres that was renovated and reopened in 2011. A community park is one that serves a population of 10,000 to 30,000 within a 3-mile radius and usually contains specialized facilities such as swimming pools, tennis courts, community centers, and sports field complexes. As such, Creekside Park is considered a community park that serves the study area.

Town of Ross

Three Town of Ross parks are located within the study area adjacent to Units 3 and 4 (Figure 4.9-1). Ross Common Park is made up of approximately 5.2 acres of open space and play fields. Station Park and Allen Park are also located in the study area. The Town of Ross conducts numerous community events throughout the year within Ross Common Park.

Recreational opportunities in the study area include biking and pedestrian opportunities along the recreational path, located adjacent to the west bank of the creek (Units 2, 3, and 4) that passes through Allen Park. The Corte Madera bicycle-pedestrian pathway runs from the Ross Town limit to Lagunitas Road over a 0.27 mile stretch. Community tennis courts are located within the study area, immediately west of Unit 3.

Town of Kentfield

Kent Middle School is adjacent to Unit 2 at the downstream end of the study area. Athletic fields with approximately 1 acre of open space are adjacent to the right bank.

4.9.3 Environmental Consequences

4.9.3.1 Avoidance and Minimization Measures

Recreation resources have no specific AMMs.

4.9.3.2 Methodology for Impact Analysis and Significance Thresholds

The analysis of effects on recreation evaluated impacts to Allen Park, the bicycle-pedestrian pathway, and Kent Middle School athletic fields in consideration of policies listed in the Marin Countywide Plan (2007) and the Town of Ross General Plan.

The Project would pose a significant impact on the recreation of the surrounding area if it would result in the following impacts.

- **Impact REC-1:** Limit or impede existing recreational uses in the project area.
- **Impact REC-2**: Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment.
- **Impact REC-3:** Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.

4.9.3.3 Effects and Mitigation

No Action Alternative

In the no action alternative, the current recreational use in the Project area would remain unchanged. Short-term impacts from construction would be avoided. No changes would be made to Allen Park or the Kent Middle School athletic fields. Long-term improvements to the bicycle-pedestrian pathway would not occur. Under the no action alternative, there would be ***no impact***.

Action Alternatives

The Project has the potential to contribute to impacts as described in this section.

- **Impact REC-1**: Limit or impede existing recreational uses in the project area.

Station Park

Staging area 4-3 is located at Station Park. During construction, access to this open space park would be limited. Station Park is small and used infrequently compared to other parks in the area.

This would be a ***less than significant*** impact.

Bicycle-Pedestrian Pathway

Flood control structures, including floodwalls, would be constructed adjacent to the bicycle-pedestrian pathway along the creek. Recreational users would view new floodwalls in some areas, but they would not impede the function of the path.

For Alternatives B, F, and G, the pathway would be lowered in some areas of Unit 3, downstream of Allen Park Corridor, to accommodate additional flow during flood events (Figures 3-2c and 3-2d). Sections of the path would be replaced and improved. Currently, the bicycle-pedestrian pathway may be closed along portions of Unit 3 during flood events. Closure for flood or high flow events would occur more frequently in Unit 3 for Alternatives B, F, and G because the pathway would be lowered from its current location. During closure from flood events, safety precautions that currently occur would continue to be implemented, such as putting out cones to mark hazards. Thus, safety on the pathway during flood events would not be altered. The Project would ensure accessibility of the bicycle-pedestrian pathway in accordance with the Americans with Disabilities Act for all alternatives.

For Alternatives F, G, and J, the bicycle-pedestrian pathway within the Allen Park Riparian Corridor would be similar to the current pathway through Allen Park. Increased closure of the pathway in Allen Park Riparian Corridor due to flood events would not be expected.

For Alternatives A, B, F, and G, the bicycle-pedestrian pathway would potentially be relocated to the opposite side of the creek near Kent Middle School and College of Marin, along an existing earthen pathway. This would not alter accessibility or quality of the pathway.

Access to the path would be blocked during construction. Construction would occur seasonally and in phases; therefore, closures would only affect a small section of the pathway at a time. Closure of the path would impact pedestrians and cyclists throughout the Project area.

Bicycle Route 15, located on local roadways west of the Project bicycle-pedestrian pathway (Figure 4.9-1), is a primary route that could be used as an alternate route from College Avenue to Lagunitas Road, spanning the length of the Project. Cyclists would share the road with motor vehicles along this detour, which would affect recreational use. Sidewalks are available for pedestrians on both sides of the street. The recreational experience would be diminished because cyclists and pedestrians would no longer view the creek vista. Because construction would be temporary and an alternate route is available, this impact would be ***less than significant.***

Allen Park Riparian Corridor

Alternatives A and B would not affect Allen Park.

The Allen Park Riparian Corridor, constructed in Alternatives F, G, and J would involve excavation, grading, and construction of flood protection structures in Allen Park. The bicycle-pedestrian pathway runs through Allen Park and community tennis courts are located adjacent to the park. Park access would be limited during construction; however, tennis courts would be outside of the construction footprint and remain accessible. Following construction, the park would be expanded and improved. Any closures during construction would result in a temporary impact.

The bicycle-pedestrian path through Allen Park would be reconstructed in a similar location to the current pathway. Nature trails would be added along the creek. The creek would be restored to a natural streambed, improving the aesthetic appeal of the recreational area. These would be long-term, beneficial impacts. Therefore, the impact to Allen Park would be ***less than significant.***

Kent Middle School Athletic Fields

Alternatives B, F, and G would construct floodwalls adjacent to Kent Middle School athletic fields. Alternative A would construct setback floodwalls around the athletic fields. All floodwalls would be constructed outside of the designated athletic field area to allow fields to continue to be used as intended without any restrictions. Alternative A setback floodwall would occupy 0.05 acre, and Alternatives B, F, and G would occupy 0.71 acre between the bike path and the proposed floodwall on the right bank. Although Alternatives A, B, F, and G would remove some acreage from the athletic fields, adequate area would remain for recreation to continue. Alternative J would not construct floodwalls near Kent Middle School.

For Alternatives A, B, F, and, G, this impact would be ***less than significant.***

For Alternative J, there would be ***no impact.***

- **Impact REC-2**: Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment.

Construction of the Project would include replacement of the existing bicycle-pedestrian pathway in Units 2 and 3 for Alternatives B, F, and G and improvement of natural ecosystems in Allen Park for Alternatives F, G, and J. Alternative J would include bicycle-pedestrian pathway improvement within Allen Park, but not further downstream.

The Project would not require expansion of recreational facilities within the Project area. The bicycle-pedestrian pathway would be replaced and improved to accommodate the new flood protection structures, but would not vary significantly from the size of the existing footprint. The bicycle-pedestrian pathway would potentially be relocated to the opposite side of the creek near Kent Middle School and College of Marin, along the route of an existing earthen pathway. Floodwalls would be constructed near the Kent Middle School athletic fields that would not require additional facilities. Changes to Allen Park (Alternatives F, G, and J) would not expand the current park footprint. Proposed changes to recreational facilities would not require expansion.

This impact would be ***less than significant.***

- **Impact REC-3:** Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.

Improvements to recreational facilities could increase use. However, the Project would not induce any growth that would create potential new users or create new or expanded facilities that may attract additional users. Although improvement of the recreational facilities could increase the appeal and usage of the recreational areas, an increase to the extent causing deterioration is not expected.

This impact would be ***less than significant.***

Table 4.9-1 summarizes the impacts to recreation**.**

TABLE 4.9-1 RECREATION IMPACT CONCLUSIONS					
Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
REC-1: Limit or impede existing recreational uses in the project area.	--	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
REC-2: Include recreational facilities or require the construction or expansion of recreational facilities which might have an adverse physical effect on the environment.	--	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
REC-3: Increase the use of existing neighborhood and regional parks or other recreational facilities such that substantial physical deterioration of the facility would occur or be accelerated.	--	All Action Alternatives	LTS	--	--
		No Action	NI	--	--

AMM = avoidance and minimization measure
LTS = less than significant
NI = no impact

4.9.3.4 Cumulative Impacts

Construction and operation of the Project would not require the designation of additional parkland to remain in conformance with locally acceptable or adopted park standards. Therefore, there would be no significant cumulative impact on these resources to which the Project would contribute. The following discussions analyze the cumulative impacts regarding whether construction and operation of the Project could increase the use of existing neighborhood and regional parks or other recreational facilities, and if construction and operation of Project would include recreational facilities and require the construction or expansion of recreational facilities.

Some of the projects identified in Table 4-2 would be under construction at the same time as the Project (Ross Valley Flood Protection and Watershed Program, San Anselmo Flood Risk Reduction Project, bridge removal and replacement projects, Sir Francis Drake Boulevard Rehabilitation Project) and could result in short-term disruption of recreational facilities. The Project would not be expected to cause any significant environmental effects on recreational facilities or affect long-term recreational use of the study area. The Project would include temporary impacts to the bike path and Allen Park during construction and would temporarily decrease the amount of park area available to the public. It is therefore possible that some of the use that would have occurred at Allen Park during the construction period would be shifted to other recreational facilities within the Town of Ross or in neighboring jurisdictions. Construction of Project facilities would occur during the same time frame and in the same vicinity as some other planned and proposed projects, which could also cause temporary park closures and shift public access and recreational use to other park facilities. This increased use of those facilities could cause congestion or other adverse effects. However, the cumulative projects listed in Table 4-2 are located throughout the Corte Madera Creek watershed, and will not all be implemented simultaneously. Therefore, while there may be some displacement of recreational uses to other locations in the region, overall the cumulative effect of implementation of all of these projects would be less than significant.

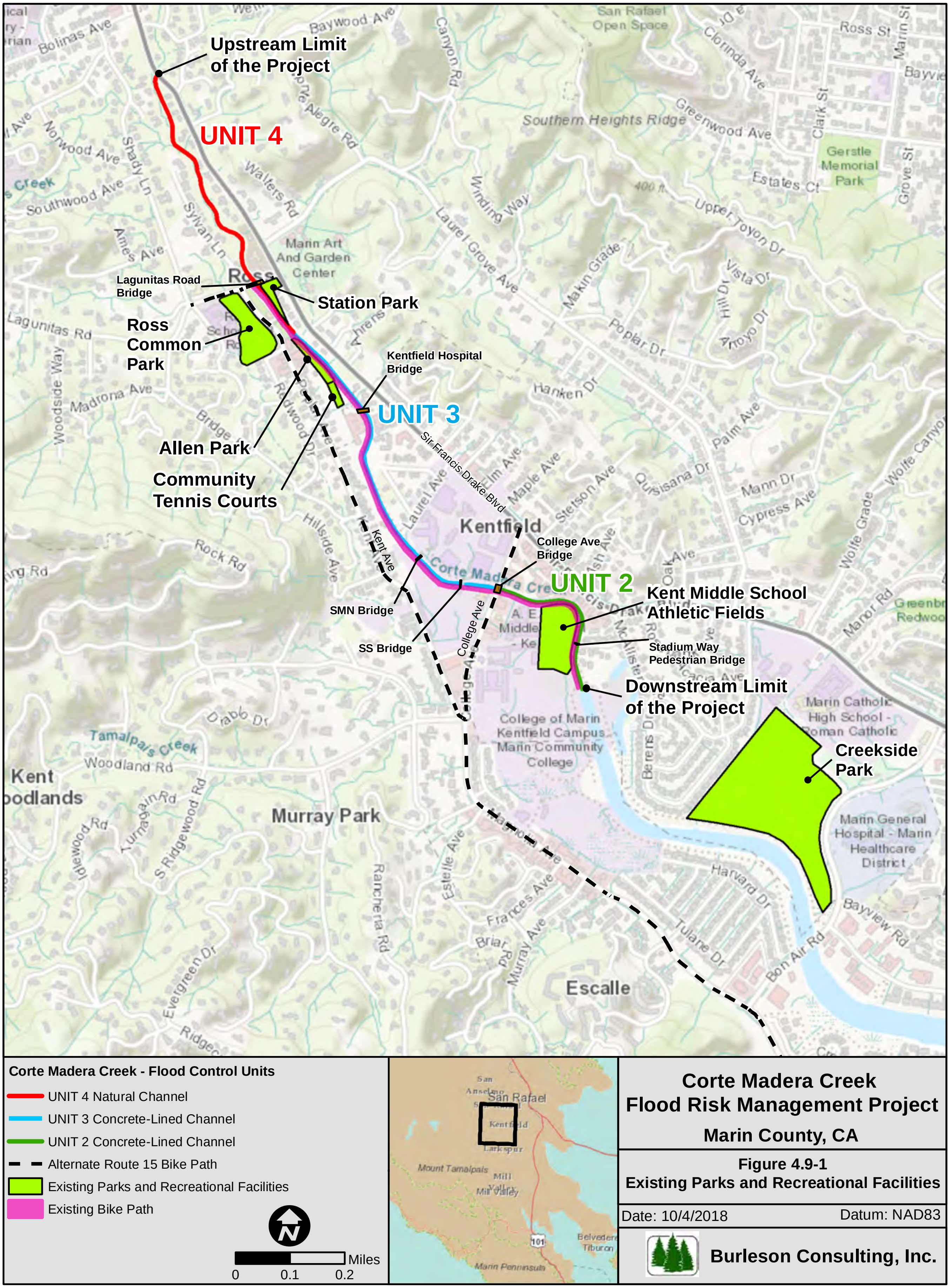


Figure 4.9-1
Existing Parks and Recreational Facilities

4.10 Noise

This section describes the existing noise environment in the study area, including existing sources of noise and groundborne vibration, and examined the potential for Project alternatives to result in a significant noise impact. Data for this section were developed based on a field investigation (March 25, 2010) to measure existing noise levels, a review of current noise standards, and noise assessment methodologies.

4.10.1 Regulatory Setting

This section discusses regulatory information that applies to noise and vibration. Additional regulatory information appears in Chapter 9 Environmental Compliance.

4.10.1.1 Federal

Safety and Health Regulations for Construction (29 CFR § 1926)

29 CFR 1926.52 (b): When employees are subjected to sound levels exceeding those listed in Table 4.10-1, feasible administrative or engineering controls shall be utilized. If such controls fail to reduce sound levels within the levels of the table, personal protective equipment as required in Subpart E, shall be provided and used to reduce sound levels within the levels of the table.

29 CFR 1926.52 (d) (1): In all cases where the sound levels exceed the values shown herein, a continuing, effective hearing conservation program shall be administered.

TABLE 4.10-1 PERMISSIBLE NOISE EXPOSURES

Duration per Day (hours)	Sound Level (dBA, slow response)
8	90
6	92
4	95
3	97
2	100
1 ½	102
1	105
½	110
¼ or less	115

USEPA Noise Control

The Noise Control Act of 1972 addressed the risk of noise pollution by promoting research, standards, and public education for noise pollution. Historically, the USEPA implemented this act through the Office of Noise Abatement and Control. This office has since been defunded, though the Act remains in place.

Today, the USEPA defers noise pollution regulation to state and local governments. The USEPA has established general guidelines for noise levels in sensitive areas in order to provide state and/or local governments' guidance in establishing local laws, ordinances, rules, or standards. The USEPA guidelines suggest that the average residential outdoor noise level be 55 A-weighted decibels (dBA) and the indoor level be 45 dBA. The indoor level also applies to sensitive noise receptors such as hospitals, schools, and libraries. However, the USEPA residential outdoor and indoor noise levels are considered general guidelines and not regulatory requirements.

4.10.1.2 State

Health and Safety Code

There are no applicable state regulations which specifically limit the generation of noise or groundborne vibrations. However, under the California Noise Control Act of 1973, the state is encouraged to assist all local agencies in combating noise pollution, as described in the California Health and Safety Code:

- **Section 46061:** The office shall provide technical assistance to local agencies in combating noise pollution. Such assistance shall include but not be limited to:
  - Advice concerning methods of noise abatement and control.
  - Advice on training of noise control personnel.
  - Advice on selection and operation of noise abatement equipment.
- **Section 46062:** The office shall provide assistance to local agencies in the preparation of model ordinances to control and abate noise. Such ordinances shall be developed in consultation with the Attorney General and with representatives of local agencies, including the County Supervisors Association of California and the League of California Cities. Any local agency which adopts any noise control ordinance shall promptly furnish a copy to the office.

California Department of Transportation Guidelines

The California Department of Transportation (Caltrans) has established guidelines for acceptable vibration limits for transportation and construction projects. Caltrans used a peak particle velocity to identify acceptable levels. These guideline values (Transportation and Construction Vibration Guidance Manual 2013) are presented in 4.10.-2.

TABLE 4.10-2 CALTRANS VIBRATION GUIDE

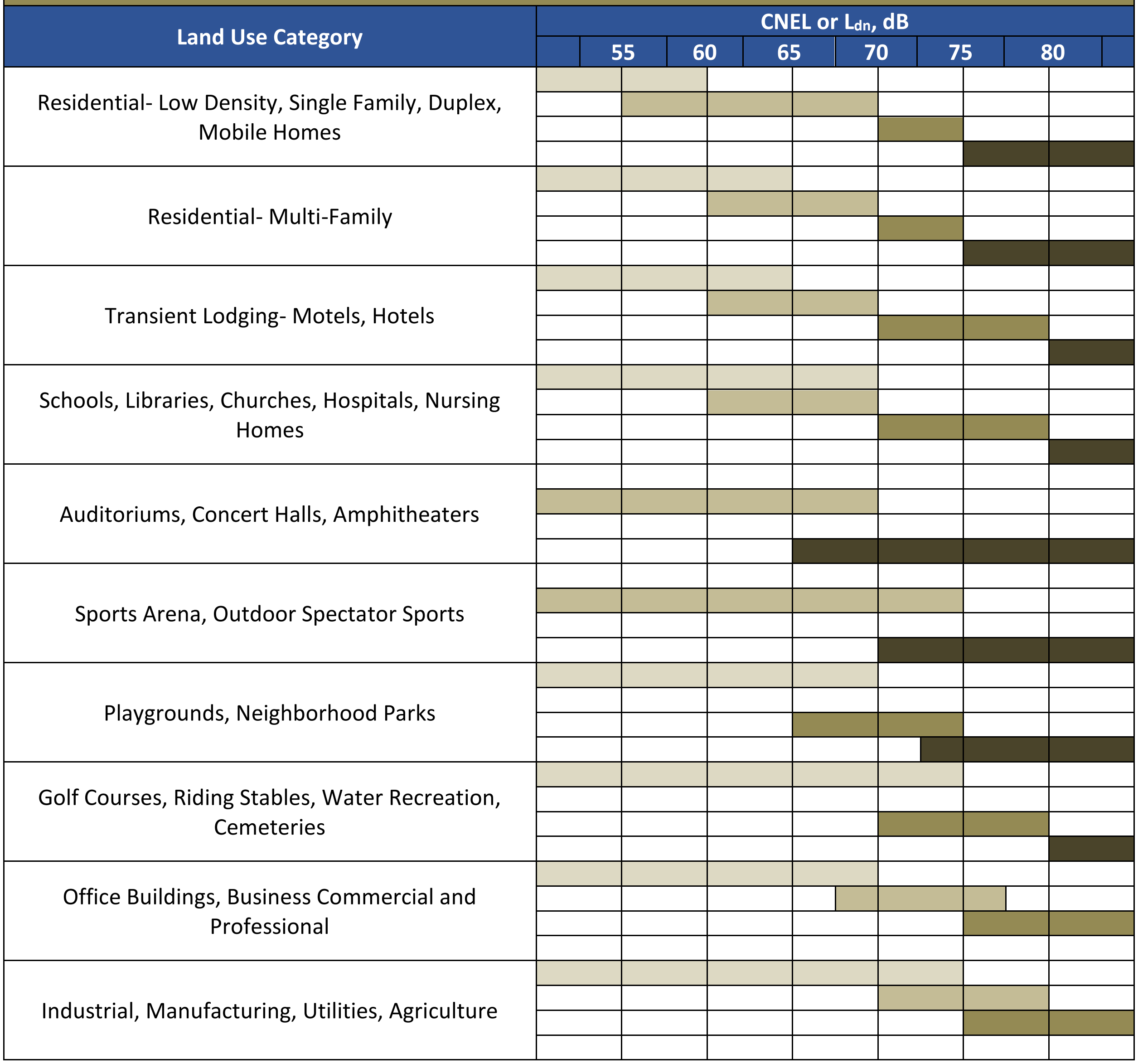
Common Outdoor Activities	Maximum Peak Particle Velocity (in/sec)	
	Transient Sources	Continuous/Frequent Intermittent Sources
Extremely fragile historic buildings, ruins, ancient monuments	0.12	0.08
Fragile buildings	0.20	0.10
Historic and some old buildings	0.50	0.25
Older residential structures	0.50	0.30
New residential structures	1.00	0.50
Modern industrial/commercial buildings	2.00	0.50

Note: Transient sources create a single isolated vibration event, such as blasting or drop balls. Continuous/frequent intermittent sources include impact pile drivers, pogo-stick compactors, crack-and-seat equipment, vibratory pile drivers, and vibratory compaction equipment.
in/sec = inch per second
Source: Caltrans 2013a

Governor's Office of Planning and Research General Plan Guidelines

Appendix D of the Governor's Office of Planning and Research General Plan Guidelines provides guidelines for the development of the noise element in local general plans. These guidelines include recommendations for evaluating the compatibility of various land uses as a function of community noise exposure. According to the guidelines, exterior noise exposures generally fall into three categories: normally acceptable, conditionally acceptable, and unacceptable. Each land use has a particular dBA range within each exterior noise exposure category. Suggested metrics for CNEL and L_{dn} provided in the guidance are provided in Table 4.10-3.

TABLE 4.10-3 SUGGESTED COMMUNITY NOISE EXPOSURE



Normally Acceptable: Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

Conditionally Acceptable: New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

Normally Unacceptable: New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

Clearly Unacceptable: New construction or development should generally not be undertaken.

4.10.1.3 Local

Marin Countywide Plan

The following policy of the Marin Countywide Plan is applicable to noise regulation:

- **Policy NO-1.3 Regulate Noise Generating Activities:** Require measures to minimize noise exposure to neighboring properties, open space, and wildlife habitat from construction-related activities, yard maintenance equipment, and other noise sources, such as amplified music.

In addition to the policy identified above, the Marin Countywide Plan, as part of the Noise Element, establishes standards for noise-sensitive land uses and standards to avoid noise-related impacts from existing uses and new developments within the unincorporated part of the county. Based on these standards, exterior noise levels of 60 dBA Day-Night Average Sound Level (L_{dn}) and lower are normally acceptable for residential uses and commercial uses that include hotels, motels, and transient lodging; exterior noise levels of up to 70 dBA Community Noise Equivalent Level (CNEL) are conditionally acceptable. Normally acceptable is defined as the highest noise level that should be considered for the construction of new buildings that incorporate conventional construction techniques, but without any special noise insulation requirements. Conditionally acceptable includes the highest noise levels that should be considered only after detailed analysis of the noise reduction requirements are made and needed noise insulation features are determined.

Marin County Noise Ordinance

The Marin County Code stipulates the following regulation for construction-related noise:

- Hours for construction activities and other work undertaken in connection with building, plumbing, electrical, and other permits issued by the community development agency shall be limited to the following:
    - Monday through Friday: 7 am to 6 pm
    - Saturday: 9 am to 5 pm
    - Prohibited on Sundays and Holidays (New Year's Day, President's Day, Memorial Day, Independence Day, Labor Day, Thanksgiving Day, and Christmas Day)
- Loud noise-generating construction-related equipment (e.g., backhoes, generators, jackhammers) can be maintained, operated, or serviced at a construction site for permits administered by the community development agency from 8 am to 5 pm Monday through Friday only.
- Special exceptions to these limitations may occur for:
    - Emergency work as defined in Section 22.130.030 of this code provided written notice is given to the community development director within 48 hours of commencing work;
    - Construction projects of city, county, state, other public agency, or other public utility;
    - When written permission of the community development director has been obtained, for showing of sufficient cause;
    - Minor jobs (e.g., painting, hand sanding, sweeping) with minimal/no noise impacts on surrounding properties;
    - Modifications required by the review authority as a discretionary permit condition of approval.

Town of Ross General Plan

The following policy of the Town of Ross General Plan is applicable to noise regulation:

- **Policy 5.6 Noise/Land Use Compatibility Standards**. The Land Use/Noise Compatibility Standards apply to the siting and design of new structures and substantial remodels. Any project that is located in a "conditionally acceptable" or "normally unacceptable" noise exposure area will be required to prepare an acoustical analysis. Noise mitigation features may be required by the Town.
    - Normally Acceptable: Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements. Normally acceptable exterior noise limits for residential sites is defined as 45-60 dB L_{dn}.
    - Conditionally Acceptable: Specific land use may be permitted only after detailed analysis of the noise reduction requirements and needed noise insulation features included in the design. Conditionally acceptable exterior noise limits for residential sites is defined as 60-75 dB L_{dn}.
- **Policy 5.7 Noise Standards for Exterior Residential Use Areas.** The noise standard for exterior use areas (such as backyards) in residential areas is 55 decibel L_{dn}. All areas of Ross meet this standard except for those properties located along Sir Francis Drake Boulevard. General Plan policy requires that any new residential construction meet this standard.
- **Policy 5.10 Traffic and Construction Noise.** Require mitigation of construction and traffic noise impacts on the ambient noise level in the Town.

Town of Ross Noise Ordinance

The Town of Ross Code stipulates the following regulation for construction-related noise:

> It is unlawful for any person or construction company within the town limits to perform any construction operation before 8 am or after 5 pm, Monday through Friday of each week and not at any time on Saturday, Sunday, or the other holidays listed in Section 9.20.060.

4.10.2 Affected Environment

4.10.2.1 Fundamentals of Sound and Environmental Noise

Sound is created when vibrations produce pressure variations that move rapidly outward into the surrounding air, and it is technically described in terms of amplitude (loudness) and frequency (pitch). Although the standard unit of sound amplitude measurement is decibel, the human ear is not equally sensitive to a given sound level at all frequencies, so a special frequency-dependent rating scale, known as the A-weighted decibel scale (dBA), has been devised to relate noise to human sensitivity.

A typical noise environment consists of a base of steady "background" noise that is the sum of many distant and indistinguishable noise sources. Superimposed on this background noise is the sound from individual local sources. Table 4.10-4 lists representative noise levels for the environment. Several rating scales have been developed to analyze the adverse effect of community noise on people. Because environmental noise fluctuates over time, these scales consider that the effect of noise upon people is largely dependent upon the total acoustical energy content of the noise, as well as the time of day when the noise occurs. The most commonly used descriptors are as follows:

- ***L_{eq}***, the equivalent energy noise level, is the average acoustic energy content of noise for a stated period of time. Thus, the L_{eq} of a time-varying noise and that of a steady noise are the same if they deliver the same acoustic energy to the ear during exposure. For evaluating community impacts, this rating scale does not vary, regardless of whether the noise occurs during the day or the night.

- ***L_{dn}*****,** the Day-Night Average Noise Level, is a 24-hour average L_{eq} with a 10 dBA penalty during the hours of 10 pm to 7 am to account for noise sensitivity in the evening and nighttime, respectively.
- ***CNEL,*** the Community Noise Equivalent Level, which is calculated exactly the same as L_{dn}, but with an additional 5 dBA penalty from the hours of 7 pm to 10 pm.
- ***L_{min}*****,** the minimum instantaneous noise level experienced during a given period of time.
- ***L_{max}*****,** the maximum instantaneous noise level experienced during a given period of time.

Noise levels from a particular source decline as distance to the receptor increases. Other factors, such as the weather and reflecting or shielding, also intensify or reduce the noise level at a location. In general, human sound perception is such that a change in sound level of 1 dBA cannot typically be perceived by the human ear, a change of 3 dBA is just noticeable, a change of 5 dBA is clearly noticeable, and a change of 10 dBA is perceived as doubling or halving the sound level. Increases of +20, +30, and +40 dBA are perceived as four, eight, and 16 times louder, respectively.

The degree to which the ground surface absorbs acoustical energy also affects sound propagation. Sound that travels over an acoustically absorptive surface, such as grass, attenuates at a greater rate than sound that travels over a hard surface, such as pavement. The increased attenuation is typically in the range of 3 to 4.5 dBA per doubling of distance for “hard” and “soft” surfaces, respectively. Barriers such as buildings and topography that block the line of sight between a source and receiver also increase the attenuation of sound over distance.

TABLE 4.10-4 REPRESENTATIVE ENVIRONMENTAL NOISE LEVELS

Common Outdoor Activities	Noise Level (dBA)	Common Indoor Activities
Power Saw	—110—	Rock Band
Jet Fly-over at 100 feet		Crying Baby
Subway	—100—	
Gas Lawnmower at 3 feet		
Tractor	—90—	
		Food Blender at 3 feet
Diesel Truck going 50 mph at 50 feet	—80—	Garbage Disposal at 3 feet
Noisy Urban Area during Daytime		
Gas Lawnmower at 100 feet	—70—	Vacuum Cleaner at 10 feet
Commercial Area		Normal Speech at 3 feet
Heavy Traffic at 300 feet	—60—	Sewing Machine
Air Conditioner		Large Business Office
Quiet Urban Area during Daytime	—50—	Dishwasher in Next Room
		Refrigerator
Quiet Urban Area during Nighttime	—40—	Theater, Large Conference Room (background)
Quiet Suburban Area during Nighttime		
	—30—	Library
Quiet Rural Area during Nighttime		Bedroom at Night, Concert Hall (background)
	—20—	
		Broadcast/Recording Studio
	—10—	
Lowest Threshold of Human Hearing	—0—	Lowest Threshold of Human Hearing

SOURCE: Caltrans 1998

Noise from stationary or point sources (including construction noise) is reduced by about 6 to 7.5 dBA for every doubling of distance at acoustically hard and soft locations, respectively. Noise levels may also be reduced by intervening structures; generally, a single row of buildings between the receptor and the noise source reduces the noise level by about 5 dBA, while a solid wall or berm reduces noise levels by 5 to 10 dBA. The manner in which older homes in California were constructed generally provides a reduction of exterior-to-interior noise levels of about 20 to 25 dBA with closed windows. The exterior-to-interior reduction of newer residential units is generally 30 dBA or more.

Vibration is sound radiated through the ground. Groundborne noise is the rumbling sound caused by the vibration of room surfaces. The ground motion caused by vibration is measured as particle velocity in in/sec; in the U.S., this is referenced as vibration velocity.

The background vibration velocity level in residential and educational areas is usually around 50 vibration velocity. The vibration velocity level threshold of perception for humans is approximately 65 vibration velocity. A vibration velocity level of 75 vibration velocity is the approximate dividing line between barely perceptible and distinctly perceptible levels for many people. Typical outdoor sources of perceptible groundborne vibration are construction equipment, steel-wheeled trains, and traffic on rough roads. Groundborne vibration is almost never annoying to people who are outdoors. Although the motion of the ground may be perceived, without the effects associated with the shaking of a building, the motion does not provoke adverse human reaction. In addition, the rumble noise that usually accompanies building vibration is perceptible only inside buildings. The range of interest is from approximately 50 vibration velocity, which is the typical background vibration velocity level, to 100 vibration velocity, which is the general threshold where minor damage can occur in fragile buildings. Table 4.10-5 describes the general human response to different levels of groundborne vibration velocity levels.

TABLE 4.10-5 HUMAN RESPONSE TO DIFFERENT LEVELS OF GROUND-BORNE VIBRATION

Vibration Velocity Level	Human Reaction
65	Approximate threshold of perception for many people.
75	Approximate dividing line between barely perceptible and distinctly perceptible. Many people find that transportation-related vibration at this level is unacceptable.
85	Vibration acceptable only if there are an infrequent number of events per day.

SOURCE: Harris Miller & Hanson Inc., 2006.

4.10.2.2 Current Noise Environment

Existing Receptors

Sensitive land uses are those uses that have associated human activities that may be subject to stress or significant interference from noise. Potentially sensitive land uses in and adjoining the study area include residences along Corte Madera Creek and Sir Francis Drake Boulevard, Ross Common Park, Station Park, Allen Park, Ross Elementary School, Kentfield Hospital, Kent Middle School, and the College of Marin. The average distance between the creek and nearby receptors is approximately 50 feet. However, residences on Sylvan Lane and along the creek near the east bank of the fish ladder are within 25 feet of the Project. Ross Elementary School is 140 feet from the Project area, while the College of Marin and Kent Middle School border the creek, within 25 feet.

Local Noise Sources

The majority of ambient noise in the study area is associated with transportation-related sources. Traffic along Sir Francis Drake Boulevard is readily noticeable along Corte Madera Creek. In addition, construction noise represents a temporary, yet pervasive type of noise source in the study area. There are no known sources of substantial permanent stationary source noise in the study area.

Existing Sources of Groundborne Vibration

Within the study area, the majority of perceivable groundborne vibration is associated with vehicular traffic and is limited to large, loaded vehicles, such as haul trucks on local roadways.

Measured Noise Levels

Existing ambient daytime noise levels were measured at three locations along Corte Madera Creek and in the vicinity of the creek to characterize existing daytime noise conditions caused by various noise sources (USACE 2010). Ambient noise levels were monitored at general locations where noise levels are considered representative of typical uses in the area, shown in Figure 4.10-1.

Noise levels were monitored using a Larson-Davis Model 814 precision sound level meter, which meets the standards of the American National Standards Institute for general environmental noise measurement instrumentation. The average noise levels and sources of noise measured at each location are identified in Table 4.10-6. These daytime noise levels are characteristic of a typical developed area, with the greatest noise levels occurring along heavily traveled roadways. It should be noted that noise measurements were staged to achieve the maximum average ambient noise levels due to the operation of nearby uses.

TABLE 4.10-6 EXISTING DAYTIME NOISE LEVELS AT SELECTED LOCATIONS

Position	Start Time	Duration (minutes)	Sound Level (dBA L_{eq})	Min dBA	Max dBA	Sources
Location 1: Town of Ross Administration Offices	12:30 pm	15	52.5	45.0	66.3	Traffic on Sir Francis Drake Boulevard, wildlife
Location 2: Frederick Allen Park	12:05 pm	15	51.3	45.5	68.4	Traffic on Ross Common and Sir Francis Drake Boulevard, pedestrians/ joggers, distant construction
Location 3: Western edge of pedestrian bridge at College of Marin	1:30 pm	15	55.5	52.4	65.4	Pedestrians, cyclists, construction north of monitoring location

SOURCE: USACE 2010.

Noise Levels Associated with Existing Construction Activities in the Study Area

Construction activities are a regular and on-going source of noise within the Town of Ross and Marin County due to the construction and/or renovation of new and existing structures. Noise levels generated by construction activities are generally isolated to the immediate vicinity of the construction site and typically occur during daytime hours in accordance with local regulations. Construction activities also typically occur for relatively short-term periods of a few weeks to a few months, and then the noise sources are removed from the construction area. At the time that noise monitoring was conducted along Corte Madera Creek, construction activities were being conducted at the College of Marin (USACE 2010).

4.10.3 Environmental Consequences

4.10.3.1 Avoidance and Minimization Measures

The following AMMs would be implemented as part of the Project and would avoid or minimize adverse effects associated with noise.

- **AMM-NOI-1: Work Hours -** Truck delivery and use of heavy construction equipment would be restricted to hours between 8 am and 5 pm, Monday through Friday, except for potential night work to install box culverts under Sir Francis Drake Boulevard. Seasonal restrictions and buffers would be imposed on construction to avoid impacts to biological resources (see Chapter 4.6 Biological Resources).
- **AMM-NOI-2: Noise BMPs** - The contractor would implement practices that minimize the disturbances to residential neighborhoods surrounding work sites, including:
    - Internal combustion engines would be equipped with adequate mufflers;
    - Excessive idling of vehicles would be prohibited;
    - All construction equipment would be equipped with manufacturer's standard noise control devices; and,
    - The use of Jake brakes would be prohibited in residential areas.

