prepared by a qualified archaeologist for all significant archaeological sites that will be directly affected if the sites cannot be avoided. Data recovery will only occur in the portion of the site being directly affected.

- **Mitigation Measure CUL-3: Construction Monitoring.** A Cultural Resources Construction Monitoring Plan will be developed prior to construction. An archaeological monitor will be onsite during construction activities to identify significant features and human remains. Prior to construction, construction personnel will be instructed on the protection and avoidance of cultural resources.

- **Mitigation Measure CUL-4: Unanticipated Discovery of Cultural Resources.** If previously unidentified cultural materials are unearthed during construction, it is Caltrans' policy that work will be halted in that area until a qualified archaeologist can assess the significance of the find. Additional archaeological survey will be needed if project limits are extended beyond the present survey limits.

- **Mitigation Measure CUL-5: CEQA-Specific Mitigation.** As described in Section 3.2.3, additional Mitigation Measures are required for significant impacts under CEQA.

2.2 Physical Environment

2.2.1 Hydrology and Floodplain

REGULATORY SETTING

EO 11988 (Floodplain Management) directs all federal agencies to refrain from conducting, supporting, or allowing actions in floodplains unless it is the only practicable alternative. FHWA requirements for compliance are outlined in 23 CFR 650 Subpart A.

To comply, the following must be analyzed:

- The practicability of alternatives to any longitudinal encroachments

- Risks of the action

- Impacts on natural and beneficial floodplain values

- Support of incompatible floodplain development
- Measures to minimize floodplain impacts and to preserve/restore any beneficial floodplain values affected by the project

The base floodplain is defined as "the area subject to flooding by the flood or tide having a one percent chance of being exceeded in any given year." An encroachment is defined as "an action within the limits of the base floodplain."

AFFECTED ENVIRONMENT

Hydrology and hydraulic information for this section was provided from the Floodplain Evaluation Report prepared for the project (Caltrans 2015c). The Floodplain Evaluation Report incorporates information from the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) for Sonoma County. The Floodplain Evaluation Report also incorporates information from United States Geological Survey (USGS) topographic maps, aerial photograph maps, and a site visit and includes a Floodplain Evaluation Report Summary that is discussed further below and presented in Appendix H.

The hydrologic study area is the watershed studied in the Floodplain Evaluation Report and discussed in the following section. The hydrologic study area includes Scotty Creek, its water surface elevation, and the watershed within which the proposed Alternatives 19A, 19B and 20 lie. The hydrologic study area also includes the Pacific Ocean at the public beach where Scotty Creek terminates and the wetlands that intersect or are adjacent to SR 1.

Hydrology and Hydraulics

The proposed project is within FEMA FIRM Panel 665 of 1150, Sonoma County, California and Incorporated Areas (06097C0665E), effective December 2, 2008. The FIRM shows that the proposed project site is located in unshaded Zone X (Figure 2-25). Unshaded Zone X represents an area with minimal flood hazard, which is outside the special flood hazard area and higher than the 500-year flood. Flood insurance is not required for properties in unshaded Zone X, and local floodplain zoning ordinances do not apply to unshaded Zone X. The beach adjacent to the endpoints of the new alignment is classified as Zone V. Zone V represents coastal areas in contact with the ocean subject to inundation by the 100-year flood event with additional hazards associated with storm-induced waves. The proposed project does not fall within the Zone V areas. No federal flood insurance requirements are associated with Scotty Creek or the Scotty Creek floodplain.

A portion of the northwestern part of the project area, adjacent to a drainage feature where the ground elevation is greater than the floodplain elevation, is located within the 100-year designated floodplain.

Tidal Exchange

In the existing condition, Scotty Creek is not tidally influenced on a regular basis because the flowline of the existing reinforced-concrete box culverts is too high. The flowline elevation of the reinforced-concrete box culverts is approximately 7.9 feet and the mean higher high water is at elevation 5.7 feet (North American Vertical Datum). The higher high water is the higher of the two high waters of any tidal day, and the mean higher high water is the average of the higher high water height of each tidal day observed. However, during higher tide events, the creek is tidally influenced. The proposed Build Alternatives would remove the restriction of flow between the creek and the ocean due to the existing embankment, which would re-establish full tidal exchange. This re-establishment of full tidal exchange is not expected to change the limits of the floodplain, and the tide is expected to be maintained within the banks of the existing creek, so no effects to surrounding areas or properties are anticipated. The proposed improvements would maintain the overall existing drainage pattern of the area.