The following AMM for biological resources would apply to noise because seasonal restrictions align with breeding/mating periods that can be impacted by noise and vibration.

- **AMM-BIO-2: Seasonal Restrictions -** Implement wet-season restrictions on construction for wildlife protection. Construction activities in or adjacent to the channel of Corte Madera Creek shall be conducted during the dry season (June 15 through October 15).

4.10.3.2 Methodology for Analysis and Significance Thresholds

Methods used to analyze noise effects expected at the work area were based on the formula from the Caltrans 2013 Technical Noise Supplement to the Traffic Noise Analysis Protocol, as well as from the 2006 Federal Highway Administration (FHWA) Roadway Construction Noise Model User's Guide. Calculations were also based on Chapter 12 of the FTA Transit Noise and Vibration Impact Assessment.

Detailed noise calculations are presented in Appendix C. Noise levels were calculated for each construction task, as defined in Chapter 3. The two loudest pieces of equipment were used to calculate the noise level produced by each task. One exception was that a vibratory pile driver would be used without any other equipment because grading activities would be completed. The L_{max} of the equipment was then converted to L_{eq} based on the typical acoustical use factor (percent) from the FHWA (see Equation 1). The combined L_{eq} of equipment was calculated using Equation 2. Calculations were only conducted for daytime, as night construction is not anticipated.

Equation 1 $$L_{eq} = L_{max} + 10\log(UF)$$

where

L_{eq} = equivalent noise level (dBA)

L_{max} = peak noise level, (dBA)

UF = usage factor (percent)

Equation 2 $$L_{eq,total} = 10\log(10^{L_{eq,1}/10} + 10^{L_{eq,2}/10})$$

where
$L_{eq,\ total}$ = combined total equivalent noise level (dBA)
$L_{eq,1}$ = L_{eq} of equipment piece #1, (dBA)
$L_{eq,2}$ = L_{eq} of equipment piece #2, (dBA)

These values were used to calculate the L_{dn} and CNEL for each site, using conservative assumptions for the night time noise level (40 dBA) and the average measured daytime noise level from Table 4.10-5, 53.5 dBA (Appendix C). The resulting L_{dn} and CNEL values were then compared to the requirements set by the Marin Countywide Plan and the Town of Ross General Plan to determine if noise would be considered a significant impact on the surrounding community. As long as at least one potential work site had any of the impact criteria, the alternative was classified as a significant impact.

For the purpose of this analysis, receptors at both 50 feet (the overall average across the Project area) and 25 feet (the local average over several short segments of the Project area) were considered. Receptors at these ranges are typically residential or commercial uses.

See Appendix C (Noise Impact Calculations) for details.

For vibration, it was assumed that only one substantial piece of vibration-generating equipment would be used at a time. Table 4.10-7 summarizes typical vibration levels generated by construction equipment applicable to the Project and their effect on humans and buildings (FTA 2006, Caltrans 2013a).

TABLE 4.10-7 VIBRATION SOURCE LEVELS FOR CONSTRUCTION EQUIPMENT

Equipment	Peak Particle Velocity at 25 feet (in/sec)	Peak Particle Velocity at 50 feet (in/sec)	Human Reaction	Effect on Buildings
Pile Driver (Sonic/Vibratory)	0.170 to 0.734	0.060 to 0.260	Ranges from annoying to unpleasant, for both indoors and outdoors	Architectural damage and minor structural damage are possible
Large Bulldozer	0.089	0.031	Vibrations perceptible but not annoying	Normal buildings safe; ruins may suffer damage
Loaded Truck	0.076	0.027	Vibrations marginally perceptible	Normal buildings safe; slight risk for ruins.
Small Bulldozer	0.003	0.001	Imperceptible	Safe for buildings

SOURCES: FTA 2006; Caltrans 2013a

The highest peak particle velocity equipment expected on any of the work sites would be a vibratory pile driver, which has a peak particle velocity between 0.170 in/sec and 0.734 in/sec at 25 feet. Thus, impacts were analyzed assuming a vibratory pile driver. The impact was determined by calculating the peak particle velocity attenuation at 50 feet (the average distance between the creek and nearby receptors) from the source and comparing it to the human and building reactions in Table 4.10-7. Equation 3 was used to calculate the vibration of a vibratory pile driver at 50 feet from a reference distance of 25 feet, sourced from the FTA (Caltrans 2013a).

Equation 3 $$\mathrm{PPV}_{\mathrm{equipment}} = \mathrm{PPV}_{\mathrm{ref}}\left(\frac{25}{\mathrm{D}}\right)^{\mathrm{n}}$$

where

$PPV_{equipment}$	= peak particle velocity (PPV) vibration from the equipment at distance D (in/sec)
PPV_{ref}	= reference PPV at 25 feet (in/sec)
D	= distance (feet)
n	= 1.5 (the value related to the attenuation rate through ground, as recommended by the FTA)

If the resulting vibration was greater than 0.10 in/sec peak particle velocity, the acceptable vibration level determined by Caltrans for fragile buildings and the point beyond which most humans find vibrations annoying, the alternative was classified as having a significant impact.

The Project was determined to have a significant noise or vibration impact on the surrounding community if it would cause any of the following:

- **Impact NOI-**1: Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.

For the purpose of this analysis, noise generation was compared to the Marin Countywide Plan and Town of Ross General Plan. The Marin Countywide Plan specifies a normally acceptable exterior noise level of 60 dBA L_{dn} and a conditionally acceptable (e.g. if implementing reasonable mitigation measures) exterior noise level of 70 dBA CNEL. The Town of Ross General Plan specifies an upper limit of 75 dB L_{dn} for conditionally acceptable exterior noise at a residential site. Values in excess of these standards were considered a significant noise impact.

- **Impact NOI-2:** A substantial temporary or periodic increase in ambient noise levels in the project vicinity, above levels existing without the project.

Construction was evaluated as a cause of temporary or periodic increased noise levels. Ambient noise levels were defined as 53.5 dBA L_{eq}, as measured in the Project area. A substantial increase in ambient noise levels was defined as exceeding the noise limits set in the Marin Countywide Plan and Town of Ross General Plan. As stated previously, these limits were a normally acceptable exterior noise level of 60 dBA L_{dn} and a conditionally acceptable exterior noise level of 70 dBA CNEL for Marin County, and an upper limit of 75 dB L_{dn} for conditionally acceptable exterior noise at a residential site for the Town of Ross.

- **Impact NOI-3**: A substantial permanent increase in ambient noise levels in the project vicinity, above levels existing without the project.

Operation and maintenance activities would not differ substantially from current stream maintenance activities and would be limited to vegetation management and sediment removal. These activities would be completed infrequently and for short durations, and would not contribute significantly to current activities. Operation and maintenance would not result in a permanent increase in noise levels.

- **Impact NOI-4**: Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.

For the purpose of this analysis, "excessive groundborne vibration" was defined as vibration felt by the nearest receptor in excess of 0.10 in/sec peak particle velocity, the point beyond which most humans find vibrations annoying and potential damage could be caused to fragile buildings (Caltrans 2013a). Values greater than 0.10 in/sec peak particle velocity were considered a significant vibration impact.

- **Impact NOI-5**: Result in adverse effects on biological resources due to noise or groundborne vibration.

The Project would be considered to have an adverse effect on biological resources if noise and vibration caused increased stress or behavioral changes to wildlife (see additional information in Section 4.6 Biological Resources).

- **Impact NOI-6**: For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, exposure of people residing or working in the project area to excessive noise levels.
- **Impact NOI-7:** For a project within the vicinity of a private airstrip, exposure of people residing or working in the project area to excessive noise levels.

The preceding impacts were not considered in this analysis, because the study area does not include or intersect an airport land use, public airport, or private airstrip. As a result, there would no impacts of this kind.

4.10.3.3 Effects and Mitigation

No Action Alternative

In the no action alternative, the existing noise conditions in the study area would remain the same. As a result, there would be ***no impact*** from noise and vibration, and no mitigation would be required.

Action Alternatives

Required Equipment

Table 4.10-8 presents the L_{max} noise level at 50 feet from the source, as well as usage factors for the equipment expected at work sites throughout Project construction (FHWA 2006).

TABLE 4.10-8 EXPECTED EQUIPMENT PEAK NOISE AND USAGE

Equipment	Specified L_{max} 50 feet (dBA)	Acoustical Usage Factor (%)
Concrete Pump	77	50
Soil Compactor	80	20
Backhoes	80	40
Concrete Pump Truck	82	20
Trenching Machine	82	50
Articulated Hauler, Track Dumper, Tracked Carrier	84	40
Crane (Truck-Mounted, Mobile)	85	16
Asphalt Drum Compactor	85	20
Dozer, Excavator, Plant Remover	85	40
Manual Soil Compactor	85	50
Concrete Cutter/Crusher	90	20
Vibratory Pile Driver	95	20

Table 4.10-9 presents the loudest pieces of equipment required for work for each task and the expected L_{eq} at 25 and 50 feet. This table assumes an average daytime noise level of 53.5 dBA and that the two

loudest pieces of noise-generating equipment would be operated simultaneously during a given work period.

TABLE 4.10-9 APPROXIMATE NOISE FROM EQUIPMENT REQUIRED FOR EACH TASK			
Task	Loudest Equipment[1]	L_{eq} 50 feet (dBA)	L_{eq} 25 feet (dBA)
Prepare site	Manual Soil Compactor, Excavator	84.0	90.1
Construct top of bank floodwalls	Vibratory Pile Drive	88.0	94.0
Construct setback floodwalls	Manual Soil Compactor, Excavator	84.0	90.1
Construct culverts	Vibratory Pile Driver	88.0	94.0
Remove existing Denil fish ladder	Manual Soil Compactor, Excavator	84.0	90.1
Widen creek to create benches	Manual Soil Compactor, Excavator	84.0	90.1
Remove concrete channel floor and right bank	Concrete Cutter, Concrete Crusher	86.0	92.0
Construct Allen Park Riparian Corridor	Excavators, Dozer	84.0	90.1
Replace and improve bicycle-pedestrian path	Manual Soil Compactor, Excavator	84.0	90.1
Nighttime installation of box culverts under Sir Francis Drake Boulevard	Crane, Dozer	82.5	88.5

1. Adjusted considering acoustical usage factor.

Construction Effects and Mitigation

Table 4.10-10 presents estimated L_{dn} and CNEL for each alternative resulting from a typical work day with heavy equipment use restricted from 8 am to 5 pm per AMM-NOI-1 (using the average noise level for the work sites) with the same assumptions as in Table 4.10-9. AMM-NOI-1 would not apply to potential night work to install the box culverts under Sir Francis Drake Boulevard. Night work may be necessary to minimize significant impacts to traffic along Sir Francis Drake Boulevard, a main thoroughfare. The use of night work has not been finalized, but is included in this analysis to disclose worst case impacts to noise. Typical daytime and nighttime noise levels were assumed during nonworking hours. Night construction was assumed to occur for 4 hours, from 8 pm to midnight. Alternative noise levels would be within one dBA of each other for both L_{dn} and CNEL for daytime construction.

TABLE 4.10-10 ESTIMATED L_{DN} AND CNEL				
Alternative	L_{dn} 50 feet (dBA)	L_{dn} 25 feet (dBA)	CNEL 50 feet (dBA)	CNEL 25 feet (dBA)
A	81.8	87.8	81.8	87.8
B	81.6	87.6	81.6	87.6
F	80.8	86.8	80.8	86.8
G	81.2	87.2	81.2	87.2
J	81.8	87.8	81.8	87.8
F & J Night Work	83.2	89.2	83.8	89.8

Based on the projected scope of work, all alternatives would contribute to the following impacts.

- **Impact NOI-1:** Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.

All alternative noise levels would exceed the normally acceptable exterior noise limit of 60 dBA L_{dn} and conditionally acceptable noise limit of 70 dBA CNEL described in the Marin Countywide Plan, and 75 dB L_{dn} for the Town of Ross General Plan. Although the noise levels during construction would exceed the standards set in the Marin Countywide Plan and the Town of Ross General Plan, the noise would be acceptable under the appropriate permit from Marin County and the Town of Ross.

Daytime construction noise would be similar for all alternatives. The primary difference in noise for each alternative would be due to varying durations of construction phases. Alternative J would have the least impact to noise because less construction would be required.

If night construction did occur, Alternatives F and J would have a greater impact to noise than the other action alternatives. Although construction activities at night would be quieter than regular daytime activities (82.5 dBA at 50 feet as shown in Table 4.10-9), they would occur at a more sensitive time. L_{dn} and CNEL for night construction would be greater than other alternatives because elevated noise levels would occur for four additional hours of the day.

For all alternatives, this would be a ***significant*** impact.

The following mitigation would be implemented:

- **Mitigation NOI-1:** Erect sound barriers around work sites that would help prevent propagation of noise to sensitive receptors where feasible.

An effective sound barrier could reduce construction noise levels by up to 10 dBA. The resulting L_{dn} and CNEL for each alternative is presented in Table 4.10-11.

TABLE 4.10-11 ESTIMATED MITIGATED L_{DN} AND CNEL

Alternative	L_{dn} 50 feet (dBA)	L_{dn} 25 feet (dBA)	CNEL 50 feet (dBA)	CNEL 25 feet (dBA)
A	71.8	77.8	71.9	77.8
B	71.6	77.6	71.6	77.6
F	70.8	76.8	70.8	76.8
G	71.3	77.3	71.3	77.3
J	71.8	77.8	71.9	77.8
F & J Night Work	73.2	79.2	73.9	79.8

These noise levels would still exceed the L_{dn} and CNEL standards set by the Marin Countywide Plan. Noise levels at 50 feet would be within the conditionally acceptable L_{dn} for the Town of Ross, but noise levels at 25 feet would still exceed this limit. Furthermore, because of the proximity of nearby properties and narrow Project area, erecting sound barriers would not always be feasible.

Construction would produce substantial noise in excess of the region's standards even with mitigation. However, because construction is temporary, excess noise would be temporary. Furthermore, as the project is linear and the construction phased, no one location would experience excess noise levels for the full duration of construction.

For all alternatives, Impact NOI-1 would remain ***significant and unavoidable.***

- **Impact NOI-2:** A substantial temporary or periodic increase in ambient noise levels in the project vicinity, above levels existing without the project.

Noise levels from the two loudest pieces of construction equipment (except when a vibratory pile driver would be used) for each task are presented in Table 4.10-9. The L_{max} that would be produced during construction would be 94 dBA L_{eq} from a vibratory pile driver at 25 feet during top of bank floodwall and culvert construction. A vibratory pile driver is the loudest piece of equipment but would be used infrequently and not simultaneously with other equipment. The vibratory pile driver would cause infrequent, temporary noise increases in the Project vicinity. Other construction tasks would also cause increased noise levels, but at a lesser dBA.

Construction equipment would cause a substantial temporary increase in noise levels above the ambient noise level of 53.5 dBA L_{eq} established for the region. The resulting L_{dn} and CNEL from construction would exceed the noise limits set in the Marin Countywide Plan and Town of Ross General Plan, as presented in Table 4.10-10.

If night work occurred for Alternatives F and J, nighttime noise levels would be temporarily increased from 10 pm to 4 am. Equipment used at night would be quieter than equipment used during the day at 88.5 dBA at 25 feet, as shown in Table 4.10-9, but would still be elevated from normal nighttime noise conditions.

For all alternatives, this would be a ***significant*** impact.

Mitigation NOI-1 would be implemented.

A noise barrier would reduce construction noise by up to 10 dBA. This would reduce the noise from a vibratory pile driver, the loudest piece of equipment to 84 dBA L_{eq}. Although a vibratory pile driver would be used infrequently, this L_{eq} would still temporarily exceed ambient noise levels. Additionally, the resulting L_{dn} and CNEL would exceed noise limits set by the Marin Countywide Plan and Town of Ross General Plan, as shown in Table 4.10-11. This impact would result from equipment use during all construction tasks.

Nighttime work would be reduced from 88.5 dBA at 25 feet to 78.5 dBA. Nighttime work would only occur during installation of box culverts under Sir Francis Drake Boulevard, but this noise level would still temporarily exceed thresholds.

For all alternatives, Impact NOI-2 would remain ***significant and unavoidable.***

- **Impact NOI-3:** A substantial permanent increase in ambient noise levels in the project vicinity, above levels existing without the project.

Operations and maintenance would be limited to minor vegetation management and sediment removal every 5 years. Because these activities would be completed infrequently and for short durations, they would not result in a permanent increase in noise levels.

For all alternatives, this impact would be ***less than significant.***

- **Impact NOI-4**: Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.

A vibratory pile driver, the piece of equipment causing the greatest vibration, was used to analyze the impact of vibration from the Project, as discussed in Section 4.10.3.2. A vibratory pile driver would produce vibrations from 0.06 to 0.26 peak particle velocity at 50 feet, the average distance between the Corte Madera Creek and nearby receptors. At 0.06 peak particle velocity, a vibratory pile driver would not exceed Caltrans acceptable vibration limits. However, at 0.26 peak particle velocity, it would potentially cause damage to some old and historic buildings, such as the Town of Ross Post Office, located 25 feet from the Project area, and cause unpleasant human reactions.

For all alternatives, this would be a ***significant*** impact.

Mitigation NOI-2: Implement management practices to reduce the effects of vibration, including:

- Buffer distances and types of equipment selected to minimize vibration impacts during construction at nearby receptors.

- Schedule construction work to reduce the effects of vibration (i.e. limiting simultaneous use of high-vibration causing equipment).
- Inform residents and property owners of vibration-generating activity and potential consequences.
- Implement a vibration, crack, and line and grade monitoring program at existing historic buildings located within 25 feet of construction activities:
  - The construction contractor shall regularly inspect and photograph crack gauges, maintaining records of these inspections to be included in post-construction reporting. Gauges shall be inspected every two weeks, or more frequently during periods of active project actions in close proximity to crack monitors.
  - If vibration levels exceed the threshold and monitoring or inspection indicates that the project is damaging the building, the historic building shall be provided additional protection or stabilization.

Vibration impacts would be reduced with the implementation of Mitigation NOI-2.

For all alternatives, this impact would be ***less than significant with mitigation incorporated.***

- **Impact NOI-5:** Result in adverse effects on biological resources due to noise or groundborne vibration.

The Project area contains habitat supporting a variety of special-status fish and wildlife species as described in Section 4.6 Biological Resources. Specifically, Corte Madera Creek is known to support several special-status species, such as the California Steelhead and Western Pond Turtle. Therefore, all action alternatives would seek appropriate mitigation features to prevent adverse effects on these populations. Many animals are not deterred by loud, continuous noise alone; however, vibration is often attributed to increased stress in animals which can adversely alter behavior patterns (JAALAS 2007). This would be a significant impact.

As such, any mitigation features considered for the alternatives would focus on preventing impacts from vibration on local wildlife, especially the use of vibratory pile drivers in the creek bed (JAALAS 2011). The most important factor to consider is the reduction of vibrational impacts on the behavior of special-status species, especially during critical times such as mating and breeding. For this purpose, the following mitigation is required:

- **Mitigation NOI-3:** High-vibration causing equipment (e.g. vibratory pile drivers) shall be used only during the construction dry season (see AMM BIO-2: Seasonal Restrictions) and only following pre-construction surveys (see AMM BIO-1: Conduct Pre-Construction Surveys) and, where necessary, with biological monitors present (see AMM BIO-6: Biological Construction Monitoring for non-Salmonids and AMM BIO-14: Salmonid Monitoring).

For all alternatives, noise and vibration impacts on local wildlife would be ***less than significant with mitigation incorporated.***

See Chapter 4.6 for more information about the particular species, behaviors, and habitats in question.

Table 4.10-12 summarizes the impacts to noise.

TABLE 4.10-12 NOISE IMPACT CONCLUSIONS

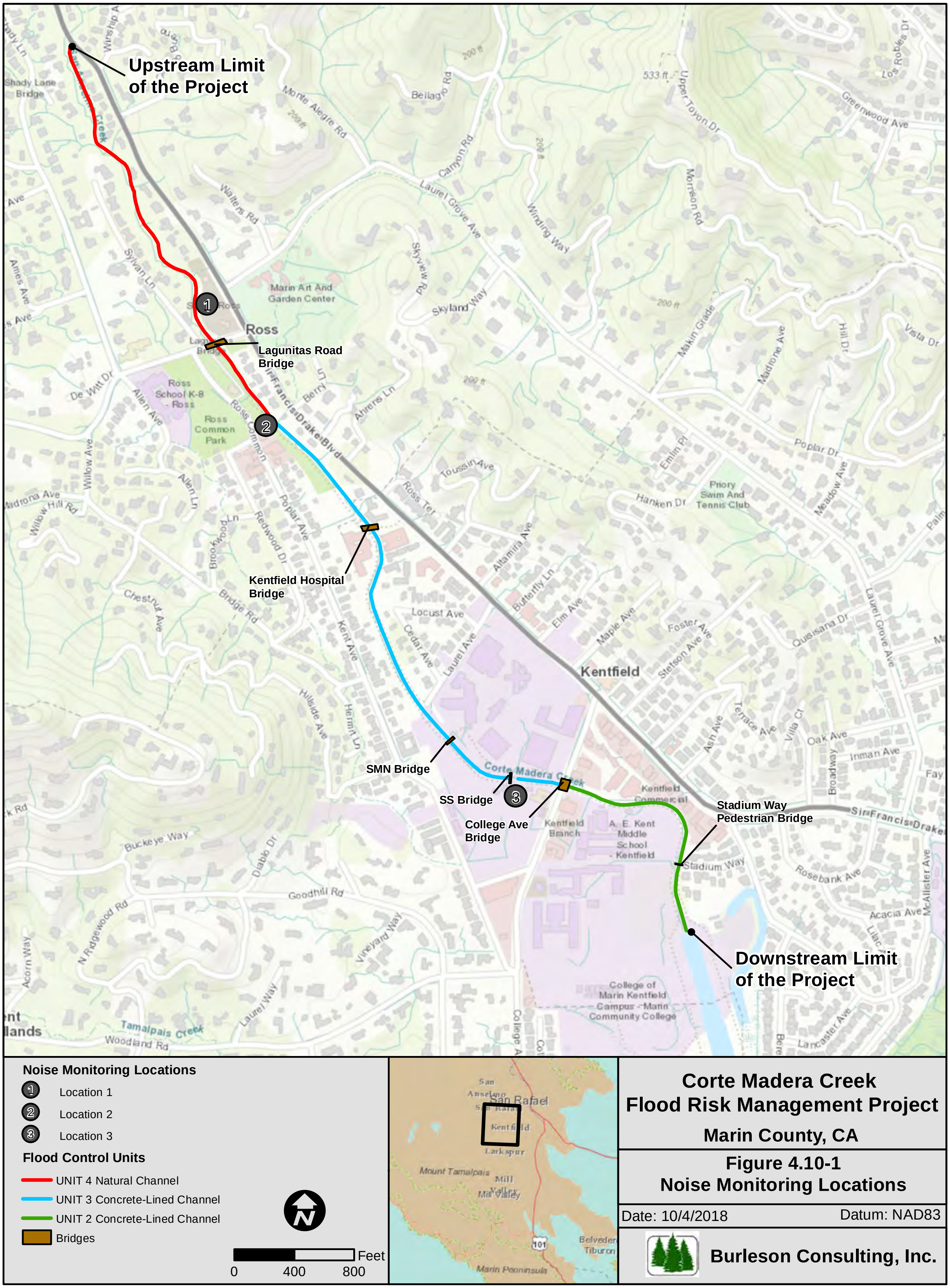
Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
NOI-1: Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies.	AMM-NOI-1 AMM-NOI-2	All Action Alternatives	S	M-NOI-1	SU
		No Action	NI	--	--
NOI-2: A substantial temporary or periodic increase in ambient noise levels in the project vicinity, above levels existing without the project.	AMM-NOI-1 AMM-NOI-2	All Action Alternatives	S	M-NOI-1	SU
		No Action	NI	--	--
NOI-3: A substantial permanent increase in ambient noise levels in the project vicinity, above levels existing without the project.	--	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
NOI-4: Exposure of persons to or generation of excessive groundborne vibration or groundborne noise levels.	AMM-NOI-1 AMM-NOI-2	All Action Alternatives	S	M-NOI-2	LTS
		No Action	NI		
NOI-5: Result in adverse effects on biological resources due to noise or groundborne vibration.	AMM-NOI-1 AMM-NOI-2 AMM-BIO-2	All Action Alternatives	S	M-NOI-3	LTS
		No Action	NI	--	--
NOI-6: For a project located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public use airport, exposure of people residing or working in the project area to excessive noise levels.	--	N/A	--	--	--
NOI-7: For a project within the vicinity of a private airstrip, exposure of people residing or working in the project area to excessive noise levels.	--	N/A	--	--	--

AMM = avoidance and minimization measure
LTS = less than significant
N/A = not applicable
NI = no impact
S = significant
SU = significant and unavoidable

4.10.3.4 Cumulative Impacts

The geographic context for changes in the noise and vibration environment in the vicinity of the project site is mainly suburban and commercial areas in the Town of Ross and unincorporated Marin County. To contribute to a cumulative noise impact, another project in close proximity would have to be constructed at the same time as Project construction activities. Most of the cumulative projects listed in Table 4-2 are located too far from the Project site for construction noise to combine in a cumulative manner. The exception is the Sir Francis Drake Boulevard Rehabilitation project. However, the EIR for that project indicates that specified mitigation measures, including construction noise reduction measures and adherence to the County Noise Ordinance's limitations on construction activities, would reduce noise impacts of that project to less than significant. Still, if construction of the Sir Francis Drake Boulevard Rehabilitation Project were to occur simultaneously with and near to construction of Project elements, the noise impacts of the two projects could combine in a cumulative manner to cause a significant -though short-term – increase in ambient noise levels. Application of the mitigation measures specified in the Sir Francis Drake Boulevard Rehabilitation Project EIR and Mitigation NOI-1 and NOI-2 would reduce this impact, but the impact may remain significant and unavoidable. The Project would make a considerable contribution to this cumulative impact and therefore, the cumulative impact would also be significant and unavoidable.

Long-term noise and vibration from operations and maintenance would contribute to existing noise in the study area. These activities would be minimal, including vegetation management, sediment removal, and maintenance of flood control structures. Operations and maintenance is expected to require some noise-generating equipment such as weed eaters, hedge trimmers, and construction equipment (such as for sediment or debris removal). However, these activities would be infrequent and span a short duration. As such, the cumulative impact to noise and vibration would be less than significant.



Corte Madera Creek Flood Risk Management Project

Marin County, CA

Figure 4.10-1
Noise Monitoring Locations

Date: 10/4/2018 Datum: NAD83

Burleson Consulting, Inc.

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4.11 Land Use

This section identifies land use in areas potentially affected by construction and operation of the Project and evaluates whether the Project alternatives would have a significant effect on land use and planning. The information presented in this section is based on reviews of aerial photography of the study area, site reconnaissance, and applicable planning information presented in the Marin Countywide Plan and the Town of Ross General Plan. Figure 4.11-1 shows simplified land use zoning for the Project area in relation to the Town of Ross and unincorporated Marin County.

4.11.1 Regulatory Setting

This section discusses regulatory information that applies to land use.

4.11.1.1 Federal

Federal policies and laws which pertain to land use are listed below. Details regarding these policies and laws are provided in Chapter 9.

- Executive Order 11988, Floodplain Management
- National Flood Insurance Program
- Farmland Protection Policy Act

4.11.1.2 State

California Government Code 65300

California GC Section 65300 *et seq*. establishes the obligation of cities and counties to adopt and implement general plans. A general plan is a comprehensive, long-term strategy document that sets forth the expected location and general type of physical development expected in the city or county developing the document. This section considers the Project's compatibility with the adopted general plans of Marin County and the Town of Ross.

4.11.1.3 Local

Marin Countywide Plan

The following policies of the Marin Countywide Plan are applicable to land use regulation:

- **Policy EH-3.1 Follow a Regulatory Approach:** Utilize regulations instead of flood control projects whenever possible to minimize losses in areas where flooding is inevitable.

The programs under this policy aim to protect people and property by regulating development (in some cases limiting or prohibiting it) in flood and inundation areas. These measures include requiring home improvements to be designed to be more flood resistant, updating flood maps, revising regulations to ensure land use activities in flood hazard areas are only allowed when in compliance with federal standards, alerting property owners regarding flood hazards when they seek development review, and restricting development in flood prone areas by applying the County Floodplain Management Ordinance, FEMA regulations, and CEQA environmental review. Other measures are also listed that include: require hydrologic studies for development, locate critical facilities in safe areas, maintain flood ponding areas, update dam inundation maps, review and inspect dams, anticipate climate change impacts, pursue funding for levee construction, assess cumulative impacts in watersheds, and develop watershed management and monitoring plans.

- **Policy EH-3.2 Retain Natural Conditions:** Ensure that flow capacity is maintained in stream channels and floodplains, and achieve flood control using biotechnical techniques instead of storm drains, culverts, riprap, and other forms of structural stabilization.
- **Policy EH-3.3 Monitor Environmental Change:** Consider cumulative impacts to hydrological conditions, including alterations in drainage patterns and the potential for a rise in sea level, when processing development applications in watersheds with flooding or inundation potential.
- **Policy OS-1.1 Enhance Open Space Stewardship:** Promote collaborative resource management among land management agencies. Monitor resource quality. Engage the public in the stewardship of open space resources.
- **Policy OS-1.2 Protect Open Space for Future Generations:** Ensure that protected lands remain protected in perpetuity, and that adequate funding is available to maintain it for the benefit of residents, visitors, wildlife, and the environment.

Marin County Development Code/Zoning

The County's Development Code is found in Title 22 of the Marin County Ordinances. Besides regulating zoning and development, it includes protections for streams and riparian habitat, which are relevant to land uses in the Project and study area. These include:

- Permit requirements for alterations to stream beds and banks (Marin County Code Section 11.08, Watercourse Diversion or Obstruction)
- Drainage setbacks (generally 20 feet from the top of stream bank) in which structures are not permitted (Marin County Code Section 24.04.560)
- Compliance with Countywide Plan Policies for biological resources (including the Stream Conservation Area policies) for any discretionary permit (e.g., Design Review, Master Plan, Tree Removal Permit, Use Permit, Variance).
- Design review requirements for development of any vacant lot adjacent to an anadromous (fish-bearing) stream. (Marin County Code Section 22.42.045).
- Preservation of native protected and heritage trees (Marin County Code Section 22.27).

Town of Ross General Plan 2007–2025

The following policies of the Town of Ross are applicable to land use regulation:

- **Policy 6.5 Permeable Surfaces:** To the greatest extent possible, development should use permeable surfaces and other techniques to minimize runoff into underground drain systems and to allow water to percolate into the ground. Landscaped areas should be designed to provide potential runoff absorption and infiltration.
- **Policy 6.6 Creek and Drainageway Setbacks: Maintenance and Restoration**: Keep development away from creeks and drainage ways. Setbacks from creeks shall be maximized to protect riparian areas and to protect residents from flooding and other hazards. Encourage restoration of runoff areas to include but not be limited to such actions as sloping banks, providing native vegetation, protecting habitat, and working with property owners to identify means of keeping debris from blocking drainage ways.
- **Policy 8.4 Downtown and Ross Common:** Maintain the Town-owned Ross Common areas linked to uses and activities at Ross School, and linked to the Town's downtown area as the central recreation, gathering, and local shopping area of Ross. Maintain the downtown area as an attractive, pedestrian-friendly, small retail/business area. Encourage smaller-scale housing units mixed with commercial uses.

- **Policy 8.6 Gathering Places:** Encourage and enhance community gathering places such as downtown, Ross Common, and the Post Office. Support the activities of Ross Recreation, Ross School, and the Marin Art & Garden Center.

Town of Ross Municipal Code

The Town of Ross Municipal Code includes standards for development, including a number of sections that relate to land uses. Chapter 12 establishes the reasoning and procedure for protecting trees and preventing unnecessary loss of native trees within the city limits.

Chapter 15 addresses flood damage prevention for houses, and lists methods for reducing flood losses. These include: restrict or prohibit uses that are dangerous to water or erosion hazards; require uses be protected against flood damage at the time of initial construction; control the alteration of natural floodplains, stream channels, and natural protective barriers; control filling, grading, dredging, and other development that may increase flood damage; and prevent or regulate the construction of flood barriers, which will unnaturally divert floodwater or increase flood hazards in other areas.

Administration of this requires a development permit before construction begins. This ordinance also contains construction standards for flood hazard areas. A variance may be required if a property does not comply with these standards.

Town of Ross Zoning (Title 18 of Municipal Code)

The Town of Ross zoning plan is contained in Chapter 18 of the municipal code and is consistent with the General Plan. The Ross Town Council also serves as the Ross Planning Commission. The planning department staff provide services related to implementation of planning and land use policies and regulations, including design review and enforcement of ordinances. Permits are required for tree removal, and installing fences, gates, and walls on property. The Town of Ross has setback requirements for houses and other equipment (pool equipment, spas, patios, etc.).

4.11.2 Affected Environment

4.11.2.1 Regional/Local Land Uses

Figure 4.11-1 shows the Town of Ross and Marin County land use designation surrounding the Project. The Project lies within highly developed suburban residential and commercial areas. On-site land uses consist of the Corte Madera Creek bed, trails and bike paths, public parks and open space, residential uses, and schools and colleges. Station Park, a community park in the Town of Ross, is located east of the Post Office on Lagunitas Road and abuts Corte Madera Creek along its left bank. Allen Park is a linear park maintained by the Town of Ross and located just south of the Post Office. It contains a bicycle-pedestrian- pathway along the right bank of the creek that continues south to Bon Air Road (Figure 4.9-1).

A variety of land uses occur adjacent to Corte Madera Creek. Within Unit 4, adjacent land uses include residential housing (predominantly single-family), parking facilities, a bicycle-pedestrian pathway, Station Park, and Ross Common Park. Ross Town Hall and Ross Valley Fire Department (RVFD) Station 18 abut the creek on the left bank north of Lagunitas Road Bridge. Land uses adjacent to Unit 3 support a mix of residential, commercial, and public uses. Residential uses occur on both sides of the creek to Kentfield Hospital. Downstream, the creek flows between residential uses to the College of Marin and a mix of commercial uses, including Woodlands Market, south of College Avenue, with uses adjacent to the channel including a variety of commercial uses and Kent Middle School.

Land Use Planning Context

The Built Environment Element of the Marin Countywide Plan identifies seven planning areas. The Project area is located within Planning Area 5 (Lower Ross Valley). The Lower Ross Valley planning area includes lands south of Southern Heights and San Quentin Ridges, north of Corte Madera Ridge, and east of Phoenix Lake. It includes the City of Larkspur, the Town of Corte Madera, and the unincorporated communities of Kentfield, Greenbrae, San Quentin, and the Greenbrae Boardwalk. Several land use and zoning designations from the Marin Countywide Plan and Town of Ross General Plan are applicable to the Project.

Marin Countywide Plan Zoning

The countywide plan presents Marin County as an environmental unit divided into regions called corridors. Each corridor is based on specific geographical and environmental characteristics and natural boundaries formed by north and south running ridges. These include the Coastal Corridor; Inland Rural Corridor; Baylands Corridor; and City-Centered Corridor. The Project area is located entirely within the City-Centered Corridor that includes areas along Highway 101 in the eastern part of the county near San Francisco and San Pablo bays. This corridor is primarily designated for urban development and for protection of environmental resources and is divided into six planning areas, generally based on watersheds (Marin County 2007).

Since approval of the countywide plan by Marin County in November 2007, the geographic configuration and composition of the designated corridors have changed slightly to reflect Project-specific planning at the tentative tract map level. Figure 4.11-1 shows the various land zoning in the Project and study area for the Town of Ross and Marin County (Marin Map, http://www.marinmap.org/dnn/DataServices/GISDataDownload.aspx). The land use zones in Unit 4 are residential and public/quasi-public. Land use zones in Unit 3 are residential, flood control, commercial public/quasi-public and public facilities (College of Marin). Unit 2 includes residential, mixed residential and commercial, planned office, and public facilities. Table 4.11-1 compares information displayed in Figure 4.11-1 to the approved zoning land use designation from the Marin County and Town of Ross plans.

TABLE 4.11-1 LAND USES AND ZONING CROSSWALK

Plan Land Use	Plan	Units	Legend Figure 4.11-1
Low Density Residential (SF6)	Town of Ross	4	One Family Residential
Limited Quasi-Public/Private Service (QP)	Town of Ross	4	One Family Residential
Public Service (PS)	Town of Ross	3,4	Public/Quasi-Public
Limited Specialized Recreational/Cultural (RC)	Town of Ross	4	Quasi-Public
Public Park and Open Space	Town of Ross	3	Public/Quasi-Public, Commercial
Local Service Commercial (C)	Town of Ross	3	Commercial
Medium Low Density (ML)	Town of Ross	3	One Family Residential
Medium to High Density Residential (MF 4-4.5)	Marin County	2	Residential
Low Density Residential (SF6)	Marin County	2,3	Residential, Residential Planned
Public, Quasi-Public, and Open Space (PF/QP/OS)	Marin County	2,3	Public Facilities, Residential Planned
Neighborhood Commercial/Mixed Use (NC)	Marin County	2	Residential Commercial Multiple Planned
Office Commercial/Mixed Use (OC)	Marin County	2	Planned Office

The approved land use designations from the countywide plan that occur in or adjacent to the study area include the following:

- **Medium to High Density Residential (MF 4-4.5):** Medium to high density residential land use categories are established within the City-Centered Corridor in communities where multi-family development can be accommodated with easy access to a full range of urban services at locations near major arterials, public transit, and community and regional shopping facilities.
- **Low Density Residential (SF6):** Established for single-family and multi-family residential developments in areas where public services and some urban services are available and where properties are not typically limited by physical hazards or natural resources.
- **General Commercial/Mixed Use (GC):** The General Commercial land use category is established to allow for a wide variety of commercial uses, including retail and service businesses, professional offices, and restaurants, as well as moderate to high-density mixed-use residential development.
- **Office Commercial/Mixed Use (OC):** The Office Commercial land use category is established to encourage a mixture of professional, administrative, and medical office uses, as well as medium to high density mixed-use residential development, where appropriate. Employee- and resident-serving retail and service businesses may also be permitted within this category.
- **Neighborhood Commercial/Mixed Use (NC):** The Neighborhood Commercial land use category is established to encourage smaller-scale retail and neighborhood-serving office and service uses, and mixed-use development oriented towards pedestrians and located in close proximity to residential neighborhoods.
- **Public, Quasi-Public, and Open Space (PF/QP/OS):** The Public, Quasi-Public, and Open Space land use categories are established for both public and quasi-public institutional purposes, including open space, schools, hospitals, cemeteries, government facilities, correctional facilities, power distribution facilities, sanitary landfills, and water facilities.

Town of Ross General Plan

The General Plan strives to preserve the small-town character of the Town of Ross, maintain architectural diversity, and protect the green, tree-dominated hills. It includes programs for conserving the character and quality of the Town of Ross community as a whole and for historic preservation. The approved General Plan land use designations and underlying zoning that occur in the vicinity of the Project and within the study area include:

- **Low Density (L):** An average of 3 to 9 persons per acre; consistent with R-1:B-20 and R-1:B-15 zoning, with lots to 20,000 or 15,000 square feet in size, respectively.
- **Medium Low Density (ML):** An average of 9 to 18 persons per acre; consistent with R-1:B-10 and R-1:B-7.5 zoning, with lots to 10,000 or 7,500 square feet in size, respectively.
- **Local Service Commercial (C):** Applies to the downtown area and is intended to constitute a compact, centrally located area of such size as is necessary to contain local service commercial uses necessary for the convenience of the Town residents. Allows smaller scale residential uses.
- **Public Park and Open Space:** Secured public and private parks, open space, and lands managed by the Marin Municipal Water District (MMWD). Building intensity and population density is essentially zero.
- **Limited Specialized Recreational/Cultural (RC):** This is applied to established recreational or cultural uses (Marin Art and Garden Center and the Lagunitas Tennis Club) which should have very limited intensity, consistent with community character and environmental constraints. Floor to area ratio is less than 0.1. Smaller scale residential uses are allowed.

- **Public Service (PS):** Lands in this classification are existing public sites upon which public service uses are appropriate, such as Town Hall, Public Safety buildings, Post Office, and Ross School. Generally, the floor to area ratio for the sites should be less than 0.5. Allowances may be made for increased intensity if needed for health and safety purposes. Smaller scale residential uses are allowed.
- **Limited Quasi-Public/Private Service (QP):** The Limited Quasi-Public/Private Service designation recognizes existing quasi-public uses, such as churches and private schools that are located throughout the community and which are expected to remain in a similar use throughout the planning period. Standards are intended to minimize impacts on surrounding residential areas. Smaller scale residential uses may be included.

4.11.3 Environmental Consequences

4.11.3.1 Avoidance and Minimization Measures

The following AMMs for biological resources would apply to land use:

- **AMM-BIO-4: Minimize Footprint -** The amount of disturbance within the project area shall be reduced to the absolute minimum necessary to accomplish the proposed project.
    - Topsoil from the creek banks shall be removed, stockpiled, covered, and encircled with silt fencing to prevent loss or movement of the soil into Corte Madera Creek. All disturbed soils shall undergo erosion control treatment prior to the rainy season and after construction is terminated.
    - Treatment typically includes temporary seeding with native species and sterile straw mulch. All topsoil shall be replaced in a manner as close as possible to pre-disturbance conditions.
    - All construction-related holes in the ground will be covered to prevent entrapment of California red-legged frogs or foothill yellow-legged frogs.

4.11.3.2 Methodology for Impact Analysis and Significance Thresholds

Land use impacts were determined by comparing Project land uses for each alternative to the applicable local policies. An alternative would pose a significant impact to land use if it would:

- **Impact LND-1:** Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.

Portions of the Project are within the Town of Ross and Marin County General Plan land uses and zoning, and are therefore subject to associated policies. The Project area is within Marin County Planning Area 5, Lower Ross Valley. Some private property may require purchase to construct top-of-bank floodwalls, extend boundaries of the creek bed, construct setback floodwalls, and construct the new bike path. Easements or variances may be required to construct setback floodwalls or barriers on property adjacent to the Project.

- **Impact LND-2:** Physically divide an established community.

The analysis considers the potential for flood control structures to divide the communities of Ross and Kentfield.

- **Impact LND-3:** Conflict with any applicable habitat conservation plan or natural community conservation plan.

The Project area is already highly developed and built-out and would not reduce existing open space. The Project would not result in land use changes that would conflict with habitat conservation plans, thus this impact would not be relevant to the Project and was omitted from further evaluation.

- **Impact LND-4:** Result in permanent conversion of existing land uses.

The analysis considers changes in land use due to construction of flood control structures. Changes were considered significant if they would be permanent and not specifically recommended by local government plans. Because additional mitigation measures for Impact LND-4 are not feasible beyond the existing AMMs and Project design requirements, significant impacts were determined to be significant and unavoidable.

4.11.3.3 Effects and Mitigation

No Action Alternative

Because it would not include any construction, the no action alternative would not physically divide any communities in the study area or cause a change in land use. Furthermore, the no action alternative would not conflict with any plan, policy, or regulation regarding land use. ***No impacts*** to land use from the no action alternative would occur.

Action Alternatives

Common to All Action Alternatives

All alternatives would be designed to be in compliance with the Marin County General Plan and the Town of Ross General Plan land use and policies. Implementation of FRM structures would not conflict with any land use regulation. Protected trees exist within the Project footprint that would be removed for construction of the FRM features. A tree survey would be completed prior to tree removal. In accordance with Marin County code, all appropriate permits would be obtained in compliance with Section 22.62.040.

For all action alternatives, Impact LND-1 would be ***less than significant.***

Project construction and operations and maintenance would occur within the existing built Corte Madera Creek and some adjacent land, located within the boundaries of the Town of Ross and the community of Kentfield in unincorporated Marin County. Project components or activities would not physically divide these communities. For all action alternatives, impact LND-2 would have ***no impact.***

Impact: LND-4 Result in a Permanent Conversion of Existing Land Use.

Construction of FRM structures including floodwalls, culverts, bench excavation, and channel widening would require easements based on the Project requirements. Floodwall widths would be expected to range from 12 to 24 inches, and all floodwalls would require right-of-way access for inspection, patrolling, maintenance, and flood-fighting. This could require easements for floodwalls extending to 15 feet beyond the landside of the floodwall and all or most of the adjacent channel. All action alternatives would include construction of floodwalls, but the length of floodwalls would be unique to each alternative.

The Project would result in change of land use to residential, commercial, and public properties through full parcel purchase or easement. USACE assessed potential conflicts with existing land use for each alternative and determined where conflicts warranted a full parcel purchase and where easements would be sufficient. Any land that would require purchase would be acquired at fair market value in accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, as amended. Affected land owners would be fairly compensated for restrictions imposed by easements. The predicted number of full parcel purchases for each alternative is presented in Table 4.11-2. Permanent easements would be needed for retaining walls, floodwalls, channel improvements, and roads. Periodic maintenance of easements including vegetation clearance would be required.

TABLE 4.11-2 LAND ACQUISITION PARCEL PURCHASES

Current Land Use	Alt A	Alt B	Alt F	Alt G	Alt J
Commercial	0	2	0	0	0
Public	13	1	0	2	0
Residential	17	14	0	16	0
Multi-family residential	0	1	0	0	0
Total Number of Parcels	**30**	**18**	**0**	**18**	**0**

Easements associated with FRM structures throughout the Project have potential to convert existing land uses; land owners would be fairly compensated. Table 4.11-3 presents the acreage of easements predicted for each alternative by land zoning.

TABLE 4.11-3 PERMANENT EASEMENTS (ACRES)

Current Land Use Type	Alt A	Alt B	Alt F	Alt G	Alt J
Commercial	0.29	0.53	0.72	0.72	0.33
Public	12.71	10.64	10.46	12.15	2.86
Residential	1.00	1.25	0.79	1.28	0.23
Multi-family Residential	0.24	0.00	0.03	0.10	0.01
Vacant Land	0.10	0.17	0.19	0.19	0.01
Total Acres of Easements	14.34	12.59	12.18	14.44	3.44

Alternative A: Top-of-bank Floodwall

Alternative A would require acquisition of 17 residential and 13 public parcels and have the greatest impact to land use because it would require the most parcel acquisition for floodwall construction on residential properties. The 7-foot high setback floodwalls around Kent Middle School athletic fields would require a permanent easement that would limit points of entry to the creek. Athletic fields could still be used, but floodwalls would restrict access and obscure views of the fields from other school facilities. The setback floodwall would not change land use; however, this would be a minor impact. Approximately 1.00 acre of residential property bordering the Project would be affected by permanent easements that range from 0.01 to 0.21 acres and could result in substantial impact to one or more land owners. Financial compensation would likely reduce this perceived impact to land owners. Acquisition of 17 residential parcels and relocation of families would be significant to those families. Impact LND-4 would be ***significant and unavoidable***.

Alternative B: Top-of-bank Floodwall/Setback Floodwall/College of Marin Widening

Alternative B would require acquisition of 18 parcels, mostly residential. Approximately 1.25 acres of residential property bordering the Project would be affected by permanent easements that range from 0.01 to 0.21 acre and could impact 22 residential parcels. Financial compensation would likely reduce the perceived impact to land owners. Although approximately 10.64 acres of public land would be under permanent easements, it would not change land use. College of Marin Widening would reduce parking for the College of Marin, although campus operations would not be impacted. Acquisition of 15 residential parcels and relocation of families would be significant to those families. Impact LND-4 would be ***significant and unavoidable***.

Alternative F: Bypass/Allen Park Riparian Corridor/College of Marin Widening

Alternative F would not require acquisition of any property. Changes to land use would be limited to permanent easements. The bypass would require relocation of utilities underneath Sir Francis Drake Boulevard, but would not change land use because the utilities would be located in new trenches outside of the box culverts. The construction of Allen Park Corridor could require realignment of sewer line, but would not impact land use because the new line would be located on public land. The inflow and outflow would be located on Marin County Flood Control property and not create an adverse impact to land use. Allen Park Riparian Corridor would result in a changed landscape that would remain a park with higher value habitat than currently exists. College of Marin Widening would have the same effects as in Alternative B. Approximately 0.79 acres of residential property bordering the Project would be affected by permanent easements that range from 0.01 to 0.17 acres and could impact 18 residential parcels. Financial compensation would likely reduce the perceived impact to land owners. Although approximately 10.64 acres of public land would be under permanent easements, it would not change land use. Impact LND-4 would be ***less than significant***.

Alternative G: Top-of-bank Floodwall/Allen Park Riparian Corridor/College of Marin Widening

Alternative G would require acquisition of 18 parcels, primarily residential. Impacts would be similar to those of Alternative B. Allen Park Riparian Corridor construction and College of Marin Widening would not have significant impacts to land use. Approximately 1.28 acres of residential property bordering the Project would be affected by permanent conversion that range from 0.01 to 0.17 acres and could impact 23 residential parcels. Financial compensation would likely reduce the perceived impact to land owners. Impact LND-4 would be ***significant and unavoidable***.

Alternative J: Bypass/Allen Park Riparian Corridor/Floodwall

Alternative J would have the smallest footprint of the action alternatives and would not require acquisition of any property. Effects from bypass and Allen Park Riparian Corridor construction would be the same as described for Alternative F. The floodwalls downstream of Allen Park would require easements, but would not result in substantial land use change. Approximately 0.23 acre of residential property bordering the Project would be affected by permanent easements that range from 0.01 to 0.09 acre and could impact 7 residential parcels. The small size of easements would not be expected to result in substantial impact to land owners. Impact LND-4 would be ***less than significant.***

Table 4.11-4 summarizes the impacts to land use***.***

TABLE 4.11-4 LAND USE IMPACT CONCLUSIONS

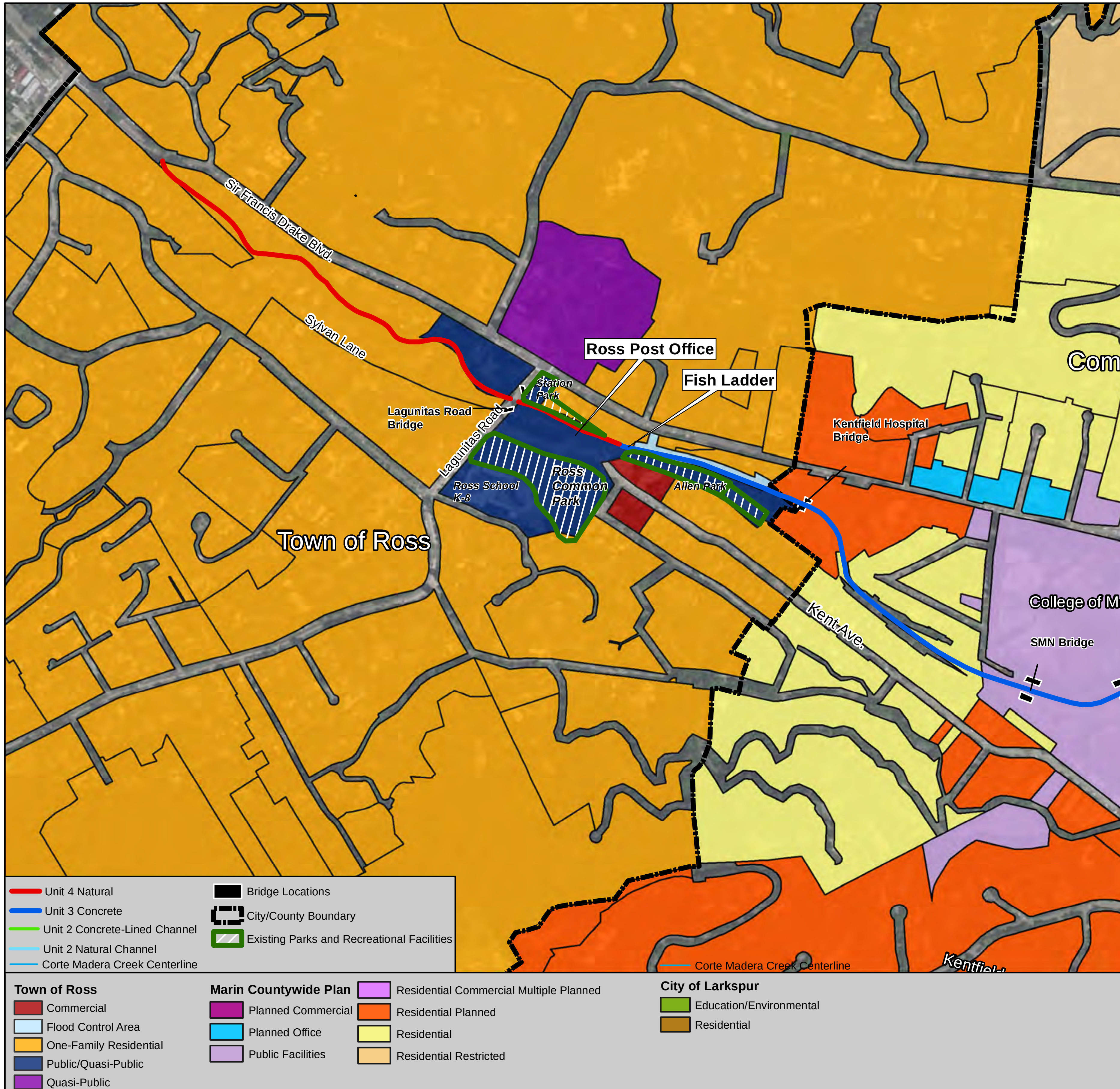
Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
LND-1: Conflict with any applicable land use plan, policy, or regulation of an agency with jurisdiction over the project (including, but not limited to the general plan, specific plan, local coastal program, or zoning ordinance) adopted for the purpose of avoiding or mitigating an environmental effect.	--	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
LND-2: Physically divide an established community.	--	All	NI	--	--

TABLE 4.11-4 LAND USE IMPACT CONCLUSIONS					
Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
LND-3: Conflict with any applicable habitat conservation plan or natural community conservation plan.	--	N/A		--	--
LND-4: Result in permanent conversion of existing land uses.	--	A, B, G,	S	None	SU
		F, J	LTS	--	--
		No Action	NI	--	--

AMM = avoidance and minimization measure
LTS = less than significant
N/A = not applicable
NI = no impact
S = significant
SU = significant and unavoidable

4.11.3.4 Cumulative Impacts

Beyond required easements and land acquisitions for construction of FRM features, no further changes in land use would be expected to result from Project implementation. No land use regulation would be violated and communities would not be divided by flood control structures. Therefore, the Project could not contribute to any cumulative impact on land use.



Date: 10/4/2018

Coordinate System: GCS North American 1983
Datum: North American 1983
Projection: UTM Zone 10N
Source: Burleson 2018: USACE, 2017: Atkins 2011: ESRI Data Server, 2012

Figure 4.11-1
Simplified Land Zoning
Corte Madera Creek Flood Risk Management Project
Marin County, CA

Burleson Consulting, Inc.

4.12 Human Health and Safety

This section describes the potential for wildland fires and hazardous, toxic, and radioactive waste (HTRW) conditions in the study area and surrounding locations that have the potential to present a human health or physical safety hazard during Project construction. Information regarding fire and police protection services is presented in Section 4.16 Public Services, Utilities, and Energy. Hazards related to flooding are addressed in Section 4.1 Hydrology and Hydraulics.

4.12.1 Regulatory Setting

This section discusses regulatory information that applies to human health and safety. Additional regulatory information appears in Chapter 9 Environmental Compliance.

4.12.1.1 Federal

The Clean Water Act is the only federal policy pertinent to human health and safety. A discussion is provided in Chapter 9.

4.12.1.2 State

California Occupational Safety and Health Administration Regulations

Construction activities are subject to occupational safety standards for excavation and trenching as specified in the California Occupational Safety and Health Administration regulations (Title 8 of the CCR) and in Chapter 33 of the California Building Code. These regulations specify the measures to be used for excavation and trench work where workers could be exposed to unstable soil conditions. The Project would be required to employ these safety measures during activities that exceed specific depths or conditions identified in the California Building Code.

Uniform Fire Code

The Uniform Fire Code contains specialized technical regulations relating to fire and life safety for construction, maintenance, and use of buildings. Topics addressed in the Uniform Fire Code include fire department access, fire hydrants, automatic sprinkler systems, fire alarm systems, fire and explosion hazards safety, hazardous materials storage and use, provisions intended to protect and assist fire responders, industrial processes, and many other general and specialized fire-safety requirements for new and existing buildings and the surrounding premises.

4.12.1.3 Local

Marin Countywide Plan

The following policy of the Marin Countywide Plan is applicable to human health and safety.

- **Policy PS-4.1 Regulate and Reduce Hazardous Material Use**: Control the use and storage of hazardous materials to minimize their presence in, and potential dangers to, the community and environment.

Town of Ross General Plan 2007–2025

The following policies of the Town of Ross General Plan are applicable to human health and safety.

- **Policy 5.12 Access for Emergency Vehicles**. New construction shall be denied unless designed to provide adequate access for emergency vehicles, particularly firefighting equipment.

4.12.2 Affected Environment

The human health and safety environment typically is defined by first characterizing the area's human population and structures (i.e., sensitive receptors or residences). Then, the general health and safety concerns are addressed by identifying existing substances, activities, or circumstances that may dictate the likelihood of those people and structures being adversely exposed to such elements. Human health and safety issues relate to both short-term construction and long-term operations and maintenance.

Many issues discussed elsewhere in this document have the potential either directly or indirectly to affect human health and safety within the Project area. These include flood hazards, water quality, air quality, soil erosion, transportation, land uses, noise, and public services (including fire protection). The affected environment and potential effects that could lead to human health and safety impacts on these resources are discussed under the corresponding resource sections found elsewhere in this EIS/EIR (see Sections 4.1 Hydrology and Hydraulics; 4.2 Water Quality; 4.3 Geology; 4.4 Air Quality; 4.10 Noise; 4.11 Land Use; 4.13 Traffic, Transportation, and Circulation; and 4.16 Public Services, Utilities, and Energy).

4.12.2.1 Wildland Fire Risk

Wildland fires are common in many places around the world, including many of the forested areas of the United States, where the climates are sufficiently moist to allow the growth of trees, but feature extended dry, hot periods when fallen branches, leaves, and other material can dry out and become highly flammable. In Marin County, Sudden Oak Death has contributed to an increase in tinder accumulation and fire risk countywide. Wildfires are also common in grasslands and scrublands. Wildland fires tend to be most common and severe during years of drought and occur on days of strong winds. With extensive urbanization of wildlands, these fires often involve destruction of suburban homes located in the wildland urban intermix. The Town of Ross and Kentfield are all listed as wildland-urban interface communities, but are not within the very high fire hazard severity zones (CAL FIRE 2008, 2018) Within the study area, Unit 4 represents the greatest risk of fire due to its dense vegetation and topography; however, no large wildfires have occurred within Unit 4 in recent years (Grasser 2010, in USACE 2010; USGS 2017).

4.12.2.2 Hazardous, Toxic, and Radioactive Waste

The USACE defines HTRW as the following:

> (1) Except for dredged material and sediments beneath navigable waters proposed for dredging, for purposes of this guidance, HTRW includes any material listed as a "hazardous substance" under the Comprehensive Environmental Response, Compensation and Liability Act, 42 U.S.C. 9601 *et seq*. (See 42 U.S.C. 9601[14]). Hazardous substances regulated under the Comprehensive Environmental Response, Compensation and Liability Act include "hazardous wastes" under Sec. 3001 of RCRA, 42 U.S.C. 6921 *et seq*.; "hazardous substances" identified under Section 311 of the CAA, 33 U.S.C. 1321, "toxic pollutants" designated under Section 307 of the CWA, 33 U.S.C. 1317, "hazardous air pollutants" designated under Section 112 of the CAA, 42 U.S.C. 7412; and "imminently hazardous chemical substances or mixtures" on which USEPA has taken action under Section 7 of the Toxic Substance Control Act, 15 U.S.C. 2606; these do not include petroleum or natural gas unless already included in the above categories.

The USACE requires an assessment to address the existence of, or potential for, HTRW contamination on lands, including structures and submerged lands in the study area, or external HTRW contamination, which could impact, or be impacted by, a project (USACE 1992).

The most recent evaluation of HTRW conditions in the study area is a Phase I Environmental Site Assessment, which was prepared for the Lagunitas Road Bridge Replacement Project (Town of Ross 2009, in USACE 2010). The Environmental Site Assessment consisted of a review of readily available public documentation regarding past and current land use for indications of the manufacture, generation, use, storage, and/or disposal of hazardous substances at the bridge replacement Project site, including a review and evaluation of the following.

- Pertinent, available documents and maps regarding local hydrogeological conditions
- Previous environmental reports prepared for the Lagunitas Road Bridge site
- Historical aerial photographs and topographic maps of the Lagunitas Road Bridge site and an area within 0.5 mile of the Lagunitas Road Bridge site for information regarding land uses that could have involved the manufacture, generation, use, storage, and/or disposal of hazardous substances
- Current and previous land use at the Lagunitas Road Bridge site based on available municipal, county, and state agency records and permits for evidence of hazardous substances, including hazardous wastes
- State agency files located on GeoTracker, the RWQCB online database, for properties within 0.25 mile of the Lagunitas Road Bridge site with known environmental impacts; and limited assessment of current practices at the site for the purpose of identifying significant environmental compliance issues

The results of an Environmental Site Assessment indicated one recognized environmental condition that would be applicable to the study area: soils could have been affected by diesel spills and airborne contaminants including lead, copper, and diesel fuel from the railroad track that formerly paralleled Corte Madera Creek (Town of Ross 2009, in USACE 2010).

Cortese List Status: CEQA (PRC section 21092.6) requires disclosure of sites included on a list of hazardous materials sites compiled pursuant to California GC Section 65962.5, and, as a result, to indicate whether a site would create a significant hazard to the public or the environment. The following data resources provide information regarding the facilities or sites identified as meeting the "Cortese List" requirements: List of Hazardous Waste and Substances Sites from the DTSC EnviroStor database; List of Leaking Underground Storage Tank Sites by County and Fiscal Year from the SWRCB GeoTracker database; List of Solid Waste Disposal Sites identified by the SWRCB with waste constituents above hazardous waste levels outside the waste management unit; List of "Active" Cease and Desist Orders and Cleanup and Abatement Orders from SWRCB; and List of Hazardous Waste Facilities Subject to Corrective Action Pursuant to Section 25187.5 of the Health and Safety Code, identified by DTSC.

A review of the online Cortese database in November 2017 did not identify any facilities or sites within the study area (DTSC 2017, SWRCB 2015).

4.12.2.3 Existing Uses nearby That Could Pose a Health Hazard

The study area is surrounded by residential and associated urban uses such as parks, commercial/retail development, public uses, schools (including the College of Marin and Kent Middle School), and health care facilities. Review of the USEPA Envirofacts online database identified three facilities that generate hazardous waste regulated by federal and state laws and regulations: Kentfield Hospital, Kent Middle School, and the Kentfield Fire Protection District (KFPD) (USEPA 2017b). The hazardous waste management functions at these sites do not involve activities expected to pose a HTRW hazard to the study area.

4.12.3 Environmental Consequences

4.12.3.1 Avoidance and Minimization Measures

The following AMMs would be implemented as part of the Project design and would avoid or minimize adverse effects associated with health and safety.

- **AMM-HAZ-1: Compliance with Federal, State, and Local Regulations** - Compliance with applicable regulations would reduce the potential for accidental release of hazardous materials during construction. The contractor would be required to prepare a SWPPP and Spill Prevention, Control, and Countermeasure Plan that details the contractor's plan to prevent discharge from the construction site into drainage systems, lakes, or rivers. This plan would include BMPs and a spill cleanup plan for implementation at each construction site.
- **AMM-HAZ-2: Prepare Health and Safety Plan** - A worker health and safety plan would be prepared before the start of construction activities that identifies, at a minimum, all the contaminants that could be encountered during construction activities; all appropriate worker, public health, and environmental protection equipment and procedures to be used during Project activities; emergency response procedures; the most direct route to the nearest hospitals; and a Site Safety Officer. The plan would describe action to be taken should hazardous materials be encountered on site, including protocols for handling hazardous materials and preventing their spread, and emergency procedures to be taken in the event of a spill.
- **AMM-HAZ-3: Records Review Prior to Construction** - If significant time has elapsed between approval of the document and construction, a second records review would be completed to reduce the risk of encountering a hazardous site during constriction.
- **AMM-HAZ-4: Implement Fire Prevention Measures -** Fire prevention measures will be implemented to reduce the risk of fire from construction equipment.
    - All earthmoving equipment with internal combustion engines will be equipped with spark arrestor.
    - During the high fire danger period (April 1 – December 1), work crews will have appropriate fire suppression equipment available at the work site.
    - On days when fire danger is high and a burn permit is required (as issued by the relevant Air Pollution Control District), flammable materials, including flammable vegetation slash, will be kept at least 10 feet away from any equipment that could produce a spark, fire, or flame.
    - On days when the fire danger is high and a burn permit is required, portable tools powered by gasoline-fueled internal combustion engines will not be used within 25 feet of any flammable materials unless at least one round-point shovel or fire extinguisher is within immediate reach of the work crew (no more than 25 feet away from the work area).

The following traffic AMM would also be applicable.

- **AMM-TRF-2: Traffic Control Plan** - A Traffic Control Plan will be prepared and submitted to Marin County Department of Public Works for review and approval. During construction activities, the Marin County Department of Public Works and the project contractors working on the project shall adhere to all requirements of the Traffic Control Plan. The Traffic Control Plan shall include the following:
    - The route selection for movement of heavy equipment in the project vicinity shall be coordinated with the Marin County Department of Public Works, Marin County Sheriff's Department, and Police Departments for applicable cities and unincorporated communities (Town of Ross and Kentfield) to minimize traffic and physical road impacts. Truck drivers

shall be notified and be required to use the most direct route between the project site and Highway 101.

- Heavy equipment transport, material transportation, or exportation to and from the project site shall not occur during weekday commute peak traffic periods and shall be coordinated by the contractor with the Marin County Department of Public Works, Marin County Sheriff's Department, and relevant city/town police departments.
- The Traffic Control Plan will define the use of flaggers, warning signs, lights, barricades, and cones, etc., according to standard guidelines required by the County and Town of Ross as appropriate. Further, the contractor will maintain the work site, including traffic control, in a safe condition at all times, even outside of normal work hours.
- Construction activities completed within public street rights-of-way shall require the use of a traffic control service, and any lane closures or traffic control measures shall be consistent with those published in the California Joint Utility Traffic Control Manual (California Inter-Utility Coordinating Committee 2010). Implementing measures contained within the California Joint Utility Traffic Control Manual would facilitate safe passage of both construction vehicles and private vehicles.
- A roadway cleaning program shall be instituted to address debris and mud caused by trucks on Sir Francis Drake Boulevard and other access and haul routes.

4.12.3.2 Methodology for Impact Analysis and Significance Thresholds

Human health and safety effects of the Project were analyzed based on comparison of existing environmental records with expected types and locations of work to be completed throughout the study area. Specifically, this analysis made use of the USEPA Envirofacts databases, GeoTracker database, and Cortese List to determine which facilities or natural features, if any, would pose a danger to workers, the public, or the environment if exposed to normal construction efforts required for the installation of flood control measures.

The Project would pose a significant impact to health and human safety if it would result in the following impacts.

- **Impact HAZ-1:** Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.
- **Impact HAZ-2:** Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials.

The primary risk regarding hazardous material transport, use, disposal, and/or release would result from construction efforts for flood control structures. As such, this analysis evaluated whether construction work could pose a danger to nearby homes and the environment, as well as the potential for the Project to bring individuals and /or the public into contact with hazardous materials.

- **Impact HAZ-3:** Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school.

This analysis considered both Kent Middle School and College of Marin. Both of these institutions have facilities adjacent to the creek, and as such may be exposed to hazards created by Project work. The likelihood of exposure and the expected probability of hazardous materials handling was taken into account when determining if the Project would pose a significant impact.

- **Impact HAZ-4:** Be located on a site which is included in a list of hazardous materials sites compiled pursuant to GC Section 65962.5 and, as a result, would create a significant hazard to the public or the environment.

This analysis considered locations of hazardous materials sites found in the Cortese List, USEPA Envirofacts database, and GeoTracker database.

- **Impact HAZ-5:** Impair implementation of or physically interfere with an adopted emergency response or evacuation plan.

This analysis considered emergency response of the Ross Fire Department and Police Department, both located near Lagunitas Road Bridge, and any potential interference with evacuation plans. This analysis coincided with analysis of emergency access due to traffic effects in Section 4.13 Traffic.

- **Impact HAZ-6:** Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.

This analysis considered the current climate of California and the study area's specific history regarding wildfires to determine if the expected Project work would contribute to any substantial increase in fire danger. In addition, the proximity of local homes and businesses was considered when evaluating the potential severity of a wildland fire event.

- **Impact HAZ-7:** If located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public-use airport, the project would result in a safety hazard for people residing or working in the project area.
- **Impact HAZ-8:** If located within the vicinity of a private airstrip, the project would result in a safety hazard for people residing or working in the project area.

The preceding impacts would not be applicable to the Project. The Project area would not include or intersect any public or private airports or airport land use regions. As a result, the Project would not contribute to any of these impacts.

4.12.3.3 Effects and Mitigation

No Action Alternative

No new hazards would be created under the no action alternative. Without construction, there would be ***no impact*** to release hazardous materials associated with construction and no increase to wildland fire risk. Flooding would remain a hazard, as described in Section 4.1 Hydrology and Hydraulics.

Action Alternatives

Routine Construction Effects

Construction activities associated with grading, installation of floodwalls, and other flood control measures would involve the use of heavy equipment that contain certain kinds of hazardous materials such as fuels and lubricants. As work may take place some distance from a predetermined staging area, it may be necessary to transport such materials to and from a work site either separately or onboard existing equipment. During these activities, there would be potential for a spill or leak to expose workers, the public, and/or the environment to hazardous substances along access routes, work sites, or staging areas. This would contribute to the following hazard impacts:

- **Impact HAZ-1:** Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.
- **Impact HAZ-2:** Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials.

Possible hazardous materials that could be used on construction sites include the following.

- Motor oils
- Spray paints
- Mastic coatings
- WD-40
- Cleaning solvents
- Pressurized gases
- Transmission fluids
- Gasoline (or other fuels)
- Oxygen and/or acetylene Canisters
- Grease and brake fluids
- Disinfectants
- Hydraulic fluid

However, with a proper health and safety plan and compliance with applicable federal and state regulations, any hazards associated with construction vehicles and equipment would be minimal. Adherence to AMMs would ensure that risk of spills or other types of hazardous release into the environment would be minimized and that any unintentional release of materials would be swiftly removed and disposed of by a licensed contractor in accordance with Project plan requirements that address accidental spills. For example, it is a standard practice to store all potentially hazardous materials in proper containers away from the active work site when not in use. Cleanup materials and equipment would be stored nearby in the event of a spill. Hazardous wastes would be disposed of in designated hazardous waste collection containers onsite. All hazardous materials in use within vehicles and other work equipment would be subject to regular inspections for leaks, breaches, and other forms of inadvertent material release.

It would be possible for construction efforts to uncover (via excavation, demolition, or other means) undocumented and/or previously unknown hazardous materials on any of the potential work sites. This could result in exposure to workers, the public, and the environment and would certainly be a significant impact as well as a potentially dangerous situation. However, because the study area is both well-developed and well-documented, the likelihood of discovering or releasing new and unexpected hazardous materials would be very small.

These impacts would be ***less than significant.***

Nearby Schools

Three schools are located within one quarter-mile of the study area, which could potentially be exposed to hazardous emissions from Project work, including Kent Middle School and College of Marin, near the junction of Units 2 and 3, and Ross Elementary, near the southern section of Unit 4. Any impact on these facilities would contribute to the following significance criterion.

- **Impact HAZ-3:** Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school.

The only potential hazards and emissions which may affect these locations would result from Project construction efforts along the banks of the creek, which have already been discussed. With proper AMMs in place, the risk of hazardous emissions or release of hazardous materials would be considered minimal.

This impact would be ***less than significant.***

Nearby Hazardous Materials Sites

The study area is not located on and would not intersect any known hazardous materials sites found in the Cortese List, USEPA Envirofacts database, or GeoTracker database. Furthermore, there are no known HTRW sites or activities within or near the study area. As a result, the Project would have no expected contribution to the following impact.

- **Impact HAZ-4:** Be located on a site which is included in a list of hazardous materials sites compiled pursuant to GC Section 65962.5 and, as a result, would create a significant hazard to the public or the environment.

Emergency and Evacuation Plans

The Ross Fire Department Police Station is located adjacent to the Project near Lagunitas Road Bridge. Evacuation could be necessary in case of wildfire or flooding. Construction could contribute to the following impact.

- **Impact HAZ-5:** Impair implementation of or physically interfere with an adopted emergency response or evacuation plan.

Emergency response by the fire and police departments could be impaired during construction due to road closure or reduced traffic lanes at Sir Francis Drake Boulevard for Alternatives F and J and increased traffic for all alternatives (see Section 4.13 Traffic). Police are usually located away from the station when emergency calls come in, so impacts to the police department would not be expected. Police would likely be temporarily stationed at Marin Art and Garden Center when construction blocks access to the station driveway, just as they currently do during flood events. Response by the fire department could be delayed. A schedule of construction activities and the Traffic Control Plan prepared per AMM-TRF-2 would be provided to any pertinent local emergency service providers, including RVFD, Town of Ross Police, KFPD, Marin County Fire Department, and Marin County Sheriff's Department (see section 4.16.2 for detailed information on fire and police services in the Project area). This would substantially reduce impacts to emergency response for Alternatives A, B, and G, which would not require construction on the roadway. However, evacuation routes and emergency response could still be impacted by road closures and reduced lanes required during installation of the bypass culvert under Sir Francis Drake Boulevard for Alternatives F and J.

For Alternatives A, B, and G, this impact would be ***less than significant***.

For Alternatives F and J, this impact would be ***significant***.

- **Mitigation HAZ-1:** Coordinate with local and regional emergency response services.

RVFD and Town of Ross Police would coordinate with local regional emergency response services, such as KFPD to the south of bypass construction and San Anselmo to the north of bypass construction. Coordinating with services on either side of construction activities would ensure that emergency response would not experience significant delays in the area.

For Alternatives F and J, Impact HAZ-5 would be ***less than significant*** with mitigation***.***

Wildland Fire Hazards

With current climate conditions in the State of California, it is vitally important to consider the potential for uncontrolled wildland fires when beginning Project work in a populated community. Though the Project setting is listed as a wildland-urban interface community, it is not located in an area designated as a very high hazard severity zone. Currently, the greatest risk for fire hazards would be expected for work in Unit 4 of the study area, as this region has a large amount of vegetation and its topography could allow fire to spread quite rapidly. No wildland fires, however, have occurred within this area over the last few years. These risks would contribute to the following impact:

- **Impact HAZ-6:** Expose people or structures to a significant risk of loss, injury, or death involving wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.

The greatest contributor to fire risk would be unattended or poorly positioned construction equipment. This equipment, which can become quite hot (especially during very warm and dry seasons), has the potential to ignite dead wood and plant matter if left in contact for extended periods of time. As such, it would be important for the contractor to enforce AMM-HAZ-4 that prevents work vehicles from being left on or near potentially flammable natural features such as leaf piles, dead grasses, and fallen trees. Furthermore, any ignitable construction materials, including fuels for vehicles and equipment, would be safely stored away from work sites and out of direct heat.

Preparing a Health and Safety Plan (per AMM-HAZ-2) and implementing construction AMM-HAZ-4 would reduce the contribution to wildland fire hazards.

Impacts from wildland fire would be ***less than significant.***

Table 4.12-1 summarizes the impacts to human health and safety**.**

TABLE 4.12-1 HUMAN HEALTH AND SAFETY IMPACT CONCLUSIONS

Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
HAZ-1: Create a significant hazard to the public or the environment through the routine transport, use, or disposal of hazardous materials.	AMM-HAZ-1 AMM-HAZ-2	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
HAZ-2: Create a significant hazard to the public or the environment through reasonably foreseeable upset and accident conditions involving the release of hazardous materials.	AMM-HAZ-1 AMM-HAZ-2	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
HAZ-3: Emit hazardous emissions or handle hazardous or acutely hazardous materials, substances, or waste within one-quarter mile of an existing or proposed school.	AMM-HAZ-1 AMM-HAZ-2	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
HAZ-4: Be located on a site which is included in a list of hazardous materials sites compiled pursuant to Government Code Section 65962.5 and, as a result, would create a significant hazard to the public or the environment.	AMM-HAZ-3	All	NI	--	--
HAZ-5: Impair implementation of or physically interfere with an adopted emergency response or evacuation plan.	AMM-HAZ-2 AMM-TRF-2	A, B, G	LTS	--	--
		F, J	S	M-HAZ-1	LTS
		No Action	NI	--	--
HAZ-6: Expose people or structures to a significant risk of loss, injury, or death involving	AMM-HAZ-2 AMM-HAZ-4	All Action Alternatives	LTS	--	--

TABLE 4.12-1 HUMAN HEALTH AND SAFETY IMPACT CONCLUSIONS					
Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
wildland fires, including where wildlands are adjacent to urbanized areas or where residences are intermixed with wildlands.		No Action	NI	--	--
HAZ-7: If located within an airport land use plan or, where such a plan has not been adopted, within two miles of a public airport or public-use airport, the project would result in a safety hazard for people residing or working in the project area.	--	N/A	--	--	--
HAZ-8: If located within the vicinity of a private airstrip, the project would result in a safety hazard for people residing or working in the project area.	--	N/A	--	--	--

AMM = avoidance and minimization measure
LTS = less than significant
N/A = not applicable
NI = no impact
S = significant

4.12.3.4 Cumulative Impacts

The geographic scope of analysis for cumulative hazardous materials impacts encompasses and is limited to the Project Area and its immediate vicinity. Many impacts related to hazardous materials are largely site-specific and depend on the nature and extent of the hazardous materials release, and existing and future soil and groundwater conditions. For example, hazardous materials incidents tend to be limited to a small, localized area surrounding the immediate location and extent of the release, and could only be cumulative if two or more hazardous materials releases overlap spatially (an exception to this is a groundwater plume of contaminants released from an otherwise isolated source). Consequently, the hazardous materials impacts related to routine use, accidental release, or being located on a listed hazardous materials site compiled pursuant to Government Code Section 65962.5 are usually site specific and are not cumulative in nature. In addition, impacts relative to hazardous materials are also usually time-specific.

The projects identified in Table 4-2 would involve construction activities using equipment that would use fuels, oil and lubricants, and cleaning solvents. In addition, alteration or demolition of existing structures may release hazardous building materials. Construction and demolition activities are required to comply with numerous hazardous materials and stormwater regulations designed to ensure that hazardous materials are transported, used, stored, and disposed of in a safe manner to protect worker safety, to reduce the potential for a release of construction-related fuels or other hazardous materials to affect stormwater and downstream receiving water bodies, and to respond to accidental spills, if any. Existing regulations require that demolition activities that may disturb or require the removal of materials that consist of, contain, or are coated with asbestos containing material, lead based paint, polychlorinated biphenyls, mercury, and other hazardous materials must be inspected and/or tested for the presence of hazardous materials. If present, the hazardous materials shall be managed and disposed of in accordance with applicable laws and regulations.

Project construction would involve localized ground disturbance activities and these activities could result in encountering contaminated soil or groundwater. However, implementation of AMMs would reduce impacts associated with encountering potentially contaminated soil or groundwater to less than significant levels by controlling contact with and release of these materials into the environment. Therefore, there would be no significant cumulative impact to which the Project would contribute.

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4.13 Traffic, Transportation, and Circulation

This section addresses environmental conditions relative to roadways, transportation resources, and traffic circulation in areas that could be potentially affected by the Project in and near the Town of Ross and in unincorporated Marin County, and examines whether the Project alternatives could have a significant impact on traffic and transportation. Data for this section were developed based on review of local planning and policy documents from the Town of Ross and County of Marin, in addition to the Lagunitas Road Bridge Replacement Project EIR.

4.13.1 Regulatory Setting

This section discusses regulatory information that applies to traffic, transportation, and circulation. Additional regulatory information appears in Chapter 9 Environmental Compliance.

4.13.1.1 Federal

There are no specific federal regulations governing traffic, transportation, and circulation in the study area.

4.13.1.2 State

California Department of Transportation

Caltrans has jurisdiction over state highways and sets maximum load limits for trucks and safety requirements for oversized vehicles that operate on highways. Caltrans developed a "Guide for the Preparation of Traffic Impact Studies" (Caltrans 2002) to provide guidance in determining if and when a traffic impact study is needed and requirements for producing a study. Caltrans prepares Transportation Concept Reports for each of its facilities. A Transportation Concept Report is a long-term planning document that each Caltrans district prepares for every state highway for long-range corridor planning process. The Transportation Concept Report determines how a highway will be developed and managed so that it delivers the targeted level of service (LOS) and quality of operations that are feasible to attain over a 20-year period as well as the "ultimate concept," which is the ultimate goal for the route beyond the 20-year planning horizon. Caltrans considers LOS E as the minimum acceptable LOS for freeway mainline segments and ramps.

SB 743

SB 743, passed in 2013, requires OPR to develop new CEQA guidelines that address traffic metrics under CEQA. As stated in the legislation, upon adoption of the new guidelines, "automobile delay, as described solely by LOS or similar measures of vehicular capacity or traffic congestion shall not be considered a significant impact on the environment pursuant to this division, except in locations specifically identified in the guidelines, if any." The OPR has submitted updated CEQA Guidelines to the California Natural Resources Agency for formal rulemaking to implement SB 743. The guidelines recommend that vehicle miles traveled should be the primary metric used to identify transportation impacts and local agencies will have an opt-in period of approximately 2 years following the completion of the rulemaking process. However, in the proposed guidelines, OPR recognizes that vehicle miles traveled and the associated thresholds for this metric may not always be applicable to every project. Therefore, it is the responsibility of the lead agency to determine the most appropriate metric to disclose transportation impacts.

4.13.1.3 Local

Marin Countywide Plan

The following policy of the Marin Countywide Plan is applicable to traffic, transportation, and circulation regulation:

- **Policy TR-1.2 Maintain Service Standards**. Establish LOS standards for vehicles on streets and highways and performance standards for transit, bicycles, pedestrians, and other modes of transportation.

Town of Ross General Plan 2007–2025

The following policies of the Town of Ross General Plan are applicable to traffic, transportation, and circulation regulation:

- **Policy 7.4 Traffic Impacts:** Ensure that full CEQA review is undertaken of significant development proposals in Ross, in nearby areas and along the Sir Francis Drake Boulevard corridor that may impact traffic operations, safety, air quality, and other environmental conditions.
- **Policy 7.5 Pavement Management:** Maintain acceptable pavement management on all public streets and mitigate roadway impacts due to construction activities for aesthetic, structural, and acoustical reasons. Hold developers responsible for pavement degradation caused by construction vehicles.
- **Policy 7.6 Parking Program:** Address on-site and street parking needs through adequate parking standards and enforcement. Limit on-street and overnight parking.
- **Policy 7.8 Bicycle and Pedestrian Travel:** Encourage travel via bicycle and walking by providing and maintaining safe pedestrian and bicycle routes along main arteries in Ross. Consider links with Town destinations, surrounding area destinations and regional trails and bicycle systems. Participate in the Safe Routes to Schools Program.
- **Policy 8.4 Downtown and Ross Common:** Maintain the Town-owned Ross Common areas linked to uses and activities at Ross School, and linked to the Town's downtown area as the central recreation, gathering, and local shopping area of Ross. Maintain the downtown area as an attractive, pedestrian-friendly, small retail/business area. Encourage smaller-scale housing units mixed with commercial uses.

4.13.2 Affected Environment

4.13.2.1 Regional Access

Primary regional access to the study area is via U.S. Highway 101 (US 101) and Interstate 580 (I-580), as illustrated in Figure 4.13-1. Northbound and southbound traffic on US 101 exits onto westbound Sir Francis Drake Boulevard, a major Marin County thoroughfare that extends from I-580 just west of the Richmond–San Rafael Bridge in the east to the Point Reyes Lighthouse in the west.

4.13.2.2 Local Access

The most direct access to Units 3 and 4 of the Project is via Lagunitas Road to Ross Commons, as illustrated in Figure 4.13-2. The most direct access to Units 2 and 3 is from College Avenue. As noted in the Lagunitas Road Bridge Replacement Project Draft EIR (Town of Ross 2009, in USACE 2010), Lagunitas Road is one of three main entry points into the Town of Ross west of Sir Francis Drake Boulevard. The other two entry points from Sir Francis Drake Boulevard are Bolinas Avenue, to the north of the study area, and College Avenue. Except for Sir Francis Drake Boulevard, the town's roadway system consists of two-lane roads (one travel lane in each direction) through primarily residential areas.

Lagunitas Road extends from the Marin Art and Garden Center at Sir Francis Drake Boulevard through central Ross, past Ross School, residences, the Lagunitas Country Club, and Natalie Coffin Greene Park. Lagunitas Road ends at Phoenix Lake. Sylvan Lane, a narrow private road that extends north from Lagunitas Road, parallels the upstream portion of Unit 4. The single access point to and from Sylvan Lane is just past the west end of Lagunitas Road Bridge (Town of Ross 2009, in USACE 2010). Ross Common, Poplar Avenue, and Kent Avenue are contiguous roads that provide access to Lagunitas Road and downtown Ross from south of the study area. Ross Common is bordered to the north by Lagunitas Road and becomes Poplar Avenue at roughly the southern edge of Ross Common Park. Ross Common and Poplar Avenue encompass the Town's main commercial district (including the Ross Post Office) and, as the roadway proceeds south, pass through a residential area.

Poplar Avenue transitions into Kent Avenue at the boundary with the Town of Kentfield, where the road continues through a residential area and passes the College of Marin, a small shopping center, and a gas station. Kent Avenue ends at Woodland Road, near a five-way intersection that includes College Avenue.

College Avenue extends from Sir Francis Drake Boulevard in the north to Murray Lane in Kentfield, where it becomes Magnolia Avenue. The primary land uses between Sir Francis Drake Boulevard and the intersection where College Avenue meets Kent Avenue are the College of Marin, Kent Middle School, and commercial uses.

4.13.2.3 Existing Roadway Conditions

Intersection LOS is a measure used to describe perceived traffic operating conditions for motorists. Table 4.13-1 identifies the relationship between LOS designations and average stopped delay per vehicle at an intersection and Table 4.13-2 identifies the relationship between LOS designations and average stopped delay per vehicle at a stop sign.

TABLE 4.13-1 MARIN COUNTY LOS DEFINITIONS FOR SIGNALIZED INTERSECTIONS

LOS	Vehicle Delay (seconds)	Description
A	0-5	Free Flow/Insignificant Delay: No approach area is fully utilized by traffic.
B	5.1-15	Stable Operation/Minimal Delay: An approach area may be fully utilized. Some drivers feel restricted.
C	15.1-25	Stable Operation/Acceptable Delay: Approach areas are fully utilized. Most drivers feel restricted.
D	25.1-40	Approaching Unstable Operation/Tolerable Delay: Drivers may have to wait through more than one red signal. Queues may develop but dissipate rapidly.
E	40.1-60	Unstable Operation/Significant Unacceptable Delay: Volumes at or near capacity. Vehicles may wait through several signal cycles. Long queues form.
F	>60	Forced Flow/Excessive Delay: Jammed conditions. Intersection operates below capacity with low volumes. Queues may block upstream intersections.

SOURCE: Marin County 2007

TABLE 4.13-2 MARIN COUNTY LOS DEFINITIONS FOR STOP SIGN CONTROLLED INTERSECTIONS

LOS	Vehicle Delay (seconds)	Description
A	<10	Little or no delay
B	>10-20	Short traffic delay
C	>20-35	Average traffic delay
D	>35-55	Long traffic delay
E	>55-80	Very long traffic delay
F	>80	Excessive traffic delay

SOURCE: Marin County 2007

Marin County has established LOS D as the standard for urban or suburban arterial roadways, such as Sir Francis Drake Boulevard. The Town of Ross has also established LOS D as the standard for operations along Sir Francis Drake Boulevard; however, all other streets within the Town of Ross are subject to an operating standard of LOS C. Based on traffic evaluations by the Town of Ross (Town of Ross 2009, in USACE 2010), intersections located in and adjacent to the study area are operating at the following LOS:

- Sir Francis Drake Boulevard at Lagunitas Road—LOS C
- Sir Francis Drake Boulevard at College Avenue—LOS C
- Sir Francis Drake Boulevard at Bolinas Avenue—LOS C
- Lagunitas Road at Shady Lane—LOS A
- College Avenue at Woodland Road/Kent Avenue—LOS C

Vehicle miles traveled is the distance of automobile travel attributable to a project or area. The BAAQMD partnered with the Metropolitan transportation Commission to develop a Vehicle Miles Traveled Data Portal that quantifies and characterizes vehicle miles traveled throughout the Bay Area. The Vehicle Miles Traveled Data Portal characterizes vehicle miles traveled by if the driver is a worker and where they live and work. Data regarding drivers who live or work out of Ross and Kentfield is provided as context for the greater Bay Area. Table 4.13-3 displays the vehicle miles traveled of Ross and Kentfield, for each area.

TABLE 4.13-3 VEHICLE MILES TRAVELED

Ross			
Population Segment	**Persons**	**Total Vehicle Miles Traveled**	**Per Capita Vehicle Miles Traveled**
Live in area/ Works in area	8	136	17.00
Live in area/ Works out of area	950	19,003	20.00
Live in area/ Non-worker	1,610	14,819	9.20
Live out of area/ Works in area	500	15,606	31.21
Live out of area/ Works out of area	4,138,318	88,722,672	21.44
Live out of area/ Non-worker	3,748,684	30,138,698	8.04
Kentfield			
Population Segment	**Persons**	**Total Vehicle Miles Traveled**	**Per Capita Vehicle Miles Traveled**
Live in area/ Works in area	162	1,171	7.23
Live in area/ Works out of area	2,818	67,018	23.78
Live in area/ Non-worker	1,838	14,938	8.13
Live out of area/ Works in area	3,174	93,272	29.39
Live out of area/ Works out of area	4,133,622	88,595,960	21.43
Live out of area/ Non-worker	3,748,456	30,138,580	8.04

Source: BAAQMD 2015

4.13.2.4 Existing Bridges

Existing bridges would not be modified as part of this project; however, they may be replaced by local departments in the future. Six bridges cross Corte Madera Creek along the Project area, three for automobiles and three for pedestrians. Automobile bridges include Lagunitas Road Bridge near Station 376, Kentfield Hospital Bridge near Station 364, and College Avenue Bridge near Station 335, as shown in Figure 4.13-2. Lagunitas Road Bridge, which crosses Lagunitas Road between Reaches 1 and 2, was replaced in 2010.

Two pedestrian bridges cross Corte Madera Creek in the College of Marin campus which lie upstream of the College Avenue Bridge (called West Campus). These bridges include: the pedestrian/maintenance access bridge connecting the West Campus parking area to the Student Services Building (SS Bridge) and the pedestrian bridge that connects the same parking area to the Science-Math-Nursing Building (SMN Bridge). The SS Bridge is located at Station 338+80, about 350 feet upstream from College Avenue, and the SMN Bridge is located at Station 343+80, about 500 feet upstream from the SS Bridge. The SMN Bridge was constructed in 2008 and does not require replacement as it is of adequate height for the designed flood protection. The SS Bridge is scheduled to be replaced by the College as part of their Capital Improvement Program. A third pedestrian bridge crosses the creek at the end of Stadium Way in Kentfield at Station 323+50. This bridge has funding to be replaced in the future by Marin County Parks Department.

4.13.2.5 Bicycle and Pedestrian Facilities

A variety of pedestrian facilities such as sidewalks, paved trails, and unpaved paths occur in and adjacent to the study area (Town of Ross 2009, in USACE 2010). Lagunitas Road has sidewalks on both sides of the south side of the bridge. It was noted that the replacement bridge would not include a sidewalk along its northern edge. While exclusively pedestrian facilities do not occur along Corte Madera Creek, north of Lagunitas Road, pedestrians can use the shoulder of Sylvan Lane along the right bank of the creek, although no sidewalk is provided. South of Lagunitas Road Bridge, a designated bicycle-pedestrian pathway follows the right side of Corte Madera Creek between Lagunitas Road and Bon Air Road. Pedestrian bridges (SMN and SS bridges) in the vicinity of the College of Marin allows pedestrians to cross from the trail to the college campus on the east side of the creek. Ross Common, Poplar Avenue, and Kent Avenue have paved sidewalks in most areas. Bolinas Avenue and College Avenue have sidewalks on both sides.

Bolinas Avenue, Shady Lane, Ross Common, and the segment of Lagunitas Road between Shady Lane and the parking lot north of the Ross Post Office are designated bicycle routes in the study area (Town of Ross 2007). The Lagunitas Road Bridge is not part of a designated bicycle route but it does provide access to other nearby routes.

4.13.2.6 Transit Service

Golden Gate Transit is the only public transit agency that serves the immediate study area with Routes 18, 22, 24, 24x, 25, 29, and 228 providing bus service along Sir Francis Drake Boulevard through the Town of Ross (Golden Gate Bridge Highway and Transportation District 2017). Routes 22, 29, and 228 are Marin County routes while 24, 24x, and 25 are commute routes. Five bus stops along Sir Francis Drake Boulevard that also serve the College of Marin and Kent Middle School area are applicable to the Project.

4.13.2.7 Parking

Within the northern portion of the study area (Unit 4 and the upstream portion of Unit 3), the Town of Ross has two public parking lots. These lots are located north and south of the Ross Post Office. The lot north of the Post Office and adjacent to Lagunitas Road contains 18 undesignated slots, 4 post office employee slots, and 3 Americans with Disabilities Act accessible slots. The lot south of the post office has 13 undesignated slots and 2 Americans with Disabilities Act accessible slots.

Street parking (both parallel and diagonal) is available along Ross Common, as well as parts of Poplar Avenue and Kent Avenue. In addition, space is available along Lagunitas Road by Town Hall to accommodate parking for three vehicles (Town of Ross 2009, in USACE 2010).

On-street parking in the southern portion of the study area (Unit 2 and downstream portion of Unit 3) is limited. The College of Marin is the largest provider of off-street public parking in this area. Additional parking is available at Woodlands Market in Kentfield and the Kentfield Hospital but only to users of these establishments.

4.13.3 Environmental Consequences

4.13.3.1 Avoidance and Minimization Measures

The following AMMs would be implemented as part of the Project design and would avoid or minimize adverse effects by limiting impacts on local traffic and transportation.

- **AMM-TRF-1: Avoid Peak Hours** - Truck delivery would be scheduled outside the a.m. and p.m. peak traffic hours, so project-related trips would occur predominantly outside peak traffic hours to minimize impacts on the area transportation system.
- **AMM-TRF-2: Traffic Control Plan** - A Traffic Control Plan will be prepared and submitted to Marin County Department of Public Works for review and approval. During construction activities, the Marin County Department of Public Works and the project contractors working on the project shall adhere to all requirements of the Traffic Control Plan. The Traffic Control Plan shall include the following:
    - The route selection for movement of heavy equipment in the project vicinity shall be coordinated with the Marin County Department of Public Works, Marin County Sheriff's Department, and Police Departments for applicable cities and unincorporated communities (Town of Ross and Kentfield) to minimize traffic and physical road impacts. Truck drivers shall be notified and be required to use the most direct route between the project site and Highway 101.
    - Heavy equipment transport, material transportation, or exportation to and from the project site shall not occur during weekday commute peak traffic periods and shall be coordinated by the contractor with the Marin County Department of Public Works, Marin County Sheriff's Department, and relevant city/town police departments.
    - The Traffic Control Plan will define the use of flaggers, warning signs, lights, barricades, and cones, etc., according to standard guidelines required by the county and Town of Ross as appropriate. Further, the contractor will maintain the work site, including traffic control, in a safe condition at all times, even outside of normal work hours.
    - Construction activities completed within public street rights-of-way shall require the use of a traffic control service, and any lane closures or traffic control measures shall be consistent with those published in the California Joint Utility Traffic Control Manual (California Inter-Utility Coordinating Committee 2010). Implementing measures contained within the

California Joint Utility Traffic Control Manual would facilitate safe passage of both construction vehicles and private vehicles.

- A roadway cleaning program shall be instituted to address debris and mud caused by trucks on Sir Francis Drake Boulevard and other access and haul routes.

4.13.3.2 Methodology for Impact Analysis and Significance Thresholds

The potential for traffic-related impacts resulting from the Project was evaluated based on planned work areas and staging areas for construction equipment at different points along the Project area. Figure 4.13-3 shows the locations of staging areas and potential access routes.

For this analysis, it was assumed that two staging areas (one on each side of the channel) would be used simultaneously during construction. This is standard practice, reducing the need to transport equipment and personnel across bridges and the channel. The contractor would develop and implement a Traffic Control Plan per AMM-TRF-2 prior to construction. Some basic assumptions were made to estimate the effects of a Traffic Control Plan on traffic conditions in the Project area.

The Project would pose a significant impact to traffic, transportation, and circulation if it would result in the following.

- **Impact TRF-1:** Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.
- **Impact TRF-2:** Conflict with an applicable congestion management program, including but not limited to LOS standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways.

This analysis compared the effect that Project alternatives would have on local traffic conditions to policies set by the Town of Ross General Plan and Marin Countywide Plan. Because construction efforts would utilize staging areas along main roads, the analysis focused on impacts to traffic at staging areas.

- **Impact TRF-3:** Result in inadequate emergency access.

This analysis evaluated the potential for construction activities to interfere with emergency access routes for fire and police services. This analysis concentrated on interference of staging areas with fire and police stations.

- **Impact TRF-4:** Conflict with adopted policies, plans, or programs regarding public transit, bicycle or pedestrian facilities, or otherwise decreases the performance or safety of such facilities.

This analysis evaluated the potential for interference with pedestrian and bicycle access around Corte Madera Creek, focusing on the bicycle-pedestrian pathway parallel to the creek.

- **Impact TRF-5:** Result in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risk.
- **Impact TRF-6:** Substantially increase traffic hazards due to design features (e.g. sharp curves or dangerous intersections) or incompatible uses (e.g. farm equipment).

The preceding impacts were not considered for this analysis. The Project would not be located on or near any airport or private airstrip and would not involve construction of any features which would require changes in current air traffic patterns above the study area. None of the alternatives would require changes to existing roadways or add new traffic features. There would be no impacts of these kinds from any of the Project alternatives.

Pursuant to OPR's proposed CEQA Guidelines, vehicle miles traveled for the Project are summarized in Table 4.13-4. Two trips per day were assumed for each worker. The estimated number of workers and haul trips are provided in Appendix B. Per CalEEMod, it was assumed that worker trips would be 10.8 miles and haul trips would be 20 miles, one way. Vehicle miles traveled has been provided for informational purposes only, and impacts are based on current CEQA Guidelines, not the proposed guidelines regarding vehicle miles traveled.

TABLE 4.13-4 CONSTRUCTION VEHICLE MILES TRAVELED

Alternative	Total Construction Vehicle Miles Traveled	Average Annual Vehicle Miles Traveled	Average Annual Vehicle Miles Traveled per Worker	Average Annual Vehicle Miles Traveled per Capita[1]
A	686,952	228,984	1,974	8
B	560,848	186,949	1,119	7
F	1,248,644	416,215	2,507	15
G	566,788	188,929	1,173	7
J	1,325,556	441,852	3,809	15

1. Includes populations of Ross and Kentfield by zip code tabulation area.

4.13.3.3 Effects and Mitigation

No Action Alternative

In the no action alternative, existing traffic conditions throughout the study area would remain unchanged and current LOS at intersections near the Project would be maintained. The risk of flooding, which the Project seeks to eliminate, would persist and would potentially impact traffic if floodwaters reach and submerge roadways adjacent to Corte Madera Creek. The no action alternative would have ***no impact*** to transportation.

Action Alternatives

During construction, the Project may contribute to impacts described in this section.

- **Impact TRF-1:** Conflict with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.
- **Impact TRF-2:** Conflict with an applicable congestion management program, including but not limited to LOS standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways.

Staging Areas

Trips to and from the Project area could increase traffic due to worker commutes and delivery trucks. Construction equipment and worker vehicles would be parked and stored at staging areas identified in Figure 4.13-3. Staging areas throughout the Project may contribute to traffic impacts in the surrounding area. Eight staging areas would be used and are identified sequentially by unit:

1. **Staging Area 4-1:** Unoccupied lot along Sir Francis Drake Boulevard, on the east bank across from the northern end of Sylvan Lane.
2. **Staging Area 4-2:** Parking lot of RVFD, Station 18, on the east bank of the creek.
3. **Staging Area 4-3:** Station Park, located at the corner of Sir Francis Drake Boulevard and Lagunitas Road (across the street from the Fire Station).
4. **Staging Area 4-4:** Town of Ross Post Office parking lot, which runs parallel to the creek along the west bank.
5. **Staging Area 3-1:** Open region at the western corner of the College of Marin, which extends north along the east bank of the creek.
6. **Staging Area 3-2:** Parking lot on the west bank of the creek across from the College of Marin.
7. **Staging Area 2-1 (College Avenue Staging Areas):** Two small parking lots across from one another where College Avenue crosses Corte Madera Creek.
8. **Staging Area 2-2 (Ball Field Staging Areas):** Two lots on opposite sides of the creek at the Kent Middle School athletic fields.

Two additional locations in Unit 3 were identified as potential staging areas, although no access roads have been identified for these staging areas. The first is on the east bank of the creek along Sir Francis Drake Boulevard near station 368+00 and the second just further downstream (Figure 4.13-3). Because access routes have not been identified, these two potential staging areas were not considered in this analysis.

Construction traffic entering and exiting staging areas has the potential to impact main thoroughfares and public access to services in the Town of Ross. Several intersections near Unit 4 may be impacted, including the intersection of Sir Francis Drake Boulevard and Lagunitas Road and the intersection of Lagunitas Road and Sylvan Lane. These impacts may have secondary impacts on the intersection of Shady Lane and Lagunitas Road and the intersection of Lagunitas Road and Kent Avenue.

Staging area 4-1 would be accessed directly from Sir Francis Drake Boulevard and egress from this location may cause traffic backups, as any large work vehicles attempting to maneuver in or out may inadvertently block the road. Staging areas 4-2 and 4-3 would pose a similar impact to both Sir Francis Drake Boulevard and Lagunitas Road. Large numbers of work vehicles moving in or out of these staging areas may reduce the LOS at the adjacent intersections, which would potentially conflict with standards set by Marin County for signaled intersections.

Staging areas 4-2 and 4-4 may interfere with public access to services in town, specifically the Fire Department, Police Department, and Post Office. Both the movement of construction vehicles and removal of parking spaces could limit the ability of the public to access these facilities, and may also affect the ability of service vehicles to deploy.

Increased congestion caused by these staging areas could have a wider impact on surrounding LOS, as backups on Lagunitas Road, Ross Common, and Sir Francis Drake Boulevard would have the potential to spill over onto surrounding roads.

Staging areas in Units 2 and 3 would be expected to have less impact on traffic because they are not located adjacent to major thoroughfares such as Sir Francis Drake Boulevard. Traffic would potentially be affected when equipment is transported across College Avenue Bridge; however, staging locations would be on either side of the bridge thereby reducing frequent transport. Staging area 3-2, located in the College of Marin west campus parking lot, would reduce parking availability for the college.

These impacts may have a synergistic effect when multiple staging areas are used simultaneously, causing a larger than expected increase in traffic congestion. This effect would be particularly noticeable during construction tasks requiring large numbers of workers for long durations, such as constructing floodwalls. This would primarily be a concern during peak traffic hours.

Traffic impacts would be minimized by limiting the hours of movement for construction equipment per AMM-TRF-1. This would minimize LOS degradation at nearby intersections by maintaining current traffic levels during peak hours. Additionally, it would be necessary to work with local services and facilities, such as the Post Office and Fire Department, to ensure sufficient access to parking and emergency services is adequate. This would be included in the Traffic Control Plan per AMM-TRF-2.

For all alternatives, in regard to staging areas, impacts TRF-1 and TRF-2 would be ***less than significant.***

Sylvan Lane

Alternative B would construct a setback floodwall around five properties along Sylvan Lane. The work at this location would impact residents of Sylvan Lane and potentially Lagunitas Road and surrounding intersections. Construction vehicles and personnel at staging areas 4-2, 4-3, and 4-4 would cross Lagunitas Road to access Sylvan Lane, potentially causing congestion at that intersection. Construction work along Sylvan Lane would interfere with the movement of residents. The Traffic Control Plan would have to address measures to minimize impacts to ingress to or egress from Sylvan Lane. The contractor would work with residents to ensure access to their properties.

Because Sylvan Lane is a dead-end street, once construction vehicles and personnel have reached their work site, there would not be substantial impacts to traffic outside of Sylvan Lane. Additionally, impacts would be limited to the duration of setback floodwall construction, about 50 days.

For Alternative B, the impact of construction efforts on Sylvan Lane traffic would be ***less than significant.***

Bypass

Alternatives F and J Unit 4 bypass would be constructed beneath Sir Francis Drake Boulevard and would cause extensive traffic interference, contributing to impacts TRF-1 and TRF-2. Bypass construction would involve road excavation, which would require closure or reduced lanes on part or all of Sir Francis Drake Boulevard on the area shown in Figure 3-3a. Construction would be implemented on one side of the road at a time to reduce traffic impacts, but closure of at least one lane of Sir Francis Drake Boulevard would be necessary. The roadway may need to be closed in both directions during box culvert installation because a crane would be needed to place precast sections into excavated areas. Detours would be established, potentially on Red Hill Avenue, Laurel Grove Avenue, or Wolfe Grade. Partial and full road closure would cause traffic delays and congestion, resulting in substantial LOS reduction. A Traffic Control Plan would be developed by the contractor per AMM-TRF-2 and would be reviewed and approved by the District and agencies with jurisdiction over roadways affected by Project construction activities, prior to construction. Once approved, the Traffic Control Plan shall be incorporated into the contract documents specifications. The Traffic Control Plan would reduce but not eliminate impacts to traffic.

Traffic impacts could be reduced by including night construction or using three smaller box culverts. By installing the box culverts at night, full closure of Sir Francis Drake Boulevard would only occur at night, minimizing impacts to traffic. Temporary shoring, excavation, backfilling, and utility relocation would still occur during the daytime construction hours, 8 am to 5 pm. Constructing three smaller box culverts would potentially reduce the trench size needed, reducing the amount of road requiring closure. This design element would be determined during PED.

For all design and construction methods, partial closure would be necessary at a minimum, and traffic impacts would persist.

For Alternatives F and J, impacts TRF-1 and TRF-2 would be ***significant***.

The following mitigation would be implemented to reduce the impact.

- **Mitigation TRF-1:** Coordinate with the public during construction. The Town of Ross and construction contractor shall implement traffic management measures to minimize traffic delays and maximize safety along the designated detour routes during project construction.

Public coordination would include signage and a project information Web page; traffic controls to minimize delays; and promotion of alternative travel modes. A detour map would be made available to the public, local businesses, and other institutions. Implementation of M-TRF-1 would inform the public of safe routes and potential delays, reducing impacts to traffic. However, construction on Sir Francis Drake Boulevard could still cause congestion or reduced LOS.

For Alternatives F and J, impacts TRF-1 and TRF-2 would remain ***significant and unavoidable***

- **Impact TRF-3:** Result in inadequate emergency access.

Traffic congestion could interfere with access for emergency services, particularly at Lagunitas Road Bridge near the RVFD and Town of Ross Police Department. As police department personnel are typically not located at the station when emergency calls come in, interference with deployment of police services would not be expected. Fire and police department response could be impacted by construction traffic and road closures. Limiting hours of equipment and personnel movement (AMM-TRF-1) and implementing a Traffic Control Plan (AMM-TRF-2) which would include sharing the construction schedule with local emergency services, would reduce the impact to emergency services. However, emergency access would still be impacted by road closures and reduced lanes which would be required during installation of the bypass culvert under Sir Francis Drake Boulevard for Alternatives F and J.

For Alternatives A, B, and G, this impact would be ***less than significant***.

For Alternatives F and J, this impact would be ***significant***.

To reduce this impact, the following mitigation would be implemented:

- **Mitigation HAZ-1:** Coordinate with local and regional emergency response services.

RVFD and Town of Ross Police would coordinate with local regional emergency response services, such as KFPD to the south of bypass construction and San Anselmo to the north of bypass construction. Coordinating with services on either side of construction activities would ensure that emergency response would not experience significant delays in the area.

For Alternatives F and J, this impact would be ***less than significant*** with mitigation.

- **Impact TRF-4:** Conflict with adopted policies, plans, or programs regarding public transit, bicycle or pedestrian facilities, or otherwise decreases the performance or safety of such facilities.

Construction would likely impact the bicycle-pedestrian pathway which runs parallel to Corte Madera Creek. The bicycle-pedestrian pathway would be inaccessible or rerouted during construction. This would be a substantial impact on pedestrians and cyclists throughout the Project area, which may lead to slightly increased motor vehicle traffic if commuters are forced to abandon biking and/or walking. For the duration of construction, this may cause the Project to conflict with Policy 7.8 of the Town of Ross General Plan 2007-2025.

Access to sections of the bicycle-pedestrian pathway would be closed during each phase of construction. Bicycle and pedestrian commuters may choose to travel via motor vehicle because of this closure. To the west of the path, Bicycle Route 15 (Kent Avenue, Poplar Avenue, and Ross Common) is a primary route that could be alternatively used from College Avenue to Lagunitas Road, spanning the majority of the length of the Project. Sidewalks line either side of this route, providing an alternative pedestrian path. After construction, the improvement of the bicycle-pedestrian pathway would encourage commute by bicycle and foot.

Because impacts would be temporary and an alternate route would be available, this impact would be ***less than significant.***

Table 4.13-5 summarizes the impacts to traffic, transportation, and circulation***.***

TABLE 4.13-5 TRAFFIC IMPACT CONCLUSIONS					
Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
TRF-1: The project conflicts with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit.	AMM-TRF-1 AMM-TRF-2	A,B,G	LTS	--	--
		F, J	S	M-TRF-1	SU
		No Action	NI	--	--
TRF-2: The project conflicts with an applicable congestion management program, including but not limited to LOS standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways.	AMM-TRF-1 AMM-TRF-2	A,B,G	LTS	--	--
		F, J	S	M-TRF-1	SU
		No Action	NI	--	--
TRF-3: The project results in inadequate emergency access.	AMM-TRF-2	A,B,G	LTS	--	--
		F, J	S	M-HAZ-1	LTS
		No Action	NI	--	--
TRF-4: The project conflicts with adopted policies, plans, or programs regarding public transit, bicycle or pedestrian facilities, or otherwise decreases the performance or safety of such facilities.	AMM-TRF-1 AMM-TRF-2	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
TRF-5: The project results in a change in air traffic patterns, including either an increase in traffic levels or a change in location that results in substantial safety risk.	--	N/A	--	--	--
TRF-6: The project substantially increases traffic hazards due to design features (e.g. sharp curves or dangerous intersections) or incompatible uses (e.g. farm equipment).	--	N/A	--	--	--

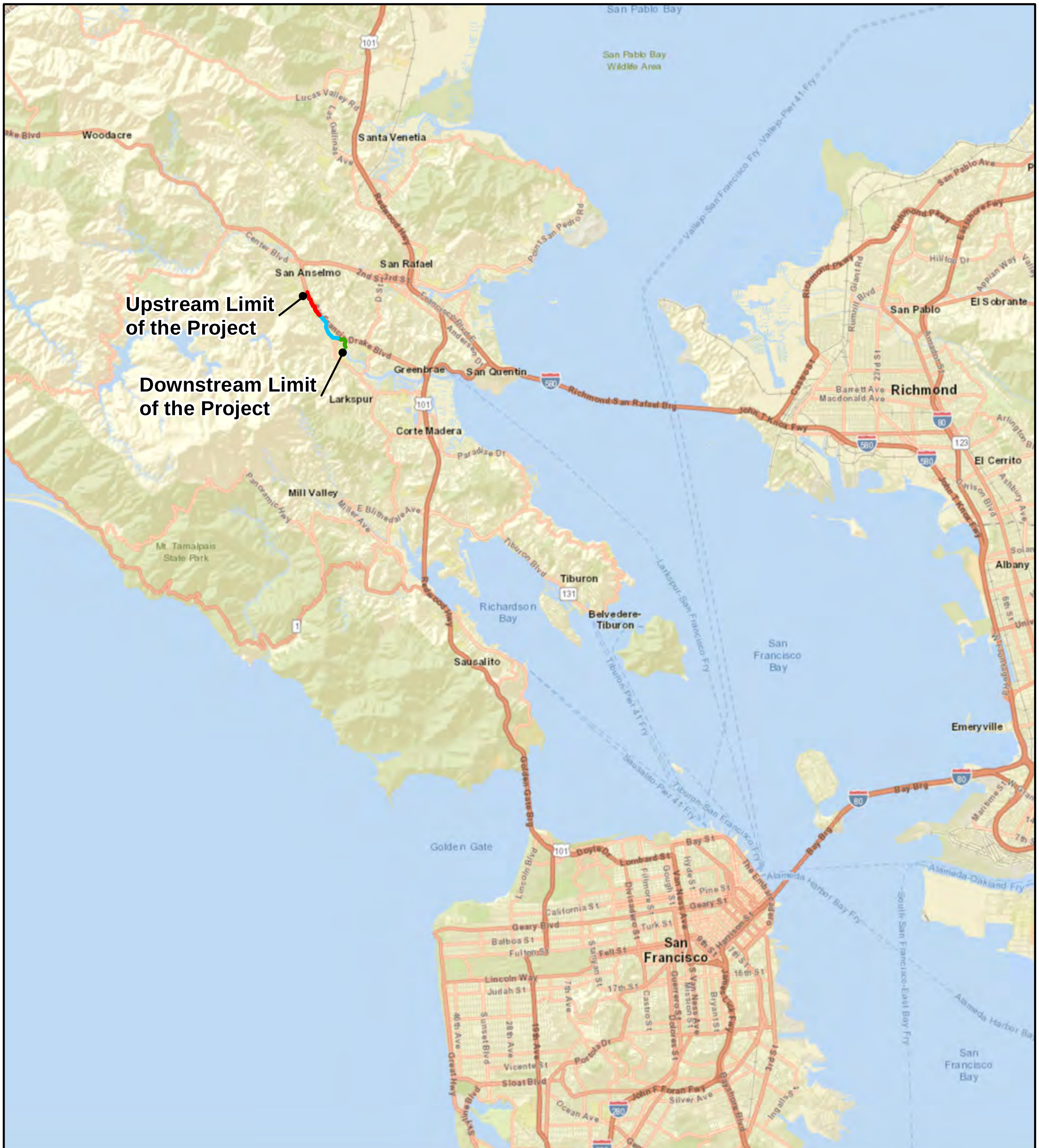
AMM = avoidance and minimization measure
LTS = less than significant
N/A = not applicable
NI = no impact
S = significant
SU = significant and unavoidable

4.13.3.4 Cumulative Impacts

During construction, traffic would be impacted in the Project area. If construction activities from other projects occur simultaneously, the Project would contribute to compounded reduction in LOS. These effects would only contribute reduced LOS during the construction phase, so the potential for cumulative effects would be temporary. However, if construction activities occurred simultaneously on nearby roadways, cumulative impacts to traffic could be significant.

If construction activities from Sir Francis Drake Boulevard Rehabilitation are not completed concurrently with bypass construction beneath the road for Alternatives F and J, the two projects would require lane closures at two separate time periods that could contribute to a significant cumulative impact. Even with implementation of the AMMs and mitigation measures specified above, the Project would make a considerable, and therefore significant, contribution to this cumulative impact.

Since all traffic-related impacts would result from construction, once construction is completed, no further contributions to traffic impacts would occur. Operations and maintenance would be minor, so any traffic impact resulting from ongoing work would be negligible. Following construction, staging areas and access routes would no longer be used. Project components would not affect traffic on nearby roads or impede the movement of emergency services long term and not contribute to cumulative impacts.



Corte Madera Creek - Flood Control Units

- UNIT 4 Natural Channel
- UNIT 3 Concrete-Lined Channel
- UNIT 2 Concrete-Lined Channel

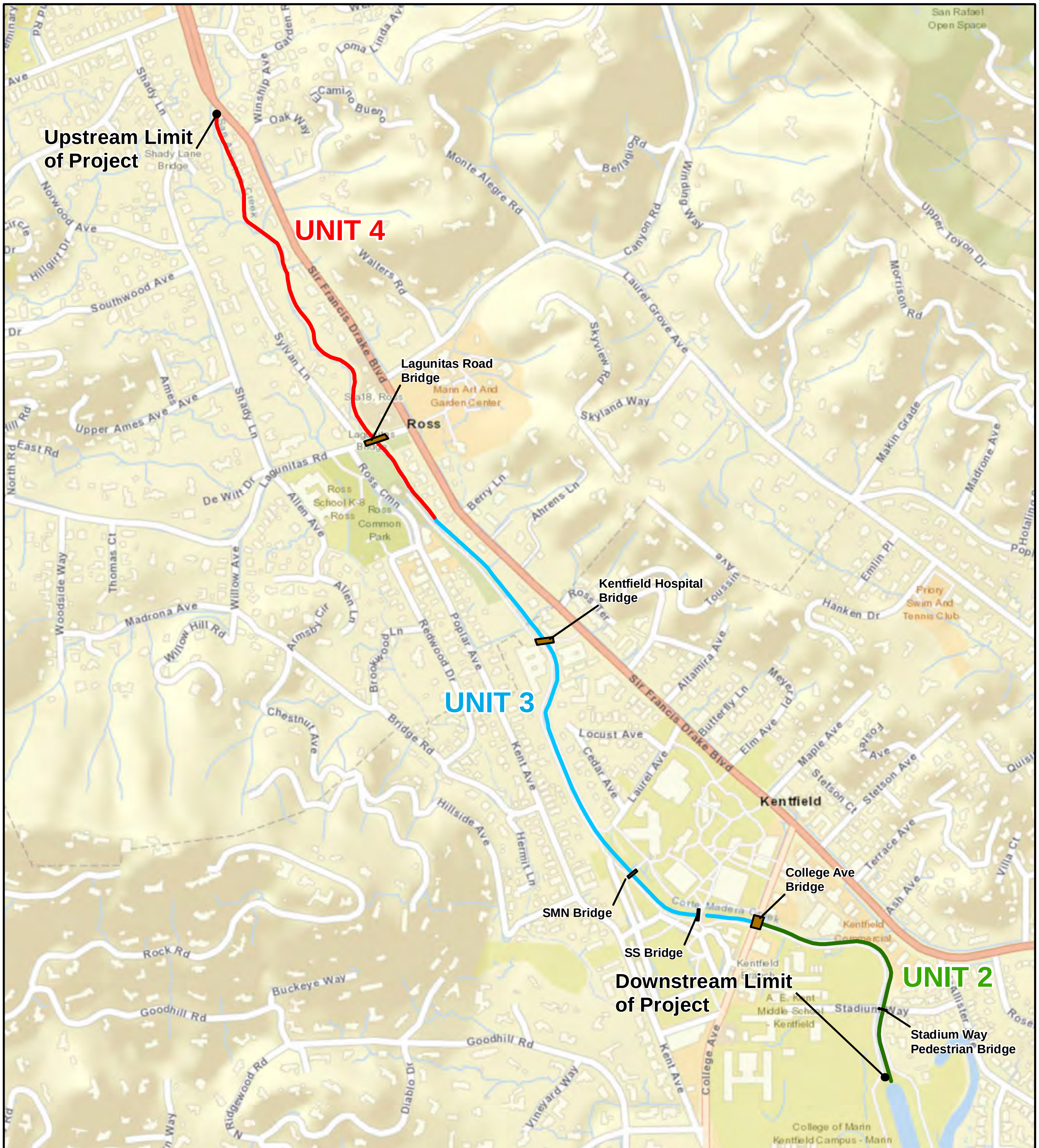
Miles
0 1.5 3

Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Figure 4.13-1
Regional Roadways

Date: 10/4/2018 Datum: NAD83

Burleson Consulting, Inc.



Corte Madera Creek - Flood Control Units

- UNIT 4 Natural Channel
- UNIT 3 Concrete-Lined Channel
- UNIT 2 Concrete-Lined Channel
- Bridges

0 400 800 Feet

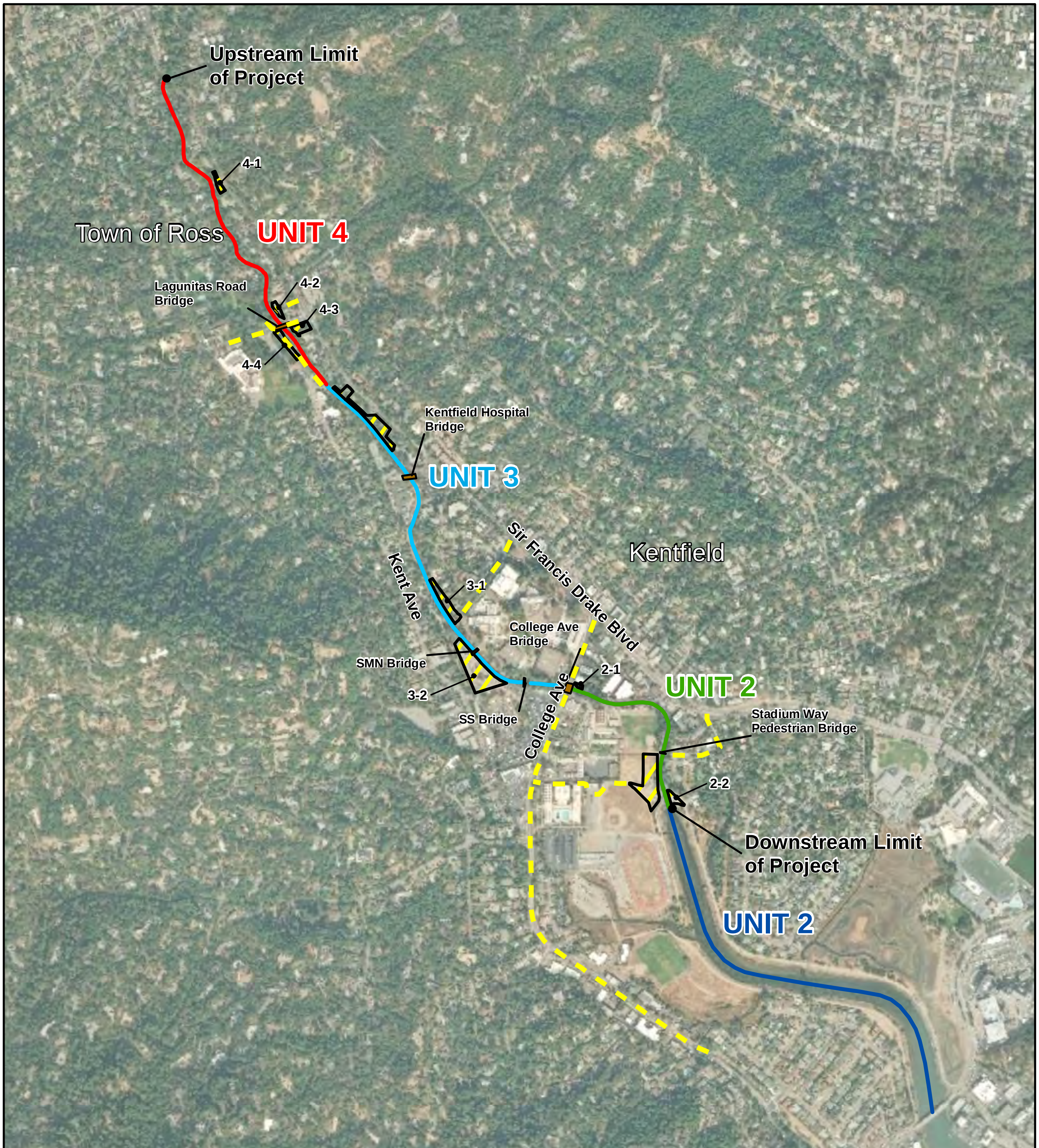
Corte Madera Creek Flood Risk Management Project

Marin County, CA

Figure 4.13-2
Local Roadways and Bridges

Date: 10/4/2018 Datum: NAD83

Burleson Consulting, Inc.



Corte Madera Creek - Flood Control Units

- UNIT 4 Natural Channel
- UNIT 3 Concrete-Lined Channel
- UNIT 2 Concrete-Lined Channel
- UNIT 2 Natural Channel
- Access Routes
- Staging Areas
- Bridges

0 500 1,000 Feet

Corte Madera Creek
Flood Risk Management Project
Marin County, CA

Figure 4.13-3
Staging Areas

Date: 10/4/2018 Datum: NAD83

Burleson Consulting, Inc.

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4.14 Environmental Justice

This section identifies the distribution of minority and low-income populations on a regional basis, and characterizes the distribution of such populations within the study area.

The CEQA does not require consideration of potential implications to environmental justice as a specific resource area. A number of state agencies, however, require that consideration be given to potential environmental justice implications of project implementation. Therefore, in the interest of full disclosure, environmental justice is considered in this EIS/EIR.

4.14.1 Regulatory Setting

This section discusses regulatory information that applies to environmental justice. Additional regulatory information appears in Chapter 9 Environmental Compliance.

4.14.1.1 Federal

Executive Order 12898 is the only federal policy pertinent to environmental justice. A discussion of this order is provided in Chapter 9.

4.14.1.2 State

Though not specific to environmental justice, Government Code section 11135, subdivision (a) can apply to environmental justice in certain circumstances. Government Code section 11135 is discussed in Chapter 9.

4.14.1.3 Local

Marin Countywide Plan

The following policy of the Marin Countywide Plan is applicable to environmental justice:

- **Policy EJ-1.4** Encourage County Participation in Decision Making. Significantly increase the role and influence in land use and environmental decisions of residents from disproportionately impacted communities.

4.14.2 Affected Environment

4.14.2.1 Terminology

For the purposes of this analysis, and as applied to tables within this section, minority, minority population, low-income, low-income population, and disproportionately high and adverse effect are defined as follows:

- **Minority**: Minority means a person who is (1) Black (having origins in any of the black racial groups of Africa); (2) Hispanic (of Mexican, Puerto Rican, Cuban, Central or South American, or other Spanish culture or origin, regardless of race); (3) Asian American (having origins in any of the original peoples of the Far East, Southeast Asia, the Indian subcontinent, or the Pacific Islands); or (4) American Indian and Alaskan Native (having origins in any of the original people of North America and who maintains cultural identification through tribal affiliation or community recognition).
- **Minority Population:** Minority population refers to any readily identifiable groups of minority persons who live in geographic proximity, and if circumstances warrant, geographically

dispersed/transient persons (such as migrant workers or Native Americans) who will be similarly affected by a proposed program, policy, or activity.

- **Low-Income**: Low-income means a household income at or below the United States Department of Health and Human Services poverty guidelines.
- **Low-Income Population**: Low-income population means any readily identifiable group of low-income persons who live in geographic proximity, and, if circumstances warrant, geographically dispersed/transient persons (such as migrant workers or Native Americans) who would be similarly affected by a proposed program, policy, or activity.
- **Disproportionately High and Adverse Effect:** Disproportionately high and adverse effect on minority and low-income populations means an adverse effect that (1) is predominantly borne by a minority population and/or a low-income population; or (2) will be suffered by the minority population and/or low-income population and is appreciably more severe or greater in magnitude than the adverse effect that will be suffered by the non-minority population and/or non-low-income population.

4.14.2.2 Regional Setting

Zip Code Tabulation Area data for zip codes 94904 (Kentfield) and 94960 (Ross/San Anselmo) were used to identify low-income and minority populations in the study area. In general, Zip Code Tabulation Areas are considered a more accurate representation of area populations over U.S. Census Bureau blocks. More specifically, Zip Code Tabulation Areas follow census block boundaries, and the Zip Code Tabulation Area code for each census block represents the majority zip code of the addresses within the census block. In addition, Zip Code Tabulation Areas exclude unique, single delivery point zip codes, such as those for firms and organizations. Lastly, Zip Code Tabulation Areas are distinct from other Census Bureau statistical areas, such as census tracts, because they are not stable over time and are computer-delineated based on the location of addresses at the time of the census rather than manually delineated by local program participants or Census Bureau staff before the census.

For assessing the regional effects on environmental justice populations, the regional study area includes the Zip Code Tabulation Areas of the communities of Kentfield and Ross, located along Corte Madera Creek in Marin County. This section discusses the percentage and distribution of population that are defined as minority and low-income within the local and regional study areas. Data used in this section are compiled from the 2016 American Community Survey 5-year Estimates, as this is the most recent comprehensive population study of the affected areas.

Minority Distribution: Table 4.14-1 displays the minority distribution for the local and regional areas studied. It also details key statistics regarding minority status of populations in the local and regional study area. The communities of Ross (Zip Code Tabulation Area 94960) and Kentfield (Zip Code Tabulation Area 94904) have minority populations of 13.0 and 16.2 percent, respectively. Marin County's minority population is significantly lower than that of the State of California, as a whole. Of note, the population within the Zip Code Tabulation Area is approximately 11 percent of the total population of the county.

Income and Poverty Levels: Table 4.14-2 details key statistics regarding income in the local and regional study area. At $100,310, the median household income in Marin County was 57 percent greater than that for the State of California in 2016. The incomes for the Town of Ross and Kentfield were greater than that for the collective county. Neither of the Zip Code Tabulation Areas in the study area or the county had a percentage of population with income below poverty level that was higher than that of Marin County or the State of California.

TABLE 4.14-1 MINORITY DISTRIBUTION 2016

Geography	Total Population	One Race (%)						Two or More Races (%)	Minority Population (%)	Hispanic or Latino (of Any Race) (%)
		White	Black or African American	American Indian and Alaska Native	Asian	Native Hawaiian and Other Pacific Islander	Some Other Race			
State of California	38,654,206	61.3	5.9	0.7	13.9	0.4	13.3	4.6	61.6	38.6
Marin County	259,358	79.0	2.3	0.3	5.7	0.2	7.9	4.5	28.1	15.8
Zip Code Tabulation Area 94904 (Kentfield)	12,459	88.9	2.1	0.1	3.9	0.2	2.0	2.9	16.2	7.4
Zip Code Tabulation Area 94960 (Ross/San Anselmo)	15,789	90.8	0.8	0.9	3.0	0.2	0.8	3.6	13.0	5.4

SOURCE: U.S. Census Bureau 2012 – 2016 American Community Survey 5-year Estimates.

TABLE 4.14-2 INCOME AND POVERTY IN 2016

Geography	Median Household Income (2016 dollars)	Per Capita Income (2016 dollars)	Percent of Individuals with Income below Poverty Level for All Ages (2016 dollars)
State of California	$63,783	$31,458	15.8
Marin County	$100,310	$63,608	8.1
Zip Code Tabulation Area 94904 (Kentfield)	$111,845	$92,879	6.3
Zip Code Tabulation Area 94960 (Ross/San Anselmo)	$112,045	$68,196	3.9

SOURCE: U.S. Census Bureau 2012 – 2016 American Community Survey 5-year Estimates.

4.14.3 Environmental Consequences

4.14.3.1 Avoidance and Minimization Measures

There would be no AMMs specific for environmental justice associated with the Project.

4.14.3.2 Methodology for Impact Analysis and Significance Thresholds

This analysis evaluated the potential for physical and economic impacts to low-income and/or minority communities in the region around the study area. The Project would pose a significant environmental justice impact on the local community if it would:

- **Impact EJ-1**: Cause a disproportionately high and adverse effect on a minority and/or low-income population in the surrounding community, as described in Section 4.14.2, including but not limited to both physical and economic effects.

A disproportionally adverse effect was defined as an adverse effect that (1) would be predominantly borne by a minority population and/or a low-income population; or (2) would be suffered by the minority population and/or low-income population and would be appreciably more severe or greater in magnitude than the adverse effect that would be suffered by the non-minority population and/or non-low-income population.

4.14.3.3 Effects and Mitigation

No Action Alternative

In the no action alternative, the continued flood risk could contribute to the following impact.

- **Impact EJ-1**: Cause a disproportionately high and adverse effect on a minority and/or low-income population in the surrounding community, as described in Section 4.14.2, including but not limited to both physical and economic effects.

The flood risk could be considered to disproportionately impact low-income populations near Corte Madera Creek in that these populations would suffer the effects of a flood event much more severely than higher income populations in the same area, due to less access to survival goods and services, possible lack of vehicles (for escaping the affected regions), and possible lack of adequate flood-proofed shelter. Given community demographics and high real estate values adjacent to the creek, this population would be small. The no action alternative would have ***no impact*** to environmental justice.

Action Alternatives

All action alternatives would have the same impacts to environmental justice.

Low-income Communities

The communities of Ross and Kentfield have greater household and per capita incomes than both Marin County as a whole and the State of California. The poverty rates in Ross and Kentfield are less than half of the poverty rate in California and substantially less than that of Marin County. Overall, the affected communities are more affluent than the greater population of the county and state. Additionally, real estate within the study area is more expensive than the rest of the surrounding community. Therefore, the population residing along the creek would be considered to be more affluent than the surrounding community. Thus, it is unlikely that Project impacts would have a disproportionate effect on low-income populations.

It is possible that low-income populations which make higher proportional use of public spaces would be more adversely affected than non-low-income populations during construction of the Project when public spaces would be temporarily closed. However, no data currently exists on the use of public creek access by income. It is assumed, then, that the demographics of creek usage are distributed the same as census data for the region, and that construction efforts therein would not disproportionately impact low-income populations.

Minority Communities

Based on the U.S. Census data presented in 4.14-1, the communities of Ross and Kentfield have lower minority populations than Marin County and California. Without more specific data on the racial distribution of individuals living along the creek, it is difficult to determine whether negative effects of construction would disproportionately impact a minority population. However, if it is assumed that the demographics in the study area reflect those of the surrounding Town of Ross and Kentfield, it is unlikely that construction of the Project would constitute a disproportionately adverse impact on any minority group.

Low-income and minority populations would be potentially affected by following impact.

- **Impact EJ-1**: Cause a disproportionately high and adverse effect on a minority and/or low-income population in the surrounding community, as described in Section 4.14.2, including but not limited to both physical and economic effects.

The population in the study area does not constitute a minority or low-income community relative to the regional context, either at the county or state level. None of the action alternatives would have a disproportional impact on minority or low-income populations anywhere in or around the study area.

The proposed Project would consist primarily of FRM measures on the creek itself, and as a result most adverse effects of the Project would be predominantly borne by current residents of properties adjacent to the creek. Although those properties adjacent to the creek may experience some burden, they would also receive the beneficial impact of flood protection.

The impact to environmental justice would be ***less than significant.***

Table 4.14-3 summarizes the impacts to environmental justice***.***

TABLE 4.14-3 ENVIRONMENTAL JUSTICE IMPACT CONCLUSIONS

Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
EJ-1: Cause a disproportionately high and adverse effect on a minority and/or low-income population in the surrounding community, as described in Section 4.14.2, including but not limited to both physical and economic effects.	--	All Action Alternatives	LTS	--	--
		No Action	NI	--	--

AMM = avoidance and minimization measure
LTS = less than significant

4.14.3.4 Cumulative Impacts

The Project would not result in significant impacts to environmental justice and would not contribute to cumulative impacts with projects presented in Table 4-2. The Project would primarily affect property owners adjacent to the Creek, who, as previously stated, do not constitute a minority or low-income community relative to the regional context. These property owners may be the most affected by construction activities, but would also receive direct benefits from flood protection of their properties. Public parks, which may be used at a higher frequency by low-income populations, would be temporarily closed during construction. However, many parks within Marin County would still be open for public use. The greater public would benefit from increased flood protection, including flood protection for public spaces used by all populations. Thus, the Project would not contribute to any significant cumulative environmental justice impact.

4.15 Socioeconomics

Socioeconomics is an umbrella term used to describe aspects of the Project that are either social or economic in nature, including population, employment, housing, and public services. This section describes the existing population and employment activity in the study area. For socioeconomic analysis, the Project study area was defined by Zip Code Tabulation Areas 94904 (Kentfield) and 94960 (Ross/San Anselmo). Public services are analyzed in Section 4.16 Public Services, Utilities, and Energy.

4.15.1 Regulatory Setting

Other than the requirement of NEPA (40 C.F.R. § 1508.14) to address socioeconomic impacts of federal projects, there are no additional federal, state, or local requirements relevant this resource category.

4.15.2 Affected Environment

4.15.2.1 Population

Information presented in this analysis was obtained from the U.S. Census Bureau's 2012–2016 American Community Survey 5-year Estimates (U.S. Census Bureau 2016). In 2016, the population of Marin County was 259,358. Kentfield represented about 5 percent of the total Marin County population with 12,459 residents, while the Town of Ross represented about 6 percent of the County's 2015 population with 15,789 residents (U.S. Census Bureau 2016).

4.15.2.2 Employment, Income, and Economic Activity

Employment within Marin County totaled 130,366 jobs in 2016 (U.S. Census Bureau 2016), representing an unemployment rate of 5.1 percent. In 2016, total employment in the study area was 14,066 jobs, which was equivalent to approximately 11 percent of the County's employment (U.S. Census Bureau 2016). Employment in the area is shown in Table 4.15-1, classified by type. Education, health, and social services had the highest percentage of employees for both Zip Code Tabulation Areas, while agriculture, forestry, fishing and hunting, and mining had the lowest.

Income and poverty for the county and the study area are presented in Table 4.15-2. The data is from the 2016 American Community Survey 5-year Estimates.

TABLE 4.15-1 EMPLOYMENT TYPE

Type	Number of Employees		
	Marin County	Zip Code Tabulation Area 94904 (Kentfield)	Zip Code Tabulation Area 94960 (Ross)
Agriculture, forestry, fishing and hunting, and mining	780	0	71
Construction	6761	156	398
Manufacturing	6,068	298	580
Wholesale trade	3,147	182	258
Retail trade	12,514	457	592
Transportation and warehousing, and utilities	3,767	106	154
Information	4,890	175	466
Finance, insurance, real estate and rental and leasing	13,327	741	783

TABLE 4.15-1 EMPLOYMENT TYPE

Type	Number of Employees		
	Marin County	Zip Code Tabulation Area 94904 (Kentfield)	Zip Code Tabulation Area 94960 (Ross)
Professional, scientific, management, administrative, and waste management services	26,326	1,385	1,739
Educational, health and social services	27,672	1,447	1,966
Arts, entertainment, recreation, accommodation and food services	12,285	421	532
Other services (except public administration)	8,194	393	359
Public administration	4,635	85	322
Total	130,366	5,846	8,220

SOURCE: U.S. Bureau of the Census 2012–2016 American Community Survey 5-year Estimates.

TABLE 4.15-2 INCOME AND POVERTY IN 2016

Geography	Median Household Income (2016 dollars)	Per Capita Income (2016 dollars)	Percent of Individuals with Income below Poverty Level for All Ages (2016 dollars)
State of California	$63,783	$31,458	15.8
Marin County	$100,310	$63,608	8.1
Zip Code Tabulation Area 94904 (Kentfield)	$111,845	$92,879	6.3
Zip Code Tabulation Area 94960 (Ross/San Anselmo)	$112,045	$68,196	3.9

SOURCE: U.S. Bureau of the Census 2012–2016 American Community Survey 5-year Estimates.

4.15.3 Environmental Consequences

4.15.3.1 Avoidance and Minimization Measures

Socioeconomic resources have no specific AMMs.

4.15.3.2 Methodology for Impact Analysis and Significance Thresholds

The socioeconomic analysis considered the potential for growth and displacement of people or homes. Employment was not considered in this analysis because the Project would be unlikely to affect the employment types presented in Table 4.15-1 or income presented in Table 4.15-2.

The Project would pose a significant socioeconomic impact on the local community if it would result in the following impact:

- **Impact SOC-1**: Induce substantial population growth in and around the study area, either directly (e.g. by creating new homes and businesses) or indirectly (e.g. by extending roads and infrastructure).

The analysis considered whether the addition of flood control structures has the potential to induce population growth due to actual or perceived increases in the 'safety' of the study area. This is considered an indirect motivator. No direct motivators for population growth (such as new homes or businesses) would be included in the Project.

- **Impact SOC-2:** Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere.
- **Impact SOC-3:** Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.

The analysis considered whether construction efforts would cause displacement of residents sufficient to warrant construction of replacement housing.

4.15.3.3 Effects and Mitigation

No Action Alternative

In the no action alternative, continued risk of flooding may contribute to the following impacts:

- **Impact SOC-2:** Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere.
- **Impact SOC-3:** Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.

Without installed flood measures, flood events in the study area may cause displacement of residents and destruction of property, necessitating the creation of emergency temporary housing for affected families. This would be a significant impact on the region.

These impacts would be ***significant.***

Mitigation is recommended in the form of adopting one of the proposed action alternatives.

Action Alternatives

- **Impact SOC-1:** Induce substantial population growth in and around the study area, either directly (e.g. by creating new homes and businesses) or indirectly (e.g. by extending roads and infrastructure).

Building flood control structures would not directly contribute to substantial population growth in the study area. Indirectly, it is feasible that greater flood protection might draw interest in real estate throughout the previously affected region, but not significantly.

This impact would be ***less than significant.***

- **Impact SOC-2:** Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere.
- **Impact SOC-3:** Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere.

All alternatives would require purchase of easements for properties adjacent to the creek to allow access for maintenance.

Alternatives A, B, and G would require the purchase of real estate, which would be acquired at fair market value (see Section 4.11, Table 4.11-2). Some homeowners may be displaced by land purchase; however, they would be compensated by receiving fair market value for their homes and relocation assistance. Alternatives A, B, and G would require the purchase of 17, 15, and 16 residential parcels, respectively. Some houses are available in the area and a timeline would be established to facilitate new home purchases by displaced residents. However, new houses may be needed to provide replacement housing for displaced residents.

Alternatives F and J would not require the purchase of any real estate. However, during construction of the bypass under Sir Francis Drake Boulevard, utilities could be temporarily cut off for some residents. If so, residents would be temporarily relocated to nearby hotels while utilities are offline.

For Alternatives A, B, and G these impacts would be ***significant and unavoidable.***

There is no feasible mitigation for this impact.

For Alternatives F and J, these impacts would be ***less than significant.***

Table 4.15-3 summarizes the impacts to socioeconomics***.***

TABLE 4.15-3 SOCIOECONOMIC IMPACT CONCLUSIONS					
Effect	**AMMs**	**Applicable Alternatives**	**Significance**	**Mitigation**	**Significance after Mitigation**
SOC-1: Induce substantial population growth in and around the study area, either directly (e.g. by creating new homes and businesses) or indirectly (e.g. by extending roads and infrastructure).	--	All	NI	--	--
SOC-2: Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere.	--	A, B, G	S	None Available	SU
		F, J	LTS	--	--
		No Action	S	--	--
SOC-3: Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere	--	A, B, G	S	None Available	SU
		F, J	LTS	--	--
		No Action	S	--	--

AMM = avoidance and minimization measure
LTS = less than significant
NI = no impact
S = significant
SU = significant and unavoidable

4.15.3.4 Cumulative Impacts

The Project would not be expected to contribute to cumulative socioeconomic impacts. As discussed in Section 4.15.3.3, the Project would not induce population growth. This is true for both the short term and the long term. All action alternatives would prevent emergency displacement of residents and destruction of property long term by minimizing the effect of flood events. Displaced residents would not be expected to contribute to cumulative impacts as other reasonably foreseeable projects in the area are not expected to displace residents.

Replacement of the natural stream bed and improvements to Allen Park would increase the aesthetic appeal of Ross Common, which could increase business in the area (see Section 4.8 Aesthetics). This would be a beneficial socioeconomic impact. Thus, the Project would not contribute to a significant adverse cumulative socioeconomic impact.

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4.16 Public Services, Utilities, and Energy

This section describes the existing public services, utilities, and energy providers in the study area, including fire and police services and schools. It also discusses the existing condition of the area's water supply, treatment, and distribution systems, wastewater and sewer systems, solid waste collection services, and the sources and transmission of electricity and natural gas in the study area. Data for this section was developed based on review of local planning and policy documents, local service provider and utility websites, and personal communication with service provider and utility staff.

4.16.1 Regulatory Setting

This section discusses regulatory information that applies to public services, utilities, and energy. Additional regulatory information appears in Chapter 9 Environmental Compliance.

4.16.1.1 Federal

The federal laws are applicable to public services and utilities are listed below. Details regarding these laws are provided in Chapter 9.

- Resource Construction and Recovery Act Subtitle D
- The Clean Water Act

4.16.1.2 State

Porter-Cologne Water Quality Control Act is relevant to public services and utilities. Details regarding this act are provided in Chapter 9.

4.16.1.3 Local

Marin Countywide Plan

The following policies of the Marin Countywide Plan are applicable to public services, utilities, and energy regulation:

- **Policy PFS-4.1** Reduce the Solid Waste Stream. Promote the highest and best use of discarded materials through redesign, reuse, composting, and shared producer responsibility. Emphasize a closed-loop system of production and consumption.
- **Policy PFS-4.2** Protect Environmental Health. Require the use of waste processing and disposal techniques that prevent contamination or other impairment of natural resources.
- **Policy PFS-4.3** Plan for Waste Transformation or Disposal. Plan for the transformation or elimination of waste materials that cannot be reduced, recycled, or composted.

Town of Ross General Plan 2007–2025

The following policy of the Town of Ross General Plan is applicable to public services, utilities, and energy regulation:

- **Policy 5.12** Access for Emergency Vehicles. New construction shall be denied unless designed to provide adequate access for emergency vehicles, particularly firefighting equipment.

4.16.2 Affected Environment

4.16.2.1 Fire Protection Services

The following three agencies provide fire protection services to the local community within the study area.

Ross Valley Fire Department

The RVFD is a consolidated fire agency protecting the communities of Fairfax, San Anselmo, Sleepy Hollow, and the Town of Ross. The RVFD has four stations and is headquartered at Station 19, approximately 1 mile from the Project area at 777 San Anselmo Avenue, in downtown San Anselmo. The daily on-duty emergency response personnel include a Battalion Chief, captain, and engineer/firefighter. The station houses one active Type 1 fire engine (structural firefighting), staffed by the captain and firefighter, one command vehicle used by the Battalion Chief, and one reserve Type 1 Fire Engine which can be staffed by off-duty and volunteer personnel as needed (RVFD 2017).

RVFD Station 18 provides fire protection services within the Town of Ross and for the majority of the Project area. The firehouse is located at 33 Sir Francis Drake Boulevard, immediately north of Unit 4 and Lagunitas Road. The daily on-duty emergency response personnel include a captain and engineer/firefighter. The station houses one active Type 1 Fire Engine (structural firefighting) and a reserve Type 1 Fire Engine, which can be staffed by off-duty and volunteer personnel as needed. Additionally, the fire station houses the Ross Valley Paramedic Authority transport ambulance, Medic 18, staffed with two paramedic firefighters (RVFD 2017).

The RVFD responded to 1,901 calls in 2012-2013. The RVFD has an Automatic Agreement with Marin County for responses to unincorporated areas adjacent to its jurisdiction. In 2012-2013, RVFD provided 180 mutual aid responses (RVFD 2013).

Kentfield Fire Protection District

The KFPD is a special district formed under the authority of the California Health and Safety Code. Twelve full-time professional firefighters and five volunteer firefighters are employed by the KFPD, although daily staffing is limited to four firefighters, including a Chief Officer. The KFPD Station is located at 1004 Sir Francis Drake Boulevard, approximately a half mile from the study area. Available within minutes are four neighboring automatic aid engines, twenty immediate need mutual-aid engines, and eight immediate need 'wildland' mutual-aid engines. The KFPD is a member of the California Inter-County Mutual-Aid Plan and the Marin County Automatic and Mutual-Aid Plan, covering emergencies and disasters such as fires, floods, mass-casualty incidents, and earthquakes. All KFPD personnel are certified Hazardous Materials First Responders and Emergency Medical Technicians. The KFPD provides paramedic service through the Ross Valley Paramedic Authority Joint Powers Agreement (KFPD 2017).

Marin County Fire Department

The Marin County Fire Department serves the unincorporated portion of Marin County's 521 square miles. The portion of the study area within unincorporated Marin County is served by the Marin City Station at 850 Drake Avenue, Marin City, approximately eight miles from the Project, and has a response time of approximately 10 minutes. The Marin City Station is staffed with three fire suppression personnel during the low season (November 1–June 1) and five fire suppression personnel during the high season (June 1–November 1).

4.16.2.2 Police Protection Services

For the majority of the study area, the Town of Ross provides primary police protection services. The southeastern portions of the study area are serviced by Marin County.

Town of Ross Police Department

The Town of Ross Police Department is located at 33 Sir Francis Drake Boulevard, immediately north of Unit 4 and Lagunitas Road. The Department is staffed with one chief, two sergeants, and five officers.

Marin County Sheriff Department

The Marin County Sheriff Department serves the unincorporated portion of Marin County's 521 square miles, including a portion of the study area. The Marin County Sheriff Department is staffed with 199 sworn deputies and 114 law enforcement professionals. In addition to its headquarters, there are three substations. The closest substation to the study area is at 831 College Avenue in Kentfield, approximately a half mile from the study area. Each station's area is divided into patrol subareas, which are served by uniformed deputies in marked patrol units. Additional patrol units are assigned during high activity periods as needed.

4.16.2.3 Other Public Services

Schools and Libraries

College of Marin and Kent Middle School are located adjacent to Corte Madera Creek while Ross School is about a quarter mile west of Unit 4 and Marin Catholic High School is about half a mile southeast of Unit 2 (Figure 1-2). Kent Middle School of the Kentfield Elementary School District serves grades 5-8, with an enrollment of 530 students. Kent Middle School is located at 800 College Avenue, with the school athletic fields adjacent to Unit 2. The College of Marin Kentfield Campus is a community college located at 835 College Avenue with an enrollment of 11,986 students for the 2014-2015 academic year. Ross School serves grades K-8 with an enrollment of 366 for the 2014/15 school year. Ross School is located at 9 Lagunitas Road. Marin Catholic High School serves 720 students and is located at 675 Sir Francis Drake Boulevard in Kentfield.

There are no public libraries located in the study area, but four are in the vicinity. San Anselmo Public Library is the closest library about 1 mile away in San Anselmo. The San Rafael Public Library is located approximately 3 miles away, at 1100 E Street in San Rafael.

4.16.2.4 Water

The MMWD is a public agency that serves approximately 190,000 people in a 147-square-mile area of south and central Marin County. The MMWD provides water to the study area for domestic, commercial, and firefighting use. Water sources include surface water, reservoirs, and water from the Russian River through an agreement with Sonoma County Water Agency, and recycled water. Groundwater in the area is very limited. The MMWD facilities include seven reservoirs, four water treatment plants, and various storage tanks, pumps, and distribution mains (MMWD 2017).

By 2030, it is anticipated that its service area will include a population of 199,800 (MMWD 2016). To maximize existing water supply, the MMWD has several aggressive water conservation programs in place. In addition, the MMWD also has a water shortage contingency plan, which includes a dry year water use reduction program and mandatory rationing. Water rationing, both voluntary and mandatory, is instituted based on reservoir water levels at the end of the rainy season. A 10 percent voluntary rationing is triggered when there is total reservoir storage of less than 50,000 acre-feet on April 1 of any given year. A 25 percent mandatory rationing is triggered when there is total reservoir storage of less than 40,000 acre-feet on April 1. The MMWD produces its own recycled water by treating secondary effluent from the Las Gallinas Valley Sanitary District. Although the district has explored desalination in the past, the MMWD does not intend to pursue desalination at this time (MMWD 2016).

Infrastructure within the Study Area

The MMWD operates one 24-inch water supply pipe and one 12-inch water supply pipe in the area of Ross, between the College of Marin and Lagunitas Road by Corte Madera Creek. These water mains are beneath an average of 2.5 feet of cover from existing grade level (Lam 2010, in USACE 2010).

4.16.2.5 Wastewater

The Ross Valley Sanitary District (RVSD) is the oldest sanitary district in Marin County. The RVSD operates and maintains approximately 200 miles of collection sewer lines and 19 pumping stations, which collect, pump, and transport approximately 5 million gallons of sewage per day to the Central Marin Sanitation Agency for treatment. The RVSD boundaries include 26.75 square miles of the Ross Valley watershed, including the study area. Under contract, the RVSD also serves wastewater collection systems in Murray Park (RVSD 2017).

Infrastructure within the Study Area

Two 24-inch sewer pipes, located at the southern end of Unit 4 near the fish ladder, run beneath Corte Madera Creek in a northeast/southwest direction within the study area (Stetson 2009). An aboveground sewer pipe crosses the creek adjacent to the pedestrian bridge at the end of Stadium Way (Figure 4.16-1).

4.16.2.6 Solid Waste

The Marin Sanitary Service is responsible for solid waste disposal in central Marin County. It serves more than 32,000 residential and commercial accounts in San Rafael, San Anselmo, Fairfax, Ross, Corte Madera, Larkspur, and Las Gallinas. The Marin Sanitary Service operates the Resource Recovery and Recycling Plant and a transfer station where waste from commercial collectors is collected then transported by truck to Redwood Landfill (Marin Sanitary Service 2010, in USACE 2010). The Redwood Landfill, operated by Waste Management, located in northern Marin County (projected to close in 2039), is the principal landfill for residential and commercial wastes generated in the vicinity of and within the study area. Current permitted capacity is 19.1 million cubic yards with a permitted daily disposal rate of 2,310 tons (Waste Management, Inc. 2017).

4.16.2.7 Electricity and Natural Gas

Pacific Gas and Electric (PG&E) provides electricity and natural gas services for all of Marin County. PG&E obtains its energy supplies from power plants and natural gas fields in northern California and from energy purchased outside its service area, which is delivered through high voltage transmission lines and pipelines. Much of the County's electricity comes from geothermal plants in the nearby Geysers region. There are no power plants located in Marin County. Marin Clean Energy procures renewable sources of electricity and partners with PG&E to deliver electricity.

Infrastructure within the Study Area

The PG&E utility system in the study area consists of transmission lines rated at 21 kilovolts and 60 kilovolts, supported by wooden poles along Lagunitas Road and Sir Francis Drake Boulevard.

4.16.3 Environmental Consequences

4.16.3.1 Avoidance and Minimization Measures

The following AMMs would be implemented as part of the Project design and would avoid or minimize adverse effects associated with public services and utilities

- **AMM-UTL-1: Locate Utilities -** Contact Underground Service Alert (DigAlert) to mark known utilities and use a subsurface utility locator prior to construction.
- **AMM-UTL-2: Relocate Utilities** - Relocate utilities in conflict with project features either before or in conjunction with construction of project features to minimize impacts.
- **AMM-GEO-2**: **Reuse of Soils** - Reuse of earth materials will reduce the amount of import material, stockpile, and landfill material, which will minimize soil effects.

4.16.3.2 Methodology for Impact Analysis and Significance Thresholds

This analysis considered the potential for each alternative to interfere with public services and utilities. An alternative would pose a significant impact on public service, utility, and energy systems in the surrounding community if it would result in any of the following impacts.

- **Impact UTL-1**: Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services:
    - Fire protection
    - Police protection
    - School
    - Parks
    - Other public facilities
- **Impact UTL-2:** Require or result in the construction of new water and/or wastewater treatment facilities, or the expansion of existing facilities, which would cause significant environmental effects.
- **Impact UTL-3:** Require or result in the construction of new storm water drainage facilities, or the expansion of existing facilities, which would cause significant environmental effects.
- **Impact UTL-4:** Have insufficient water supplies available to serve the project from existing entitlements and resources and require new or expanded entitlements.
- **Impact UTL-5:** Exceed wastewater treatment requirements of the applicable RWQCB.
- **Impact UTL-6:** Result in a determination by the wastewater treatment provider which serves or may serve the project that it does not have the capacity to serve the project’s projected demand in addition to currently existing commitments.
- **Impact UTL-7:** Require new or expanded solid waste (landfill) services in order to meet the needs of the project work.

The Project would not induce growth (see Section 5.5 Growth-Inducing Impacts); thus, impacts due to additional population were not considered. The analysis focused on effects caused by construction of FRM structures. This analysis considered the expected water, wastewater, and solid waste needs for construction.

Existing water, wastewater, and stormwater pipelines in the study area were considered (Figure 4.16-1). This analysis evaluated the risk posed by construction efforts on utility lines, and whether the risk would be high enough to warrant moving or replacing existing pipes.

As operations and maintenance would be minimal, no impact on public services or utilities would be expected. Thus, operations and maintenance was excluded from this analysis.

- **Impact UTL-8:** The project is unable to comply with federal, state, and/or local statutes and regulations related to solid waste.

This analysis did not consider the preceding impact because the Project would be designed to comply with all applicable regulations, including those pertaining to solid waste.

4.16.3.3 Effects and Mitigation

No Action Alternative

In the event of another major flood, local utilities such as water, wastewater, stormwater, and electrical lines could be damaged. Flooding could increase the pressure on police and fire services. In the no action alternative, there would be a ***less than significant impact*** to public services, utilities, and energy in the study area beyond the existing risk of flooding.

Action Alternatives

The Project has the potential to contribute to impacts described in this section.

- **Impact UTL-1**: Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services.

Schools and Libraries

Floodwalls would be constructed adjacent to Kent Middle School and College of Marin facilities. A setback floodwall would be constructed around the Kent Middle School athletic fields for Alternative A, but this would not interfere with the function or performance of the school. Parking areas would be slightly reduced at the College of Marin from grading activities under Alternatives B, F, and G. For all alternatives, construction may be a temporary disturbance to schools. All schools would, however, benefit from increased flood protection. For all alternatives, impacts to schools would be ***less than significant***.

Libraries are not located close to the study area and there would be ***no impact*** to libraries.

Fire & Police Services

Emergency access for fire services would potentially be impacted due to traffic effects. This impact is addressed in Section 4.13 Traffic, Transportation, and Circulation.

If flood management measures are enacted as part of an alternative, police and fire departments would require training in these new measures so that they can provide adequate services in the event of future flooding. Overall, FRM structures would reduce the need for emergency services during flooding, relieving strain on fire and police services.

For all alternatives, this impact would be a ***less than significant.***

Utilities

Utilities of concern include water, wastewater, and stormwater systems. No adverse effect is expected for energy utilities. All alternatives have the potential to contribute to the following impacts.

- **Impact UTL-2:** Require or result in the construction of new water and/or wastewater treatment facilities, or the expansion of existing facilities, which would cause significant environmental effects.
- **Impact UTL-3:** Require or result in the construction of new storm water drainage facilities, or the expansion of existing facilities, which would cause significant environmental effects.

Construction work would pose a risk of damage or interference with the drainage facilities and utilities installed under and around Corte Madera Creek, and Sir Francis Drake Boulevard for Alternatives F and J, as errant digging or excavation could breach the pipes. It would be likely that action alternatives would require construction of new pipes or relocation of existing systems either permanently or temporarily out of relevant work zones. AMM-UTL-2 would require the relocation of utilities in conflict with the Project prior to or in conjunction with Project construction. Locations of pipelines are well documented, and construction would be planned around these features. Existing stormwater drainage to the creek and sewer pipes crossing the creek at the fish ladder and southern pedestrian bridge and utility relocation under Sir Francis Drake Boulevard would be incorporated into the Project design (Figure 4.16-1).

The existing sewer line which crosses the creek at the fish ladder may need to be relocated during construction. For Alternatives F, G, and J, potential relocation could include placement under Allen Park Riparian Corridor. Sewer line relocation would be determined during PED.

The construction of floodwalls would be accompanied by the installation of pump stations and other interior drainage facilities to divert water into the creek. Pump station and interior drainage facility locations would be determined during PED. See the discussion of Impact WQ-3 in Section 4.2, Water Quality, regarding potential impacts of construction and operation of these facilities.

The construction of the bypass under Sir Francis Drake Boulevard for Alternatives F and J would require relocation of underground utilities that exist underneath Sir Francis Drake Boulevard. These utilities would be realigned in trenches along one or both sides of Sir Francis Drake Boulevard outside of the box culverts. Some utilities could be temporarily cut off for several hours for residences along Sir Francis Drake Boulevard. Affected residents would be notified in advance of utilities being cut off. The excavation schedule would be established during PED.

Relocation and replacement of utilities would incur a substantial expense; therefore, the Project would be designed to avoid and minimize this risk. All relocation and replacement would be coordinated with the utility providers to minimize impacts. Subsurface utility location would be conducted in accordance with AMM-UTL-1 prior to excavation. Clear instructions would be provided to work crews to allow the Project to proceed in areas around existing utilities without causing inadvertent damage. If it is determined at any point that an existing utility structure is at risk, the Project would be modified to avoid the danger. For all alternatives, these impacts would be ***less than significant.*** See, however**,** the discussion of Impact WQ-3 in Section 4.2, Water Quality, regarding potential impacts of construction and operation of interior drainage facilities, including pump stations.

- **Impact UTL-4:** Have insufficient water supplies available to serve the project from existing entitlements and resources and require new or expanded entitlements.

Construction would result in a temporary increase in water use. This would include water for the construction process, dust suppression, and construction employees' consumption. This volume would be limited in quantity and duration and would come from existing sources.

Water use during construction would be primarily limited to earthwork operations. Construction activities would require up to two water trucks per day for exposed surfaces at 2,500 gallons per truck. This volume of water would not require construction of new water facilities and sufficient water supplies are available to serve the project from existing entitlements and resources.

For all alternatives, this impact would be ***less than significant.***

The following impacts would be applicable to wastewater facilities:

- **Impact UTL-5:** Exceed wastewater treatment requirements of the applicable RWQCB.
- **Impact UTL-6:** Result in a determination by the wastewater treatment provider which serves or may serve the project that it does not have the capacity to serve the project's projected demand in addition to currently existing commitments.

Portable toilets would be used at construction sites, as required. Wastewater would, therefore, not exceed the capacity of local utilities.

For all alternatives, impacts to wastewater treatment would be ***less than significant.***

Regarding solid waste, all alternatives are expected to require removal of construction debris as well as temporary or permanent extraction of trees, plants, and other environmental features as part of the work conducted at each site. This could contribute to the following impact:

- **Impact UTL-7:** Require new or expanded solid waste (landfill) services in order to meet the needs of the project work.

Redwood Landfill accepts construction and demolition debris, including concrete, and has adequate capacity to meet the Project's needs. An efficient work plan at each site, following all the proper state and federal regulations for disposal of construction-related refuse, would minimize the amount of excess material and environmental features requiring disposal. Reusing materials (AMM-GEO-3) would also reduce the amount of waste produced. All alternatives would have a minor impact on solid waste utilities.

For all alternatives, this impact would be ***less than significant.***

Table 4.16-1 summarizes the impacts to public utilities, services, and energy***.***

TABLE 4.16-1 PUBLIC SERVICES, UTILITIES, AND ENERGY IMPACT CONCLUSIONS					
Effect	AMMs	Applicable Alternatives	Significance	Mitigation	Significance after Mitigation
UTL-1: Result in substantial adverse physical impacts associated with the provision of new or physically altered governmental facilities, need for new or physically altered facilities, the construction of which could cause significant environmental impacts, in order to maintain acceptable service ratios, response times or other performance objectives for any of the public services.	--	All Action Alternatives	LTS	--	--
		No Action	LTS	--	--
UTL-2: Require or result in the construction of new water and/or wastewater treatment facilities, or the expansion of existing facilities, which would cause significant environmental effects.	AMM-UTL-1 AMM-UTL-2	All Action Alternatives	LTS	--	--
		No Action	LTS	--	--
UTL-3: Require or result in the construction of new storm water drainage facilities, or the expansion of existing facilities, which would cause significant environmental effects.	AMM-UTL-1 AMM-UTL-2	All Action Alternatives	LTS	--	--
		No Action	LTS	--	--
UTI-4: Have insufficient water supplies available to serve the project from existing entitlements and resources and require new or expanded entitlements.	--	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
UTL-5: Exceed wastewater treatment requirements of the applicable RWQCB.	--	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
UTL-6: Result in a determination by the wastewater treatment provider which serves or may serve the project that it does not have the capacity to serve the project's projected demand in addition to currently existing commitments.	--	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
UTL-7: Require new or expanded solid waste (landfill) services in order to meet the needs of the project work.	AMM-GEO-2	All Action Alternatives	LTS	--	--
		No Action	NI	--	--
UTL-8: The project is unable to comply with federal, state, and/or local statutes and regulations related to solid waste.	--	N/A	--	--	--

AMM = avoidance and minimization measure

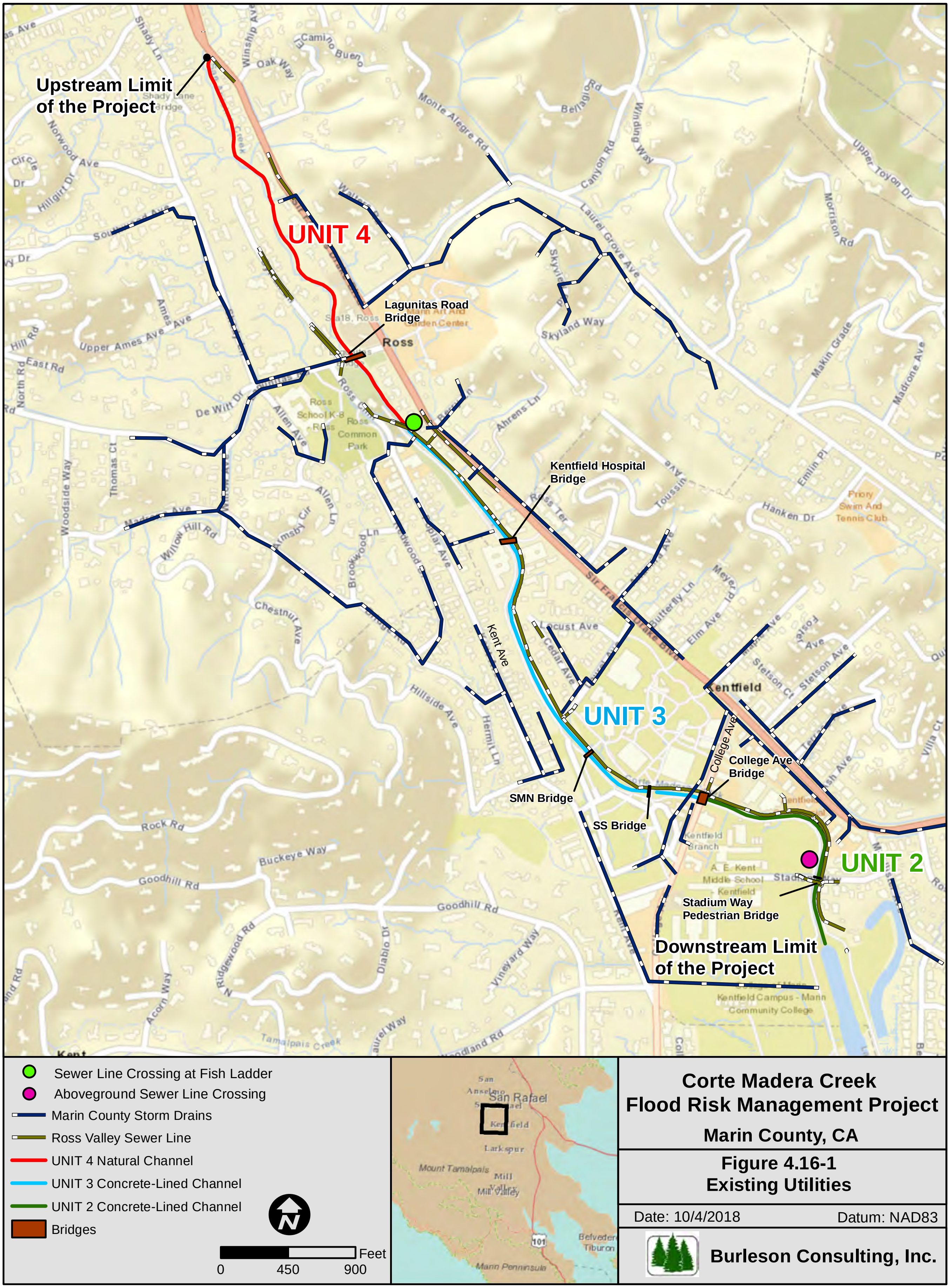
LTS = less than significant
N/A = not applicable

4.16.3.4 Cumulative Impacts

The analysis of cumulative impacts considered effects to services and utilities after completion of construction and any compounding effect on existing impacts. Long-term impacts to utilities would be less than significant. By the nature of the proposed FRM structures, operation and maintenance activities would be minimal, and thus, would not require expanded utilities.

New flood control measures could impact how emergency services operate. Flood control structures would improve the ability of the community to avoid and minimize loss of life and property in the event of a flood; however, it would be important for emergency services to understand the limitations of the various flood control measures so that they may efficiently provide aid during a flood event. New floodwalls would need to be incorporated into rescue procedures for emergency services. The Project may require that the police and fire departments update their procedures and methods when providing services in the vicinity of the creek and would ensure that emergency services can operate at maximum effectiveness in the event of a flood. This would not constitute a significant cumulative impact.

The vast majority of effects on local utilities and services would be limited to the construction period. As stated above, the project could result in significant impacts related to development of new interior drainage facilities, including pump stations, gravity drains, and storm sewers. These impacts, while not fully understood at this time (because design of such facilities would occur at a later stage) could be significant and unavoidable. Cumulative projects listed in Table 4-2 are not expected to require construction of new storm drain facilities, and so would not combine with the Project to result in a cumulative effect of this kind.



Upstream Limit of the Project
UNIT 4
Lagunitas Road Bridge
Ross
Kentfield Hospital Bridge
UNIT 3
Kentfield
College Ave Bridge
SMN Bridge
SS Bridge
UNIT 2
Stadium Way Pedestrian Bridge
Downstream Limit of the Project
Sewer Line Crossing at Fish Ladder
Aboveground Sewer Line Crossing
Marin County Storm Drains
Ross Valley Sewer Line
UNIT 4 Natural Channel
UNIT 3 Concrete-Lined Channel
UNIT 2 Concrete-Lined Channel
Bridges
N
0
450
900
Feet
San Rafael
Kentfield
Larkspur
Mount Tamalpais
Mill Valley
Corte Madera Creek
Flood Risk Management Project
Marin County, CA
Figure 4.16-1
Existing Utilities
Date: 10/4/2018
Datum: NAD83
Burleson Consulting, Inc.

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5 OTHER REQUIRED ANALYSIS

5.1 Energy Requirements and Conservation Potential

Per Public Resources Code (PRC) Section 21100(b)(3), in order to ensure that energy implications are considered in Corte Madera Creek Flood Risk Management Project (Project) decisions, the California Environmental Quality Act (CEQA) requires that an EIR include a discussion of the potential energy impacts of the proposed Project, with particular emphasis on avoiding or reducing inefficient, wasteful, and unnecessary consumption of energy. Potentially significant energy implications of a Project are to be considered in the EIR to the extent relevant and applicable to the Project.

Appendix F of the state CEQA Guidelines outlines issues related to energy conservation and includes potential Project description considerations, types of impacts applicable to energy use, and potential mitigation measures to reduce wasteful, inefficient, and unnecessary consumption of energy.

Energy conservation can be accomplished by reducing energy consumption (e.g., natural gas and oil) and increasing reliance on renewable energy sources. Energy used during project construction, operation, and maintenance would be expended in the form of electricity, gasoline, and diesel fuel, which would be used primarily by construction equipment and trucks.

Energy would be used wisely and efficiently during Project construction and operations and maintenance because, in all cases, the potential adverse environmental effects of the project would be reduced through Project design, construction practices, preconstruction surveys and analysis, regulatory requirements, and best management practices (BMPs). Further, applicable proposed avoidance and minimization measures (AMMs) and mitigation measures identified in Chapter 4 of this EIR would ensure that energy is conserved to the maximum extent possible. Measures that have been included in the Project that would contribute to energy conservation include the following:

- Fuel management plan
- Use on-site material and natural sedimentation processes to fill in low areas of ponds
- Minimize footprint of disturbance
- Truck delivery and regular construction work hours would be outside the a.m. and p.m. peak traffic hours
- Minimize idling times
- Maintain construction equipment in accordance with manufacturer's specifications
- Require Best Available Control Technology on all construction equipment, including diesel vehicles
- Contractors must use equipment that meets California Air Resources Board (ARB) standards for off-road heavy-duty diesel engines
- Maintain construction equipment
- Reuse materials

The measures identified above would contribute to energy conservation by reducing vehicle trips, improving fuel efficiency, and limiting the size of construction areas and reusing materials where practical. Together, the project design features, construction practices, compliance with regulatory requirements, and implementation of AMMs and mitigation measures would ensure that the project would not result in the inefficient, unnecessary, or wasteful consumption of energy, and impacts would be less than significant.

5.2 Irreversible and Irretrievable Commitment of Resources

Section 15126(c) of the CEQA Guidelines requires an EIR to address any significant irreversible environmental changes and irretrievable commitment of resources that may occur as a result of alternative implementation. Resources that are irreversibly or irretrievably committed to a project are those that are typically used on a long-term or permanent basis; however, some are considered short-term resources that cannot be recovered and are thus considered irretrievable. This includes use of nonrenewable resources (e.g., fuel, wood, or other natural or cultural resources), the commitment of future generations to similar uses, and irreversible damage, which can result from environmental accidents associated with the project. Irreversible changes associated with all of the alternatives include the use of building materials, nonrenewable energy sources, and labor required to operate trucks, machinery, and other equipment. The unavoidable destruction of natural resources which limit the range of potential uses of that particular environment would also be considered an irreversible or irretrievable commitment of resources.

The Project would constitute an irreversible or irretrievable commitment of nonrenewable or depletable resources for the materials, time, money, and energy expended during implementation. Under all alternatives except the no action alternative, there would be irreversible and irretrievable commitments of resources. The following paragraphs summarize the particular irreversible and/or irretrievable impacts of the Project.

Project construction and long-term maintenance of the study area would require consumption of fossil fuels and energy. Fossil fuels (gasoline and diesel oil) would be used to power construction equipment and vehicles and, possibly, equipment used during long-term maintenance (e.g., portable pumps and maintenance vehicles). The energy consumed for project construction and operation represents a permanent and nonrenewable commitment of these resources.

All of the materials used for the construction of the proposed flood control structures would come from off-site sources. This would constitute a long-term, nonrenewable investment by the federal and non-federal sponsors. Other materials used for constructing accessory structures, such as closure structures, would require obtaining and using nonrenewable materials. Construction and maintenance activities are considered a long-term nonrenewable investment of these resources.

Land that would be physically altered by construction would be committed to the new use for the foreseeable future and would represent a permanent commitment of the land for the life of the project. The project would not, however, decrease the amount of open land available for urban uses.

The capital and labor required for construction would be an irreversible and irretrievable commitment of financial resources.

These commitments of resources could have been applied to projects other than the proposed Project. However, the Project would not result in the use of a substantial amount of resources. Project activity would occur periodically through phases and would not be continuous. Many of the effects of Project activity would be short term and limited to active construction areas. Additionally, no natural resources would be permanently destroyed, and flood risk management (FRM) would be considered beneficial to the region.

5.3 Significant and Unavoidable Adverse Environmental Effects

Chapter 4 describes the potentially significant project-related effects on the built and natural environments. The analyses in Chapter 4 identify a number of potentially significant effects associated with the action alternatives; most of those effects could be reduced to a less-than-significant level with the application of additional measures designed to address the impacts. Table 5-1 displays the unavoidable adverse effects that would occur with one or more action alternatives.

TABLE 5-1 CORTE MADERA CREEK COMPARISON OF IMPACTS BY ALTERNATIVE

Impact	A	B	F	G	J
WQ-1: Violate any water quality standards or waste discharge requirements or otherwise substantially degrade water quality	•	•			
WQ-3: Require or result in the construction of new storm water drainage facilities or expansion of existing facilities, the construction of which could cause significant environmental effects.	•	•	•	•	•
AES-1: Substantially degrade the existing visual character or quality of the study area and its surroundings	•	•		•	
AES-2: Have a substantial adverse effect on a scenic vista	•	•		•	
BIO-1: Have a substantial adverse effect, either directly or through habitat modifications, on any species identified as a candidate, sensitive, or special-status species in local or regional plans, policies, or regulations, or by the NMFS, USFWS, and CDFW.	•	•		•	
BIO-2: Have a substantial adverse effect on any riparian habitat or other sensitive natural community identified in local or regional plans, policies, and regulations or by the NMFS, USFWS, and CDFW.	•	•		•	
BIO-4: Interfere substantially with the movement of any native resident or migratory fish or wildlife species or with established native resident or migratory wildlife corridors, or impede the use of native wildlife nursery sites.	•	•		•	
LND-4: Result in permanent conversion of existing land uses	•	•		•	
NOI-1: Exposure of persons to or generation of noise levels in excess of standards established in the local general plan or noise ordinance, or applicable standards of other agencies	•	•	•	•	•
NOI-2: A substantial temporary or periodic increase in ambient noise levels in the project vicinity, above levels existing without the project.	•	•	•	•	•
TRF-1: The project conflicts with an applicable plan, ordinance, or policy establishing measures of effectiveness for the performance of the circulation system, taking into account all modes of transportation including mass transit and non-motorized travel and relevant components of the circulation system, including but not limited to intersections, streets, highways and freeways, pedestrian and bicycle paths, and mass transit			•		•
TRF-02: The project conflicts with an applicable congestion management program, including but not limited to level of service (LOS) standards and travel demand measures, or other standards established by the county congestion management agency for designated roads or highways			•		•
SOC-2: Displace substantial numbers of existing housing, necessitating the construction of replacement housing elsewhere.	•	•		•	
SOC-3: Displace substantial numbers of people, necessitating the construction of replacement housing elsewhere	•	•		•	

5.4 Local Short-Term Uses and Maintenance or Enhancement of Long-Term Productivity

The Council on Environmental Quality Guidelines that implement the National Environmental Policy Act (NEPA) regulations (40 Code of Federal Regulations [CFR] 1500 *et seq*.) require that an EIS discuss issues related to environmental sustainability. The discussion relates to environmental consequences, including consideration of “the relationship between local short-term uses of (our) environment and the maintenance and enhancement of long-term productivity” (42 United States Code [USC] 4332[C][iv]).

The Project has United States Army Corps of Engineers (USACE) objectives and local sponsor objectives. The USACE objectives are to:

- Contribute to National Economic Development (NED) while remaining consistent with protecting the nation’s environment, pursuant to national environmental statutes, applicable executive orders, and other federal planning requirements; and
- Contribute to the nation’s ecosystems (or NER) by restoring degraded ecosystem structure, function, and dynamic processes to a less degraded, more natural condition.

The non-federal sponsors’ objectives are to provide FRM benefits in the study area to the extent that it is economically justified, and in consideration of planning constraints such as maintenance of existing wildlife populations. Increased recreation access is a subordinate goal and would be constrained by the need to protect sensitive wildlife populations and public safety.

The Project would result in construction of flood control structures designed to address the risk associated with a 4 percent annual exceedance probability (AEP) event. Building the FRM structures would support the USACE NED and NER objectives by supporting economic development in Marin County and restoring the creek bed. The Project is also consistent with policies contained in the Town of Ross and Marin Countywide General Plans. The project would also meet the stated project need.

Implementation of the proposed Project or any alternative would not result in any environmental impacts that would significantly narrow the range of beneficial uses of the environment or pose long-term risks to health, safety, or the general welfare of the public communities surrounding the study area. Rather, the Project would enhance long-term safety in and productivity of both the built and natural environments. The Project would provide near- and long-term FRM that is better than that currently projected within the project study period.

5.5 Growth-Inducing Impacts

The CEQA Guidelines require an EIR to discuss the ways in which a project could foster economic or population growth or require the construction of additional housing, either directly or indirectly, in the surrounding environment. This includes ways in which the Project would remove obstacles to population growth or trigger the construction of new community services facilities that could cause significant effects (CEQA Guidelines §15126.2).

NEPA requires an EIS to examine the potential of the Project to significantly or adversely affect the environment; potential impacts could be either direct or indirect. Indirect effects (NEPA, 40 CFR 1508.8[b]) may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density or growth rate, and related effects on air, water, and other natural systems including ecosystems. The analysis presented in Sections 5.5.1 Direct Growth-Inducing Impacts and 5.5.2 Indirect Growth-Inducing Impacts focuses on whether the Project would directly or indirectly induce growth in the surrounding area.

5.5.1 Direct Growth-Inducing Impacts

The Project would directly induce growth if it would directly foster economic or population growth or the construction of new housing in the surrounding environment (e.g., if it would remove an obstacle to growth by expanding existing infrastructure). The community is built-out and there is not a substantial amount of vacant or underutilized land available.

The Project, along with the primary goals to provide FRM, would not directly foster economic or population growth or the construction of new housing in the surrounding environment. Therefore, the Project would not directly induce local or regional growth.

5.5.2 Indirect Growth-Inducing Impacts

The Project would indirectly induce growth if it would foster economic or population-expanding activities that would lead to further development by taxing existing facilities and eventually requiring the construction of new facilities (e.g., an increase in population as a result of development authorized by approval of a general plan).

The Project would not include activity that would directly result in new residential or non-residential development.

Because the Project would not cause an increase in local growth, it would not result in an increased demand for growth-supporting resources (such as additional utility service and new roadways). The Project would use existing utilities and roadways and would not require the construction of new infrastructure to support its construction and operation.

The Project would not indirectly induce local or regional growth.

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6 TENTATIVELY SELECTED PLAN

This chapter describes the Tentatively Selected Plan (TSP), as well as the procedures and cost sharing required for implementation of the plan if it becomes the plan recommended to, and authorized by, Congress. A schedule and a list of further studies are also included.

6.1 Tentatively Selected Plan Description

Alternative J, the 4 percent annual exceedance probability (AEP) option is both the TSP and the Preferred Plan. The TSP consists of a combination of floodwalls, an underground bypass (along Sir Francis Drake Blvd.), and the creation of Frederick S. Allen Park (Allen Park) Floodplain Riparian Corridor. The underground bypass would alleviate the need to construct any floodwalls in Unit 4, allowing the creek within Unit 4 to remain a natural channel. Refer to section 3.7 for a full description of flood risk management (FRM) features for Alternative J, the TSP.

Unit 4 Bypass

An underground bypass, starting on the left bank near the Corte Madera Creek and Ross Creek confluence in Unit 4, would mostly run under Sir Francis Drake Boulevard and re-enter the stream channel at Allen Park Riparian Corridor (Unit 3). The bypass would be constructed using 2 parallel box culverts, each 12-feet wide by 7-feet high with a length of approximately 2,200 feet. Construction activities would include trenching portions of Sir Francis Drake Boulevard up to 20 feet deep by 30 feet wide for installation of the prefabricated box culverts. Although site preparation work would still be necessary, Alternative J would require minimal riparian vegetation removal because the majority of work would occur along an existing roadway.

Fish Ladder Removal and New Transition

The Denil fish ladder, located at the downstream end of Unit 4, approximately 580 feet downstream of Lagunitas Road Bridge, would be removed and replaced with a smooth transition. The Denil fish ladder would be replaced with a combination of natural bed material and biotechnical bank stabilization or stone protection treatments to create a smooth transition to avoid or minimize adverse impacts to Endangered Species Act (ESA) listed steelhead and coho salmon.

As a result of removing the fish ladder, channel modifications would be necessary to accommodate the change in flow dynamics, and also create the need to modify and lower the channel floor elevations to allow for a smooth transition and geomorphologically sustainable channel bed. The channel bed modification would extend from the existing fish ladder to approximately 110 feet upstream of Lagunitas Road Bridge. A portion of the natural channel in Unit 4, extending a length of approximately 115 feet, within the reach between Lagunitas Road Bridge and the fish ladder, would be widened to increase hydraulic conveyance capacity. The existing concrete channel downstream of the existing fish ladder, at the beginning of Unit 3, would be demolished and removed with approximately 750 feet of downstream improvements including realigned natural gravel creek bed and the lowering of the southwest side of the new creek channel in Allen Park to restore a historic floodplain and to increase flow capacity. At the downstream end of Allen Park, Corte Madera Creek would enter a new smooth transition to guide flow into the remaining existing concrete channel upstream of the Kentfield Hospital.

Allen Park Riparian Corridor

Allen Park Floodplain Riparian Corridor, would extend a length of approximately 900 feet and encompass approximately 2 acres. The floodplain riparian corridor would include a widened, native substrate channel that allows higher flows to spread over a larger area and include floodwalls on both streambanks to a maximum height of 2 feet. At the upstream end of the left bank, the channel could not be widened due to limited real estate. The floodwall at this location would be constructed at the left limit of the existing concrete channel.

Floodwalls

Floodwalls would be constructed in three main areas within the project: along both banks of Allen Park Riparian Corridor (mentioned previously), in close proximity to Granton Park, and adjacent to College Avenue. Allen Park Riparian Corridor is designed so that the widened restored channel is gradually narrowed to smoothly transition to the existing 33-foot wide concrete channel at the downstream end for hydraulic efficiency and minimizing upstream water surface elevations.

The Granton Park floodwall would be constructed along the left bank and extend approximately 1,050 feet, terminating at the western boundary of the College of Marin campus. The height of the Granton Park floodwall would vary. At its upstream end, the wall would be about 2 feet high and gradually increase to 6 feet at the downstream end. The new floodwall would be installed as a separate wall offset from the existing concrete wall.

Alternative J would also construct a short wingwall upstream of the College Avenue Bridge (approximately 75 feet long) and a longer floodwall downstream of College Avenue Bridge extending approximately 950 feet. The College Avenue floodwall would be constructed along the left bank. At its upstream end the floodwall would be about 4 feet high and gradually decrease to 2 feet at the downstream end. Drainage features such as gravity drains or pump stations needed to resolve interior drainage issues would be designed during PED.

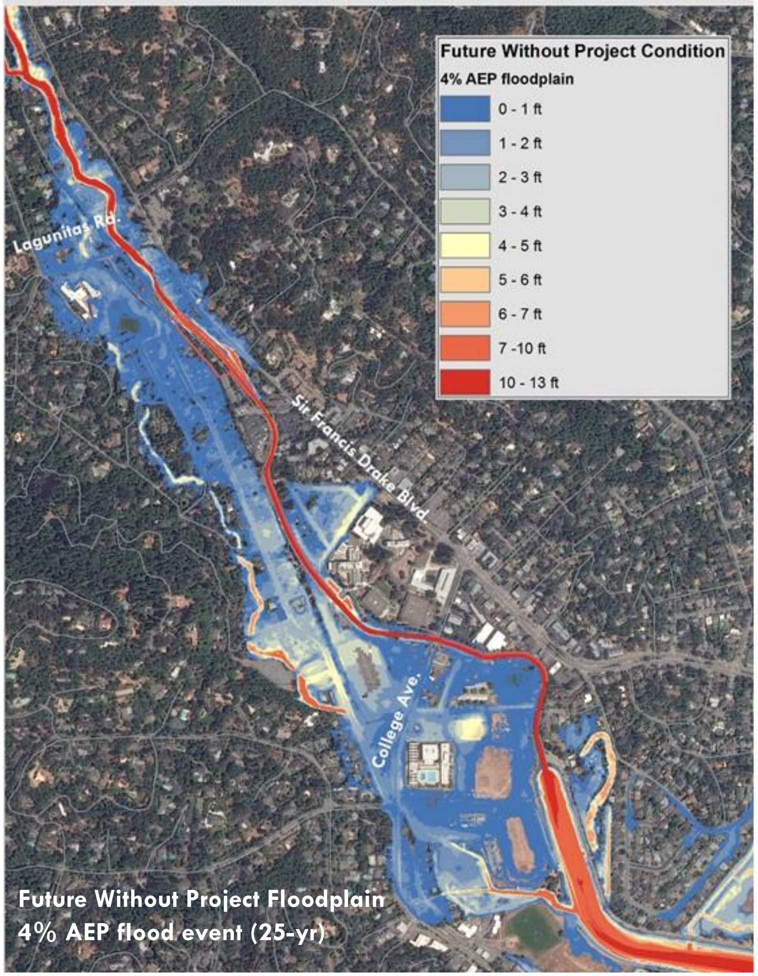
6.2 Project Achievements

The TSP achieves the following:

- Provides protection up to the 4 percent AEP event for 164 structures and up to 32 inches
- Removes critical infrastructure from the 4 percent AEP event flood plain, including a fire station, a police department, and two schools
- Reduces urban damages by approximately 69 percent compared to the no action alternative
- Achieves $2,556,000 in project benefits

Figure 6-1 provides a visual representation of the difference between the future without project condition and the residual floodplains for Alternative J 4 percent AEP (25-year) event. Figure 6-2 provides a visual representation the residual floodplains for Alternative J 1 percent and 2 percent AEP (25-year) events.

Figure 6-1 FWOP 4 percent Annual Exceedance Probability Event Floodplain and Alternative J, Future Without Project 4 percent Annual Exceedance Probability Residual Floodplains



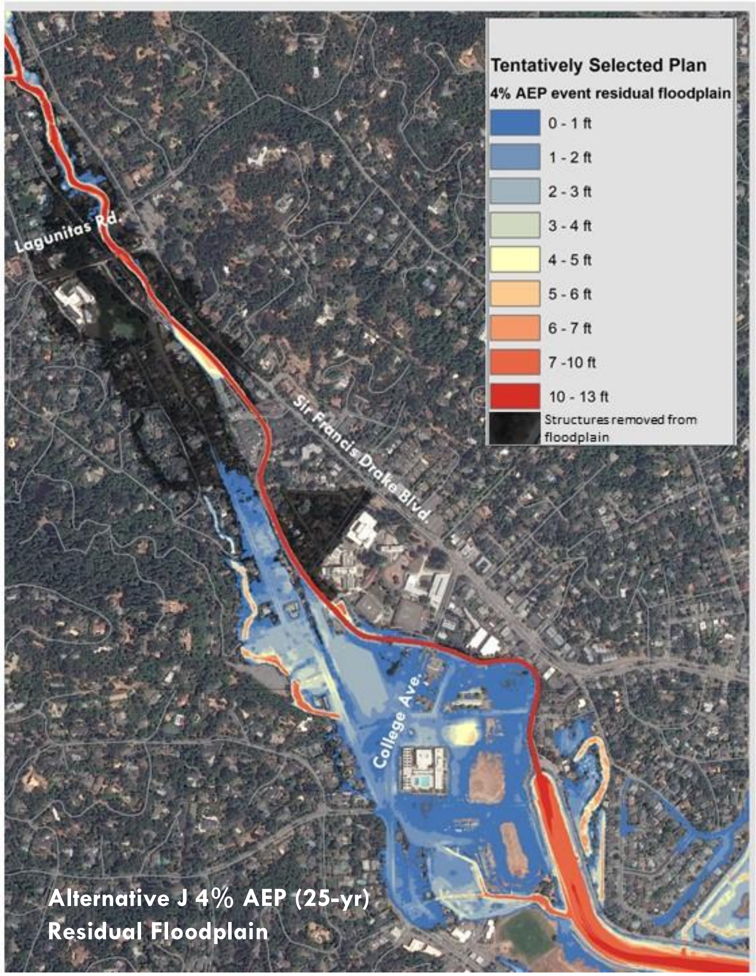
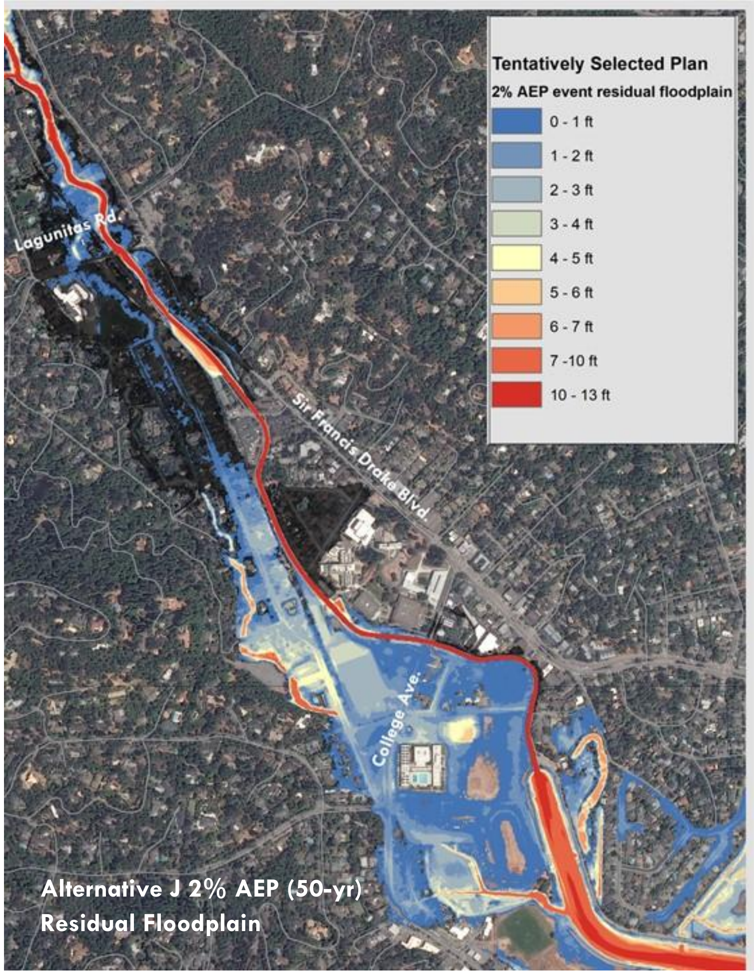
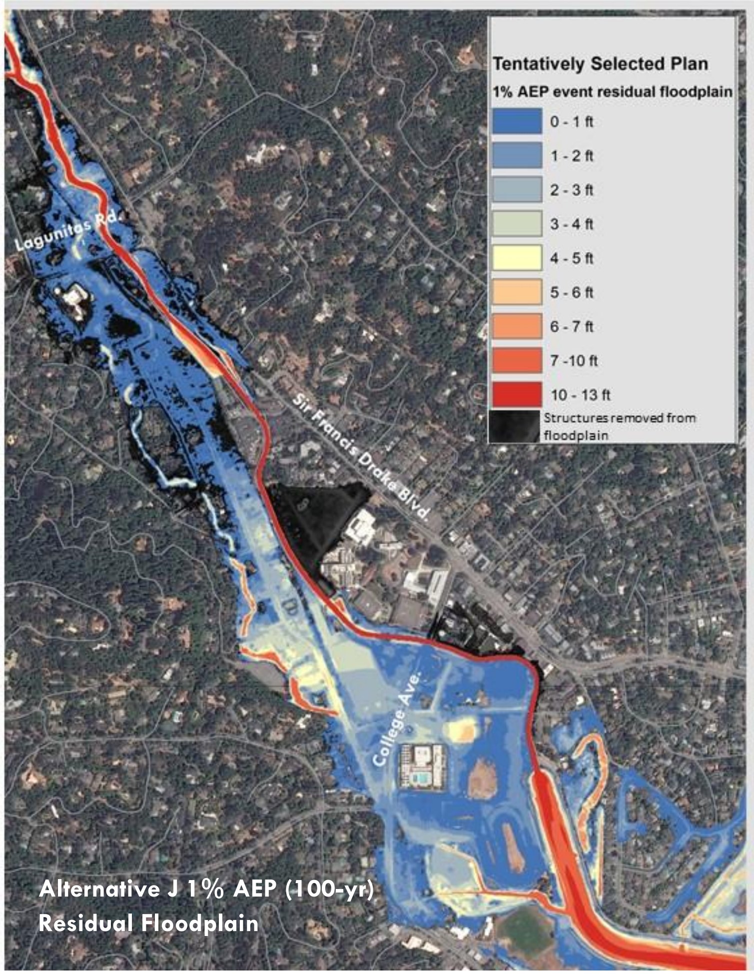


Figure 6-2 Alternative J 2 percent and 1 percent Annual Exceedance Probability Residual Floodplains





6.3 Watershed Context

The Project is an important component of the greater Ross Valley Flood Protection and Watershed Management Program (Program), a regional effort led by the Marin County Flood Control and Water Conservation District with an overall objective to substantially reduce the frequency and severity of flooding throughout the Ross Valley Watershed, in an economically viable manner while prioritizing public safety and minimizing environmental impacts.

The Program's major flood reduction measures are intended to work cooperatively to reduce peak out-of-bank flows, and has the future goal of achieving protection from a 100-year flood event (1 percent chance of occurring or being exceeded in any one year). Proposed flow reduction measures include detention basins, located in the upper reaches of the watershed to detain peak flows during flood events (for additional information go to www.rossvalleywatershed.org). Capacity enlargement measures include bridge replacements in Fairfax, San Anselmo, and Ross to remove impediments to flows and reduce localized flooding, dredging of channels in the lower watershed, and creek improvements watershed-wide to increase capacity and handle flood flows as they move through the watershed. Flood preparation measures include coordination with local emergency officials and planners in development of local hazard mitigation plans, communication with the community on flood preparation planning and education, and working on floodplain management activities that exceed the minimum standards through the Community Rating System to help reduce flood insurance premium rates for policyholders.

Ross Valley Watershed Phased Approach—100-year flood protection will be implemented in two phases. Phase 1 (2017-2027) will target a goal of completing a series of flood mitigation projects including the proposed Project which is expected to provide up to a 4 percent AEP (25-year). Phase 2 (2028- 2050, depending on flood safety priorities established within the community and securing additional funding sources such as grants) will add additional measures to achieve a target goal of up to 1 percent AEP (100-year) flood protection.

6.4 Environmental Operating Principles

Alternative J 4 percent AEP (25-year) supports each of the seven USACE Environmental Operating Principles. The TSP would improve aquatic and riparian ecosystem function by providing native fish and wildlife habitat which would be used by threatened and endangered salmonid species. Removal of the Denil fish ladder and a section of concrete channel at Allen Park would aid steelhead and coho in traveling upstream to spawn. Alternative J 4 percent AEP (25-year) would be effective from a flood conveyance perspective, and the design is also self-mitigating. Alternative J has incidental environmental impacts, which eliminate the need for additional mitigation costs.

Alternative J 4 percent AEP (25-year) recognizes the interdependence of life and the physical environment by reducing the impact of construction in the riparian corridor, reducing the likelihood of flood impacts to the surrounding area, and improving hydrologic processes that support aquatic ecosystem function and improve riparian habitat that in turn support fish and wildlife. The TSP seeks balance and synergy among human development activities and natural systems by having a low impact to the riparian habitat and improving the system for ESA salmonids. Formulation of the TSP followed and ensured compliance with applicable laws demonstrating USACE will accept responsibility and accountability.

Alternative J 4 percent AEP (25-year) ameliorates cumulative impacts to the environment by reducing future detrimental impacts while reversing historic trends in degrading habitat function and value. With coordination and outreach with other federal, tribal and state agencies, and the public, the TSP will help achieve the larger flood risk reduction vision for the entire watershed. The FRM measures featured in Alternative J 4 percent AEP (25-year) were developed in coordination with resource agencies and stakeholders, and will benefit both human and natural environments.

6.5 Timeline and Budget

Table 6-1 presents the timeline and budget for the Project. Table 6-2 presents the federal and non-federal cost share allocations for the Project.

TABLE 6-1 PROJECT TIMELINE AND BUDGET

Deliverable	Target Cost	Target Completion Date
Draft Report for Public Review	$416,000	October 2018
Agency Decision Milestone	$462,000	February 2019
Director's Report and Record of Decision	$519,000	September 2019

TABLE 6-2 COST SHARE ALLOCATIONS- FEDERAL AND NON-FEDERAL

Item	Federal	Non-Federal	Total
Underground Bypass (Sir Francis Drake Blvd)	$10,961,000	-	$10,961,000
Floodwall	$3,245,000	-	$3,245,000
Floodplain Riparian Corridor	$1,927,000	-	$1,927,000
Fish Ladder Removal & Grading	$23,000	-	$23,000
Sub-Total	**$16,156,000**	**-**	**$16,156,000**
Real Estate		$19,232,000	$19,232,000
Mitigation	-	-	-
Preconstruction Engineering Design	$3,231,000	-	$3,231,000
Construction Management	$1,616,000	-	$1,616,000
Contingency (28%)	$5,881,000	-	$5,881,000
Project First Cost	$26,884,000	$19,232,000	$46,116,000
Mandatory 5% Non-Federal Cash Contribution	-$807,000	$807,000	-
Total	**$26,077,000**	**$20,039,000**	**$46,116,000**
Cost Share (%)	57%	43%	100%

6.6 Climate Risk and the Tentatively Selected Plan

The TSP provides protection for floods up to and including the 4 percent AEP flood. In the future, climate models indicate changes in the magnitude and frequency of precipitation resulting from winter storms, which is likely to alter the flow magnitudes for different annual chance exceedance events. Climate models differ, however, in the rate and magnitude of hydrologic change, and therefore there is considerable model uncertainty: qualitatively, flood risk is likely to increase in the study area, but lack of certainty with respect to the magnitude, frequency, and timing of these changes prevents quantitative analysis at this time. Table 6-3 summarizes the hazards that may occur for the TSP with climate change.

TABLE 6-3 CLIMATE CHANGE HAZARDS FOR ALTERNATIVE J

Feature	Trigger	Hazard	Harm	Qualitative Likelihood
Unit 4 Bypass	Increases in the frequency and magnitude of precipitation (winter storms become larger, more intense)	Increase in flood magnitude and frequency	Increase in frequency of inundation in areas that would be inundated under flows >4% AEP with the TSP	Likely
Fish Ladder Removal / Downstream channel modifications / Allen Park Riparian Corridor	Increases in the frequency and magnitude of precipitation (winter storms become larger, more intense)	Increase in flood magnitude and frequency	Increase in frequency of inundation of Allen Park Riparian Corridor at flows greater than current 4% AEP	Likely
Floodwalls	Increases in the frequency and magnitude of precipitation (winter storms become larger, more intense)	Increase in flood magnitude and frequency	Increase in frequency of inundation in areas that would be inundated under flows >4% AEP with the TSP Chaning flood characteristics may result in a changes to the level of performance in the future if the flows associated with the 4% AEP change	Likely Likely

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7 ENVIRONMENTALLY SUPERIOR ALTERNATIVE

National Environmental Policy Act (NEPA) requires the identification of an environmentally preferable alternative or alternatives. According to the Council on Environmental Quality, the environmentally preferable alternative is the alternative that

> …will promote the national environmental policy as expressed in NEPA's Section 101. Ordinarily, this means the alternative that causes the least damage to the biological and physical environment; it also means the alternative which best protects, preserves, and enhances historic, cultural, and natural resources.

The California Environmental Quality Act (CEQA) requires identification of the environmentally superior alternative and guidelines (Section 15126.6[a] and [e][2]) require that an EIR's analysis of alternatives identify the "environmentally superior alternative" among all of those considered. If the No Project Alternative is identified as environmentally superior, then the EIR also must identify the environmentally superior alternative among the project alternatives.

In this integrated document the term environmentally superior alternative is used to encompass both the environmentally preferable alternative (NEPA) and environmentally superior alternative (CEQA).

The no action alternative would not result in any impacts during construction, and would avoid the significant and unavoidable impacts to water quality, aesthetics, noise, and traffic. However, the no action alternative would not meet the purpose and need, and would not produce any beneficial impacts to biological resources from removal of the fish ladder and concrete-lined channel for some alternatives. It would also result in ongoing significant impacts to socioeconomic resources and biological resources, specifically California Central Coast steelhead and potentially coho salmon.

Construction of more floodwalls, particularly in Unit 4, for Alternatives A, B, and G would cause impacts equal to or greater than those for Alternatives F and J for all resource areas except traffic and emergency access. Impacts from Alternatives F and J would be greater for traffic and emergency access during bypass construction under Sir Francis Drake Boulevard (Table 3-8 Summary of Alternative Impacts). However, construction of the bypass would avoid greater impacts to biological resources in Unit 4 that would occur under Alternatives A, B, and G. Alternative J would have fewer negative impacts to air quality, climate change, and noise than Alternative F because it would include less construction. However, it would have fewer beneficial impacts to biological resources than Alternative F because it would retain the concrete-lined channel in Units 2 and 3 that would otherwise be removed in Alternative F. Thus, Alternative F would be the Environmentally Superior Alternative because it would minimize negative impacts and would provide long-term benefits to biological resources.

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8 STAKEHOLDER COORDINATION AND OUTREACH

8.1 Public Involvement

The goal of public involvement and coordination is to open and maintain channels of communication with the public in order to give full consideration to public views and information in the planning process. The objectives of public involvement are: 1) to provide information about project activities to the public; 2) to make the public's desires, needs, and concerns known to decision-makers; 3) to provide for consultation with the public before decisions are reached; and 4) to consider the public's views in reaching decisions.

In 1996, Marin County requested the completion of Unit 4 by USACE, and damages incurred by the December 2005 flood also renewed public interest in finding solutions to minimize the risk of future floods. The Corte Madera Creek Flood Risk Management Project (Project) has been through several iterations since that period. This discussion on scoping activities focuses on the scoping period beginning in 2015 and onward.

8.1.1 Scoping Activities

A Notice of Intent (NOI) to prepare an Environmental Impact Statement/Environmental Impact Report (EIS/EIR) was published in the Federal Register on December 18, 2015. An NOI/Notice of Preparation (NOP) was also developed by USACE and Marin County Flood Control and Water Conservation District (District) on December 21, 2015, and issued on December 23, 2015. The NOI/NOP was sent to local, state, and federal agencies, local landowners, residents, and interested parties through the U.S. Postal Service. The NOI/NOP included background project information, methods for public comment, and notification of one upcoming public scoping meeting (Appendix D).

8.1.1.1 Summary of Public Concerns

Scoping Meeting, Thursday, January 28, 2016

The public scoping period extended from December 23, 2015, to March 1, 2016. A public scoping meeting was held on January 28, 2016, in the Town of Ross, California at the Marin Arts and Garden Center, 30 Sir Francis Drake Boulevard. A Public Notice was published in the Marin Independent Journal to inform the public of this meeting. The purpose of the public scoping meeting was to solicit comments regarding the potential impacts, environmental issues, and components associated with the project to be considered in the draft EIS/EIR. The meeting place, date, and time were advertised in advance in local newspapers, and meeting announcement letters were sent to interested parties. The National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA) extended comment period ended on March 1, 2016.

The public meeting held in Ross was attended by over 65 people, where local public agencies and elected officials addressed the crowd and provided project information. The attendees included individuals, stakeholders, local and government agencies, and USACE representatives. Specific issues that received five or more comments included: notice and details; biology; fisheries or fish passage; dredging; hydrology/watershed; and land use/land acquisition. The Scoping Report is included as Appendix E.

8.2 Institutional Involvement

8.2.1 Agencies and Organizations Consulted

Table 8-1 lists the project delivery team members associated with the EIS/EIR.

TABLE 8-1 PROJECT DELIVERY TEAM

Agency or Organization	Role	Primary Area of Concern
United States Army Corps of Engineers (USACE) San Francisco District	Federal Lead Agency, Federal Sponsor	Feasibility of flood risk management (FRM)
Marin County Flood Control and Water Conservation District	State Lead Agency, Local Sponsor	Feasibility of flood risk management (FRM)

8.2.2 Coordination with Other Agencies

A number of federal and state agencies are coordinating the NEPA and CEQA processes as required by federal and state law. Table 8-2 summarizes these coordination efforts.

TABLE 8-2 AGENCY COORDINATION FOR NEPA AND CEQA PROCESSES

Agency	Responsibility or Interest
California State Historic Preservation Officer	Administers Section 106 of the National Historic Preservation Act
Bay Area Air Quality Management District	Air permit(s)
San Francisco Bay Conservation and Development Commission (BCDC)	
National Oceanic and Atmospheric Administration Fisheries Service (also known as National Marine Fisheries Service)	Administers Marine Mammal Protection Act; administers Federal Endangered Species Act for pelagic and anadromous fisheries; administers Magnuson-Stevens Fishery Conservation And Management Act; consulting party for Fish and Wildlife Coordination Act
California Department of Fish and Wildlife	Trustee agency under the CEQA; implements State Fish and Game Code; issues stream alteration permits; consulting party for Federal Fish and Wildlife Coordination Act
San Francisco Bay Regional Water Quality Control Board	Administers Federal Clean Water Act Section 401 Water Quality Certification program and issues certifications; administers State's Porter-Cologne Water Quality Control Act
State Lands Commission	Trustee agency that manages sovereign land in the study area; issues leases
USFWS	Fish and Wildlife Coordination Act consultation
Environmental Protection Agency (USEPA)	

8.3 Report Circulation

The Draft EIS/EIR will be circulated for a period of 45 days from October 12, 2018 to November 27, 2018. A Notice of Availability/Notice of Completion and Project fact sheet was distributed in conjunction with the Draft EIS/EIR.

8.4 List of Recipients

This EIS/EIR and a Notice of Availability was distributed to the following agencies and organizations:

- California Coastal Commission
- California Department of Fish and Wildlife (CDFW)
- City of Larkspur Planning
- City of Larkspur Library
- College of Marin
- Flood Zone 9 Advisory Board members
- Friends of Corte Madera Creek Watershed
- Kentfield Planning Advisory Board
- Kentfield School District
- Marin Conservation League
- Marin County Bicycle Coalition
- Marin County Clerk
- Marin County Community Development Agency
- Marin County Counsel-Jenna Brady
- Marin County Department of Public Works
- Marin County Free Library
- Marin Municipal Water District (MMWD)
- National Audubon Society
- National Oceanic and Atmospheric Administration and National Marine Fisheries Service (NOAA/NMFS)
- Office of Planning & Research (OPR)/State Clearinghouse
- Pacific Gas and Electric PG&E)
- Ross Valley Sanitary District
- San Francisco Bay Conservation and Development Commission (BCDC)
- San Francisco Bay Regional Water Quality Control Board (Water Board)
- Town of Corte Madera Library
- Town of Fairfax Library
- Town of Fairfax Planning
- Town of San Anselmo Library
- Town of San Anselmo Planning
- Town of Ross Planning
- United States Environmental Protection Agency NEPA Review Office
- United States Fish & Wildlife Service (USFWS)

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9 REGULATORY JURISDICTION AND ENVIRONMENTAL COMPLIANCE

This chapter describes federal, state, regional, and local regulatory requirements identified in the Environmental Impact Statement/Environmental Impact Report (EIS/EIR).

9.1 Federal Regulations

National Environmental Policy Act

The National Environmental Policy Act (NEPA) is federal legislation that established environmental policy for the nation. It requires federal agencies to consider the potential effects of implementing their regulations, policies, and programs, as well as alternatives to the proposed actions.

Clean Water Act

The Clean Water Act (CWA) (33 United States Code [USC] § 1251 *et seq*.) provides guidance for the restoration and maintenance of the chemical, physical, and biological integrity of the nation's waters. The CWA is further intended to achieve a level of water quality that allows for recreation opportunities in and on the water and to promote the propagation of fish and wildlife. Four sections of the CWA are especially pertinent to the Project, Sections 303, 401, 402, and 404.

Section 303 requires states to adopt numeric criteria for specific, priority toxic pollutants if those pollutants could interfere with the designated beneficial uses of a state's waters. It also requires States to identify water bodies that do not meet water quality standards and the pollutants or factors that impair them. For California, this combined report is called the California 303(d)/305(b) Integrated Report. Under section 303(d) of the CWA, states, territories and authorized tribes (included in the term state here) are required to submit lists of impaired waters. These are waters that are too polluted or otherwise degraded to meet water quality standards. The law requires that the states establish priority rankings for waters on the lists and develop total maximum daily loads (TMDL) for these waters.

Section 401 of the CWA requires that an entity that is granted permission under Section 404 of the CWA must obtain a State certification that the discharge complies with the provisions of the CWA. In order to comply with this requirement, a certifying agency evaluates the potential impacts of the discharge in light of water quality standards and Section 404 criteria governing discharge of dredged and fill materials into waters of the U.S. The Regional Water Quality Control Boards (RWQCBs) administer the California certification program with federal oversight provided by the USEPA.

As the Project would include modifications (including the removal and/or addition of materials) to Corte Madera Creek, which is considered a water of the U.S., the Project would be subject to requirements of Section 401. Prior to completion of a final EIS/EIR, the USACE will request a letter of concurrence from the SFRWQCB indicating its concurrence

Section 402 governs the National Pollutant Discharge Elimination System (NPDES) permit program, established under Section 402 of the CWA. As part of the NPDES program, any point source discharge of a pollutant or pollutants into any waters of the U.S. must be permitted. Waters of the U.S. include navigable waters; all other waters where the use, degradation, or destruction of the waters could affect interstate or foreign commerce; tributaries to such waters; and wetlands that are adjacent to these waters.

Section 402(p) of the CWA requires NPDES permits for stormwater discharges from municipal stormwater systems, industrial activities, construction activities, and designated dischargers that are considered significant contributors of pollutants to waters of the U.S. In California, NPDES permitting authorities are the RWQCBs.

Any project that disturbs one or more acres of soil or disturbs less than one acre but is part of a larger common plan of development that in total disturbs one or more acres, is required to obtain coverage under the NPDES General Permit for Stormwater Discharges Associated with Construction Activity (NPDES General Construction Permit; Order No. 2009-0009-DWQ, NPDES No. CAR000002, adopted September 2, 2009). The NPDES General Construction Permit requires the development and implementation of a Stormwater Pollution Prevention Plan (SWPPP). The SWPPP must include specific minimum best management practices (BMP), depending on project sediment risk level, and any additional BMPs that the discharger will use to protect stormwater runoff, along with a monitoring program.

As the Project is anticipated to include modifications to Corte Madera Creek, a water of the U.S., and to result in disturbance of more than one acre, the Project would be subject to the requirements of Section 402.

Under Section 404 of the CWA, the USACE is granted permitting authority for any activity that would involve the discharge of dredged or fill materials into waters of the U.S., including wetlands. Section 404(b)(1) guidelines specifically requires that —no discharge of dredged or fill materials shall be permitted if there is a practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem, so long as the alternative does not have other significant adverse environmental consequences. Based on this provision, a project is required to evaluate alternatives and opportunities that would result in less adverse impacts on the aquatic ecosystem.

The Project would include modifications (including the discharge of fill material) to Corte Madera Creek, a water of the U.S., and as such, the Project would be subject to the requirements of Section 404. The USACE is responsible for ensuring compliance with Section 404(b)(1) guidelines of the CWA. A 404(b)(1) analysis is provided in Appendix O.

National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973

The National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973 were intended to reduce the need for large, publicly funded flood control structures and disaster relief by restricting development on floodplains. Federal Emergency Management Agency (FEMA) administers the National Flood Insurance Program to subsidize flood insurance to communities that comply with FEMA regulations limiting development in floodplains.

Water Resources Development Act of 1986

The Water Resources Development Act (WRDA) authorizes specific water resources projects. Section 904 identifies required considerations when developing alternative plans (part of Step 3 of the United States Army Corps of Engineers [USACE] Planning Process). These include National Economic Development (NED), environmental quality, the well-being of the people of the United States, the prevention of the loss of life, and the preservation of historic and cultural values.

Executive Order 11988, Floodplain Management

Executive Order 11988 requires federal agencies to avoid to the extent possible the long- and short-term adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative.

USACE Floodwall/Levee Design Criteria

All floodwalls included in the proposed Corte Madera Creek Flood Risk Management Project (Project) area are federally authorized and fall within the jurisdiction of USACE. The floodwall evaluation for the Project area conforms to the engineering criteria established by USACE for the assessment and repair of floodwalls. USACE technical criteria in the following list should be used as guidance unless noted otherwise.

- Overtopping of Flood Control Levees and Floodwalls (Publication USACE Engineer Technical Letter [ETL] 1110-2-299, August 22, 1986).
- Structural Design of Closure Structures for Local Flood Protection Projects (Publication EM 1110-2-2705, March 31, 1994).
- Design Guidance on Levees (Publication ETL 1110-2-555, November 30, 1997).
- Conduits, Culverts, and Pipes (Publication EM 1110-2-2902, March 31, 1998).
- Guidelines on Ground Improvement for Structures and Facilities (Publication ETL 1110-1-185, February 1, 1999).
- Engineering and Design for Civil Works Projects (Publication ER 1110-2-1150, August 31, 1999).
- Design and Construction of Levees (Publication EM 1110-2-1913, April 30, 2000).
- Geotechnical Investigations (Publication EM 1110-1-1804, January 1, 2001).
- Slope Stability (Publication EM 1110-2-1902, October 31, 2003).
- Geotechnical Levee Practice (Publication SOP EDG-03, June 28, 2004).
- Quality Management (Publication ER 1110-1-12, September 30, 2006).
- ETL 1110-2-571 Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures (April 10, 2009[a]).

Floodwall/levee height

Riverine floodwalls/levees must provide assurance by having added height above the water level that would occur in the design flood event. In this EIS/EIR analysis, the floodwalls were designed to contain the water surface in the 4 percent annual exceedance probability (AEP) flood event (i.e., 25-year flood event), plus an additional height for assurance. For the current phase of project development, the floodwalls were designed to provide an additional height of 3 feet for assurance. The final floodwall height would be determined in the final design based on risk and uncertainty analysis[10].

Earthquake Hazards Reduction Act

In October 1977, the U.S. Congress passed the Earthquake Hazards Reduction Act (EHR) to reduce the risks to life and property from future earthquakes in the United States through the establishment and maintenance of an effective earthquake hazards reduction program. To accomplish this goal, the act established the National Earthquake Hazards Reduction Program. This program was substantially amended in November 1990 by the National Earthquake Hazards Reduction Program Act, which refined the description of agency responsibilities, program goals, and objectives.

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[10] Risk and uncertainty (R&U) analysis entails analysis of the probability of containment of the design flood event (e.g., 4 percent AEP flood) for a given floodwall height, considering the uncertainties inherently existed in the flood frequency vs. discharge relationship and the stage vs. discharge relationship. The R&U analysis aims to optimize the floodwall height. The R&U analysis will follow the procedures from EM 1100-2-1619, Risk-Based Analysis for Flood Damage Reduction Studies (USACE 1976) and ER 1105-2-101, Risk Analysis for Flood Damage Reduction Studies (USACE 2006).

Seismic Hazards Mapping Act

The Seismic Hazards Mapping Act of 1990, under Public Resources Code (PRC) Section 2690-2699.6 addresses seismic hazards such as strong ground shaking, soil liquefaction (sudden loss of soil strength), and earthquake-induced landslides. This Act requires the State of California to identify and map areas that are at risk for these and other related hazards. Cities and counties are also required to incorporate the mapped seismic-hazard zones into their safety elements.

Clean Air Act

Requires that federal agencies ensure that their activities are in conformance with federally approved State Implementation Plans for geographical areas designated as “nonattainment” and “maintenance” areas under the Clean Air Act (CAA). An air quality analysis was conducted as part of this EIS/EIR. Appendix B provides the results of the air quality and greenhouse gas emissions. The analysis is summarized in Sections 4.4 and 4.5.

Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) of 1972, as amended (16 U.S.C. § 1451 et seq.) and the act’s implementing regulations, Federal Consistency with Approved Coastal Management Programs, 15 C.F.R. Part 930, requires federal agencies to analyze actions which have the potential to affect the coastal zone to be consistent to the maximum extent practicable with the enforceable policies of the approved coastal management program of respective state in which the project lies. Federal agencies prepare either a consistency determination, which is intended to show compliance to the maximum extent practicable with the state’s coastal management program’s enforceable policies, or a negative determination if impacts to the coastal zone would not occur.

In the San Francisco Bay, the San Francisco Bay Conservation and Development Commission has jurisdiction under the CZMA and regulates the bay’s coastal zone per the approved coastal zone management plan, the San Francisco Bay Plan (BCDC 1969, as amended). The Bay Plan identifies areas within the San Francisco Bay region for which BCDC has jurisdiction and policies to protect coastal resources. The Bay Plan specifies the areas within Corte Madera Creek which are under the jurisdiction of BCDC, these areas include:

“Corte Madera Creek in Marin County, to the downstream end of the concrete channel on Corte Madera Creek which is located at the U.S. Army Corps of Engineers Station No. 318 50 on the Corte Madera Creek Flood Control Project.”

The study area is just upstream of BCDC’s jurisdiction and only alternatives which have the potential to affect BCDC’s jurisdiction require compliance with the CZMA. Construction of alternatives A, B, G, and F would require a consistency determination because floodwalls would be installed within 100 feet of BCDC jurisdiction in the downstream portion of Unit 2. Alternative J, the proposed project, would not require a consistency determination because the all construction activities would be at least 700 feet upstream of the Bay Plan’s defined coastal zone and any in-water work would occur approximately 1 mile upstream of the coastal zone in waters that are not tidal. Appendix R provides USACE’s determination that the proposed action is outside of the coastal zone, would not affect the coastal zone, and therefore, does not require a consistency determination.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (FWCA) of 1934 (16 USC § 661 *et seq*.) ensures that fish and wildlife receive consideration equal to that of other project features for projects that are constructed, licensed, or permitted by federal agencies. The FWCA requires that the views of USFWS, National

Marine Fisheries Services (NMFS), and applicable state fish and wildlife agencies be considered when impacts are evaluated and mitigation needs determined. A Coordination Act Report, documenting the findings and recommendations of the reviewing agencies, is required before the Record of Decision is signed.

Based on fish and wildlife, including special-status species, and habitat known to exist within the study area, the Project would be subject to the requirements of the FWCA. A draft Coordination Act Report is provided in Appendix K.

Magnuson-Stevens Fishery Conservation and Management Act

The Magnuson-Stevens Fisheries Conservation and Management Act (MSA) of 1976 (16 USC § 1801 *et seq*.), as amended and reauthorized in 2007 by the Magnuson-Stevens Fisheries Conservation and Management Reauthorization Act (PL 109-479), promotes conservation and management of the nation's fishery resources. In addition, the MSA promulgated the term essential fish habitat (EFH) to ensure that fishery resources are managed through the regulation of EFH. The MSA defines EFH as "... those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." The terms in this definition have been further defined by the U.S. Pacific Fishery Management Council to include:

- aquatic habitat and associated physical, chemical, and biological properties that are used by fish (historically used areas may be included);
- sediment, stream substrates, instream structure, and associated biological communities;
- the habitat required to support a sustainable fishery including that particular species' place in a properly functioning ecosystem; and
- the habitat required to support a full life cycle for the species under consideration.

The NMFS consults with federal agencies under the MSA in a process similar and often parallel to the ESA Section 7 consultation. Because the Project would modify designated EFH within the study area (Units 2, 3, and 4), consultation with NMFS is required in conformance with the MSA. The USACE has completed an EFH assessment for salmonid EFH. The draft EFH assessment is provided in Appendix N.

Federal Endangered Species Act

The federal ESA of 1973 requires a federal agency authorizing, funding or carrying out a project within its jurisdiction to determine whether any federally listed threatened or endangered species may be present within a study area and determine whether the agency's action could affect any federally listed species. Threatened and endangered species (which are identified in 50 CFR §§ 17.11 and 17.12) are protected and prohibited from "take," defined as direct or indirect harm or harassment, unless an ESA Section 10 permit is granted to an entity other than the federal agency or a Biological Opinion with incidental take provisions is rendered to a federal lead agency via ESA Section 7 consultation. Pursuant to the requirements of the ESA, an agency reviewing the proposed project within its jurisdiction must determine whether any federally listed or proposed species may be present in the study area and determine whether the proposed project is likely to jeopardize the continued existence of such species or result in the adverse modification or destruction of the habitat for such species (16 USC § 1536[a]). Under the ESA, habitat loss is considered to be an impact to a species. Therefore, any project-related impacts to these species or their habitats would be considered significant and would require mitigation. As the study area contains habitat for known threatened and endangered species and such species have been historically documented within the study area, the Project would be subject to the requirements of the ESA. The USACE will request formal consultation with the NMFS and informal consultation with the USFWS following completion of the EIS/EIR comment period. A draft biological assessments are provided in Appendix N.

Migratory Bird Treaty Act

The Migratory Bird Treaty Act, which was first enacted in 1918, implements domestically a series of treaties between the United States and Great Britain (on behalf of Canada), Mexico, Japan, and the former Soviet Union that provide for international migratory bird protection. The Migratory Bird Treaty Act authorizes the Secretary of the Interior to regulate the taking of migratory birds; the Act provides that it shall be unlawful, except as permitted by regulations, "to pursue, take, or kill any migratory bird, or any part, nest or egg of any such bird" (16 USC § 703). This prohibition includes both direct and indirect acts, although harassment and habitat modification are not included unless they result in direct loss of birds, nests, or eggs. Currently several hundred species are protected under the Migratory Bird Treaty Act. The Act offers no statutory or regulatory mechanism for obtaining an incidental take permit for the loss of nongame migratory birds.

Based on the presence of potential nesting habitat for migratory bird species within the study area, it is anticipated that the Project would be subject to requirements of the Migratory Bird Treaty Act. As discussed in section 4.3.6.1 (AMM-BIO-1), migratory bird surveys will be conducted prior to construction and as necessary to protect migratory birds. To the extent feasible, tree removal will take place outside the migratory bird and raptor nesting period (February 1 through August 31 for most birds). If tree removal or construction must occur during the nesting season, a qualified wildlife biologist will conduct pre-maintenance surveys for raptors and nesting birds within suitable habitat within 300 feet of the worksite.

Executive Order 11990

Intended "to minimize the destruction, loss, or degradation of wetlands and to preserve and enhance the natural and beneficial values of wetlands." To meet this intent, Executive Order 11990 requires federal agencies, in planning their actions, to consider alternatives to wetland sites and limit potential damage if an activity affecting a wetland cannot be avoided.

National Historic Preservation Act

The National Historic Preservation Act of 1966 (16 USC § 470 *et seq*.) requires federal agencies to take into account the effects of a proposed action on properties that have been determined to be eligible for listing in, or are listed in, the National Register of Historic Places.

Section 106 of this Act requires that federal agencies having direct or indirect jurisdiction over a proposed federal, federally assisted, or federally licensed undertaking, prior to approval of the expenditure of funds or the issuance of a license, take into account the effect of the undertaking on any district, site, building, structure, or object included in or eligible for inclusion in the National Register of Historic Places (NRHP), and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment with regard to the undertaking. If archaeological deposits are found during project activities, work would be stopped. Discoveries would be assessed to determine the significance of the find as required under Section 106.

The Project would be subject to the requirements of the National Historic Preservation Act because of federal involvement. Historic resources in the study area include the Ross Town Hall and Firehouse. Correspondence with the State Historic Preservation Office is detailed in Appendix M.

Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act (NAGPRA) of 1990 (23 USC § 3002) requires federal agencies to (a) establish procedures for identifying Native American groups associated with cultural items on federal lands, (b) inventory human remains and associated funerary objects in federal possession, and (c) return such items upon request to the affiliated groups. The law also requires that any discoveries of cultural items covered by the NAGPRA be reported to the head of the federal entity, who would notify the appropriate Native American group.

In the event of an accidental discovery of a Native American grave, NAGPRA would apply to the Project.

Archaeological Resources Protection Act

The Archaeological Resources Protection Act of 1979 (16 United States Code [USC] § 470 *et seq*.) prohibits the removal, sale, receipt, and interstate transportation of archaeological resources obtained illegally (without permits) from public lands, and requires that an individual obtain an Archaeological Resources Protection Act permit from the lead federal agency prior to conducting an archaeological excavation on public lands. If archaeological deposits are found during project activities, the lead federal agency is responsible for protecting the archaeological deposit. Discoveries would be assessed to determine the significance of the find as required under Section 106 of the National Historic Preservation Act.

Based on historical archaeological records for the study area, it is not anticipated that project activities would result in the discovery of archaeological resources; however, the Project would be subject to the requirements of this act in the event that these resources were found during Project construction.

A Presidential Memorandum on Government-to-Government Relations (1994)

Directs federal agencies to operate within a government-to-government relationship with federally recognized Indian tribes.

Federal Occupational Safety and Health Act of 1970

Under authority granted in the Occupational Safety and Health Act of 1970, the Occupational Safety and Health Administration (OSHA) assures safe and healthful working conditions by setting and enforcing standards and by providing training, outreach, education and assistance. OSHA has set standards for all facets of work conditions, including for safety-related personal protective equipment, heat exposure, toxic chemical handling and exposure, noise exposure, and working at heights.

Noise Control Act of 1972

Addresses the risk of noise pollution by promoting research, standards, and public education for noise pollution. The USEPA has established general guidelines for noise levels in sensitive areas in order to provide State and/or local governments' guidance in establishing local laws, ordinances, rules, or standards.

29 CFR 1926.52 (b) and 1926.52 (d)(1)

29 CFR 1926.52 (b) and 1926.52 (d)(1) establish noise thresholds for which administrative or engineering controls must be utilized and determine when a continuing, effective hearing conservation program shall be administered.

Executive Order 12898

Executive Order 12898 was issued on February 11, 1994. This order requires federal actions to address environmental justice in minority populations and low-income populations. This order requires federal agencies to identify and address disproportionately high and adverse human health and environmental effects of federal programs, policies, and activities on minority and low-income populations. As the federal sponsor of the proposed Project, the USACE must consider how the project might affect minority and low-income populations.

9.2 State Regulations

California Environmental Quality Act

The California Environmental Quality Act (CEQA) of 1973 (PRC Section 21000 et seq.) establishes requirements similar to those of National Environmental Policy Act (NEPA) for considering environmental impacts and alternatives and for preparing an EIR prior to implementing applicable projects. The CEQA Guidelines (PRC Section 15000 et seq.) provide further guidance on the application of the CEQA.

The CEQA requires that significant environmental impacts be mitigated to a level of insignificance or to the maximum extent feasible. If full mitigation is not feasible, the state lead agency must make a finding of overriding considerations before approving the project. The CEQA requires full consideration of impacts to biological resources, including effects on endangered, threatened, or rare plant or wildlife species, effects on the habitat of such species, effects on wetlands, and conflicts with policies or ordinances protecting biological resources.

In addition to providing an overarching environmental review requirement, the CEQA also directs agencies to make additional considerations for special-status species and historic and unique archaeological resources.

Porter-Cologne Water Quality Control Act

The Porter-Cologne Water Quality Control Act of 1969 (California Water Code § 13000 *et seq*.) requires projects that are discharging or proposing to discharge wastes that could affect the quality of the State's water to file a Report of Waste Discharge with the appropriate RWQCB. This act also implements, on a State-level, the federal NPDES program requirements pertaining to construction site erosion and sedimentation control. NPDES permits, issued by RWQCBs pursuant to the CWA, also serve as Waste Discharge Requirements (WDR) issued pursuant to the Porter-Cologne Act. Generally, WDRs are issued for discharges that are exempt from the CWA NPDES permitting program, discharges that may affect waters of the State that are not waters of the U.S. (i.e., groundwater), and/or wastes that may be discharged in a diffused manner. WDRs are established and implemented to achieve the water quality objectives for receiving waters as established in the RWQCB basin plans.

As the Project would involve modifications to Corte Madera Creek, and may involve discharges into the creek during construction, the Project would be subject to the requirements of this Act. The non-federal sponsor will apply for a waste discharge requirement, which will be included in the CWA 401 certification.

Department of Water Resources Urban Levee Design Criteria

Pursuant to SB 5 (Government Code [GC] §65007[l]), the Urban Levee Design Criteria (ULDC 2012) define the urban level of flood protection as the level of protection that is necessary to withstand flooding that has a 1-in-200 chance of occurring in any given year using criteria consistent with, or developed by the Department of Water Resources (DWR). While cities and counties located outside of the Sacramento–San Joaquin Valley are not required to make findings related to the urban level of flood protection, the Urban Levee Design Criteria can help inform engineering and local land use decisions for areas at risk of flooding anywhere in California. The Urban Levee Design Criteria was developed through a collaborative process with stakeholders from local government (including representatives from the Central Valley, San Francisco Bay Area, and Los Angeles Region), State Government, and the Federal Government.

2007 San Francisco Bay RWQCB Basin Plan

Describes the water quality control measures that contribute to the protection of the beneficial uses of the San Francisco Bay watershed. The Basin Plan identifies beneficial uses for each segment of the San Francisco Bay and its tributaries, water quality objectives for the reasonable protection of the uses, and an implementation plan for achieving these objectives.

Alquist-Priolo Earthquake Fault Zoning Act

The Alquist-Priolo Special Studies Act was signed into law in 1972 (in 1994 it was renamed the Alquist-Priolo Earthquake Fault Zoning Act). The primary purpose of the Act is to mitigate the hazard of fault rupture by prohibiting the location of structures for human occupancy across the trace of an active fault. This state law was passed in direct response to the 1971 San Fernando earthquake, which was associated with extensive surface fault ruptures that damaged numerous homes, commercial buildings, and other structures. Surface rupture is the most easily avoided seismic hazard. The act requires the state geologist to delineate "Earthquake Fault Zones" along faults that are "sufficiently active" and "well defined." The Act dictates that cities and counties withhold development permits for sites within an Earthquake Fault Zone until geologic investigations demonstrate that the sites are not threatened by surface displacements from future faulting. No portion of study area is within an Alquist-Priolo Earthquake Fault Zone.

California Clean Air Act

The California Clean Air Act (CCAA) of 1988 (California Health and Safety Code § 40910 *et seq*.) required California Air Resources Board (ARB) to establish California Ambient Air Quality Standards (CAAQS) for sulfates, hydrogen sulfide, vinyl chloride, visibility-reducing particulate matter, and criteria air pollutants. The CCAA requires that all local air districts in the state endeavor to achieve and maintain the CAAQS by the earliest practical date, and gives districts the authority to regulate indirect sources of emissions. The CAAQS represent more stringent standards than the National Ambient Air Quality Standards (NAAQS). The Bay Area Air Quality Management District (BAAQMD) has responded to this requirement by preparing a sequence of O_3 Attainment Plans and Clean Air Plans that comply with the CAA and the CCAA to accommodate growth, reduce pollutant levels in San Francisco Bay Area Air Basin, meet NAAQS and CAAQS, and minimize the fiscal impact that pollution control measures have on the local economy.

California Global Warming Solutions Act

The California Global Warming Solutions Act (Assembly Bill [AB] 32) of 2006 (California Health and Safety Code § 38500 *et seq*.) requires ARB to develop and enforce regulations for the reporting and verification of statewide greenhouse gases (GHG) emissions.

Senate Bill 97

Requires the California Governor's Office of Planning and Research to prepare amendments to the CEQA Guidelines regarding the effects of GHG emissions as required by CEQA and the formulation of feasible mitigation measures for GHG emissions.

OPR Technical Advisory on CEQA and Climate Change

In 2008, OPR published a technical advisory on CEQA and climate change, providing OPR's perspective on the emerging role of CEQA in addressing climate change and GHG emissions, while recognizing that approaches and methodologies for calculating GHG emissions and addressing environmental impacts through CEQA review are rapidly evolving.

In 2009, amendments submitted by OPR were certified, representing relatively modest changes to various portions of existing CEQA Guidelines.

The amendments include a new section to assist lead agencies in determining the significance of GHG impacts by quantifying emissions, where possible, and recommend consideration of several other qualitative factors that may be used in determination of significance including:

1. The extent to which the project may increase or reduce GHG emissions as compared to the existing environmental setting;
2. Whether the GHG emissions exceed a threshold of significance that the lead agency determines applies to the project; and
3. The extent to which the project complies with regulations or requirements adopted to implement a statewide, regional, or local plan for the reduction or mitigation of GHG emissions. Such requirements must be adopted by the relevant public agency through a public review process and must reduce or mitigate the project's incremental contribution of GHG emissions.

The amendments include a new subdivision 15064.7(c) to clarify that in developing thresholds of significance, a lead agency may appropriately review thresholds developed by other public agencies, including ARB's recommended CEQA thresholds, or suggested by other experts, such as the California Air Pollution Control Officers Association, so long as any threshold chosen is supported by substantial evidence. BAAQMD has recently adopted thresholds which were used for Project analysis.

California Endangered Species Act of 1984

California Endangered Species Act (CESA) regulates the listing and take of endangered and threatened species through a permit process that is administered by the California Department of Fish and Wildlife (CDFW). The CESA is similar to the Federal Endangered Species Act (ESA) but pertains only to species state-listed as Endangered and Threatened. For projects sponsored by state or local agencies and being reviewed under the CEQA, the CESA directs the state and/or local agencies to consult with the CDFW on projects or actions that could affect listed species, directs the CDFW to determine whether jeopardy to listed species would occur, and allows the CDFW to identify "reasonable and prudent alternatives" to the project consistent with conserving the species. Agencies can approve a project that affects a listed species if the agency determines that there are "overriding considerations"; however, the agencies are prohibited from approving projects that would cause the extinction of a listed species.

Streambed Alteration Agreements (Fish and Game Code Section 1600)

Defines the responsibilities of the CDFW and the requirement for public and private applicants to obtain an agreement to "divert, obstruct, or change the natural flow or bed, channel, or bank of any river, stream, or lake designated by the CDFW in which there is at any time an existing fish or wildlife resource or from which those resources derive benefit, or will use material from the streambeds designated by the department." The federal government is not subject to this code; however, the local sponsor may be required to obtain a Streambed Alteration Agreement for the Project.

Assembly Bill No. 52

The bill requires a lead agency to begin consultation with a California Native American tribe that is traditionally and culturally affiliated with the geographic area of the proposed project, if the tribe requested to the lead agency, in writing, to be informed by the lead agency of proposed projects in that geographic area and the tribe requests consultation, prior to determining whether a negative declaration, mitigated negative declaration, or environmental impact report is required for a project.

California Health and Safety Code

Section 46061: The office shall provide technical assistance to local agencies in combating noise pollution. Such assistance shall include but not be limited to:

- Advice concerning methods of noise abatement and control.
- Advice on training of noise control personnel.
- Advice on selection and operation of noise abatement equipment.

Section 46062: The office shall provide assistance to local agencies in the preparation of model ordinances to control and abate noise. Such ordinances shall be developed in consultation with the Attorney General and with representatives of local agencies, including the County Supervisors Association of California and the League of California Cities. Any local agency which adopts any noise control ordinance shall promptly furnish a copy to the office.

Government Code section 11135, subdivision (a)

Though not specific to environmental justice, GC section 11135, subdivision (a) can apply to environmental justice in certain circumstances.

> *"No person in the State of California shall, on the basis of race, national origin, ethnic group identification, religion, age, sex, sexual orientation, color, or disability, be unlawfully denied full and equal access to the benefits of, or be unlawfully subjected to discrimination under, any program or activity that is conducted, operated, or administered by the State or by any State agency, is funded directly by the State, or receives any financial assistance from the State…."*

Local agencies must adhere to this environmental justice regulation when qualifying circumstances occur, such as funding of a project by a government source (Department of Justice 2012).

Integrated Waste Management Act of 1989 (AB 939)

The California Integrated Waste Management Act of 1989 established a state-wide goal of reducing the amount of solid waste being sent to the state's landfills by 50%, through planning and implementation of source reduction, recycling, and composting programs by local agencies. Subsequent legislation has increased the landfill diversion goal and the scope of waste types addressed by the law.

9.3 Regional and Local Regulations

9.3.1 Marin Countywide Plan

The Marin Countywide Plan guides the conservation and development of Marin County. The Marin Countywide Plan identifies the following goals:

- **A Preserved and Restored Natural Environment.** Marin watersheds, natural habitats, wildlife corridors, and open space will be protected, restored, and enhanced.
- **A Sustainable Community.** Marin's working agricultural landscapes will be protected, and the agricultural community will remain viable and successfully produce and market a variety of healthy foods and products.
- **A High-Quality Built Environment.** Marin's community character, the architectural heritage of its downtowns and residential neighborhoods, and the vibrancy of its business and commercial centers will be preserved and enhanced.
- **More Affordable Housing.** Marin's members of the workforce, the elderly, and special needs groups will have increased opportunities to live in well-designed, socially and economically diverse

affordable housing strategically located in mixed-use sites near employment or public transportation.

- **Less Traffic Congestion.** Marin community members will have access to flexible work schedules, carpools, and additional transportation choices for pedestrians, bicyclists, and transit users that reduce traffic congestion.
- **A Vibrant Economy.** Marin's targeted businesses will be clean, be prosperous, meet local residents' and regional needs, and provide equal access to meaningful employment, fair compensation, and a safe, decent workplace.
- **A Reduced Ecological Footprint.** Marin residents and businesses will increasingly use renewable energy, fuel efficient transportation choices, and green building and business practices similar to the level of Western Europe.
- **Collaboration and Partnerships.** Marin public agencies, private organizations, and regional partners will reach across jurisdictional boundaries to collaboratively plan for and meet community needs.
- **A Healthy and Safe Lifestyle.** Marin residents will have access to a proper diet, health care, and opportunities to exercise, and the community will maintain very low tobacco, alcohol, drug abuse, and crime rates.
- **A Creative, Diverse, and Just Community.** Marin will celebrate artistic expression, educational achievement, and cultural diversity, and will nurture and support services to assist the more vulnerable members of the community.
- **A Community Safe from Climate Change.** Marin will be a leader in averting and adapting to all aspects of climate change.

The Marin Countywide Plan outlines the goals and policies for the County into three sections: the Natural Systems and Agriculture Element, the Built Environment Element, and the Socioeconomic Element. The specific policies and goals within these elements applicable to the Project are discussed previously under each resource section.

9.3.2 Town of Ross General Plan

The Town of Ross General Plan outlines the goals of the community and guides development. The Town of Ross Goals are as follows:

- Goal 1 An Abundance of Green and Healthy natural Systems
- Goal 2 Sustainable Building and Community Practices
- Goal 3 Design with Nature, Neighborhood, and Community
- Goal 4 Protect Historic Places and Resources
- Goal 5 Protect Community Health and Safety, and Preparing for Emergencies
- Goal 6 Protect Creek Habitat and Reducing Flooding Hazards
- Goal 7 Safe, Connected and Well-Maintained Streets, Pedestrian and Bicycle Routes
- Goal 8 Beautiful, Safe and Close-knit Community
- Goal 9 Excellence of Community Stewardship
- Goal 10 Provision of Affordable Housing Opportunities
- Goal 11 Implement the Ross General Plan

The specific policies applicable to the Project are discussed previously under each resource section.

9.3.3 Other Local Regulations

Marin Climate Action Plan

The Marin County Climate Action Plan 2015 Update (Marin County 2015), builds on the County's 2006 GHG Reduction Plan and provides an update of GHG emissions in 2012, forecasts of emissions for 2020, and an assessment of actions that the County will take to further reduce emissions by 2020. The update includes two targets: reduce GHG emissions from community activities in the unincorporated areas of Marin County by at least 30 percent below 1990 levels by 2020; and reduce GHG emissions from the County's municipal activities by at least 15 percent below 1990 levels by 2020. The update includes a variety of regulatory and incentive-based strategies that aim to reduce GHG emissions from both existing and new development in the County, supplement State programs, and achieve additional emissions reductions. There are 15 local community actions and 8 local municipal actions included in the update.

Marin Sea Level Rise

Marin Sea Level Rise has initiated the BayWAVE project, a focused vulnerability assessment of the eastern Marin shoreline from the Golden Gate Bridge to the northern end of Novato. BayWAVE will evaluate the extent of impacted assets, assess the sensitivity and adaptability of selected assets and work with the local cities and towns to plan implementation of adaptation strategies. BayWAVE is an early action to begin the adaptation planning along the shoreline, including coordination with Marin Multi-Jurisdictional Hazard Mitigation Planning team on flood warnings, an adaptation toolkit to explain how the various engineering solutions work, and lastly, a summary of several ongoing feasibility studies to integrate flood protection, sea level rise, and habitat in Novato, Santa Venetia, and Richardson Bay. BayWAVE is a long-term planning effort, expected to continue planning and response based on the vulnerability assessment.

Town of Ross Noise Ordinance

This Ordinance establishes the following regulation for construction-related noise:

> It is unlawful for any person or construction company within the town limits to perform any construction operation before 8 am or after 5 pm, Monday through Friday of each week and not at any time on Saturday, Sunday, or the other holidays listed in Section 9.20.060.

9.4 Areas of Controversy and Unresolved Issues

9.4.1 Areas of Controversy

The public scoping period extended from December 23, 2015, to March 1, 2016. On January 28, 2016, a scoping meeting was held in the Town of Ross. Oral comments were received at the scoping meeting, and additional written comments were received at and following the meeting. The main areas of controversy included:

1. Community perception of floodwalls on private property
2. Traffic Impacts along Sir Francis Drake Boulevard
3. Potential vegetation removal for floodwalls per the USACE guidance - ETL 1110-2-583, *Guidelines for Landscape Planting and Vegetation Management at Levees, Floodwalls, Embankment Dams, and Appurtenant Structures*, April 2014.

4. Single Purpose Authorization of the Congressional authorization around considering only single purpose, flood reduction measure and not the other ecological and environmental benefits of the project such as the Riparian Corridor.
5. Increased flood risk downstream of project sites.
6. Adequate passage and habitat for enhanced fish species

9.4.2 Unresolved Issues

Refinements to the Tentatively Selected Plan's construction cost:

The TSP's construction cost estimate needs refinement to better represent utility relocation and the potential for flood wall pumps stations to prevent the accumulation of water during a flood event. The relocation of the sanitary sewer line, which intersects with the fish ladder and Allen Park Riparian Corridor, have not been factored into the current cost estimate. Similarly, pump stations are also not in the cost estimate and the project team has not performed an interior drainage analyses to determine if there is a need.

Floodwall Heights of the Tentatively Selected Plan:

USACE has not completed a Risk and Uncertainty Analysis to determine the exact heights of floodwalls, and thus the heights could change after the analysis is complete. Furthermore, Unit 4 does not include floodwalls in the Lagunitas Bridge area as it has a bypass culvert structure. Depending on the final design of the culverts and the Risk and Uncertainty Analysis, some vegetation removal within the creek channel may be needed within Unit 4 to achieve the desired level of assurance (e.g. 4 percent APE) without the presence of a floodwall.

Construction of the Underground Bypass

Construction methodology of the bypass under Sir Francis Drake Boulevard has not yet been determined. Sir Francis Drake Boulevard is a main thoroughfare so several approaches are being considered to address traffic impacts. The underground bypass may be constructed of three parallel box culverts, which would reduce the trench size needed, reducing the amount of road requiring closure. Alternatively, the box culverts could be installed at night, limiting full road closure to nighttime construction hours, 8 pm to midnight. Temporary shoring, excavation, backfilling, and utility relocation would still occur during the daytime construction hours, 8 am to 5 pm. Although night work would reduce traffic impacts, it would cause additional noise impacts during sensitive times. Construction methodology of the underground bypass would be determined during PED.

Geotechnical Risks for Bypass Construction

Several borings from a geotechnical investigation along the left bank encountered shallow bedrock. The use of a temporary shoring system will need to be evaluated as sheet piles may not be sufficient to excavate to the depths currently anticipated for the bypass. Additional geotechnical investigations will be needed to better understand the subsurface soil and rock characteristics along the bypass alignment. This could have significant cost impacts during Project construction.

Vegetation Variance along Floodwalls

The riparian habitat impact analysis is conservative and addresses the loss to riparian habitat assuming a 15-foot buffer without a variance. ETL 1110-2-583 provides USACE design policy for vegetation near levees, dams, and floodwalls. Vegetation policy guidance letters (October 2017) indicate that vegetation variances may be granted in cases where the flood safety risks of the vegetation do not outweigh the benefits of allowing non-policy compliant vegetation. A risk analysis will be performed for Corte Madera Creek prior to PED and results of those findings will be included in the final design to assess compliance with ETL 1110-2-583. This will determine to what extent riparian vegetation could be restored at Frederick Allen Park Riparian Corridor within 15 feet of floodwalls.

Sir Francis Drake Boulevard Rehabilitation Project and Bypass Construction

Kittle Creek is an intermittent stream that drains under Sir Francis Drake Boulevard near the Lagunitas Road Bridge. The Sir Francis Drake Boulevard Rehabilitation Project will alter the drainage of Kittle Creek and likely construct a culvert beneath the road. Because a culvert and bypass would be constructed beneath Sir Francis Drake Boulevard, coordination during Project design would be required. Many cumulative impacts could be avoided to resources evaluated in this EIS/EIR if the Sir Francis Drake Boulevard rehabilitation project and the bypass were designed and constructed together.

9.5 Permitting

Table 9-1 presents the status of National Environmental Policy Act (NEPA) compliance for the Project.

TABLE 9-1 NEPA COMPLIANCE

NEPA Compliance	Status
Public Release of Draft EIS/EIR	Scheduled – October 2018
Draft USFWS Coordination Act Report	Ongoing- October 2018
404(b)(1)	Ongoing – September 2018
Clean Air Act	Ongoing – September 2018
SHPO Section 106 Consultation	Ongoing – Fall 2018
ESA Consultation	Ongoing – Fall 2018
Essential Fish Habitat	Ongoing – Fall 2018
401 Water Quality Certification	Deferred Until Preconstruction Engineering and Design

Section 404(b)(1) (Clean Water Act [CWA]) consultations are ongoing, however the USACE and District expect that Alternative J - 4 percent AEP (25-year) will be the least environmentally damaging practicable alternative with federal interest. Active ongoing coordination with both NMFS and the RWQCB has been favorable with strong support for Alternative J in particular with the Allen Park Floodplain Riparian Corridor feature.

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The individuals listed in the following table were primarily responsible for preparation of this report.

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APPENDICES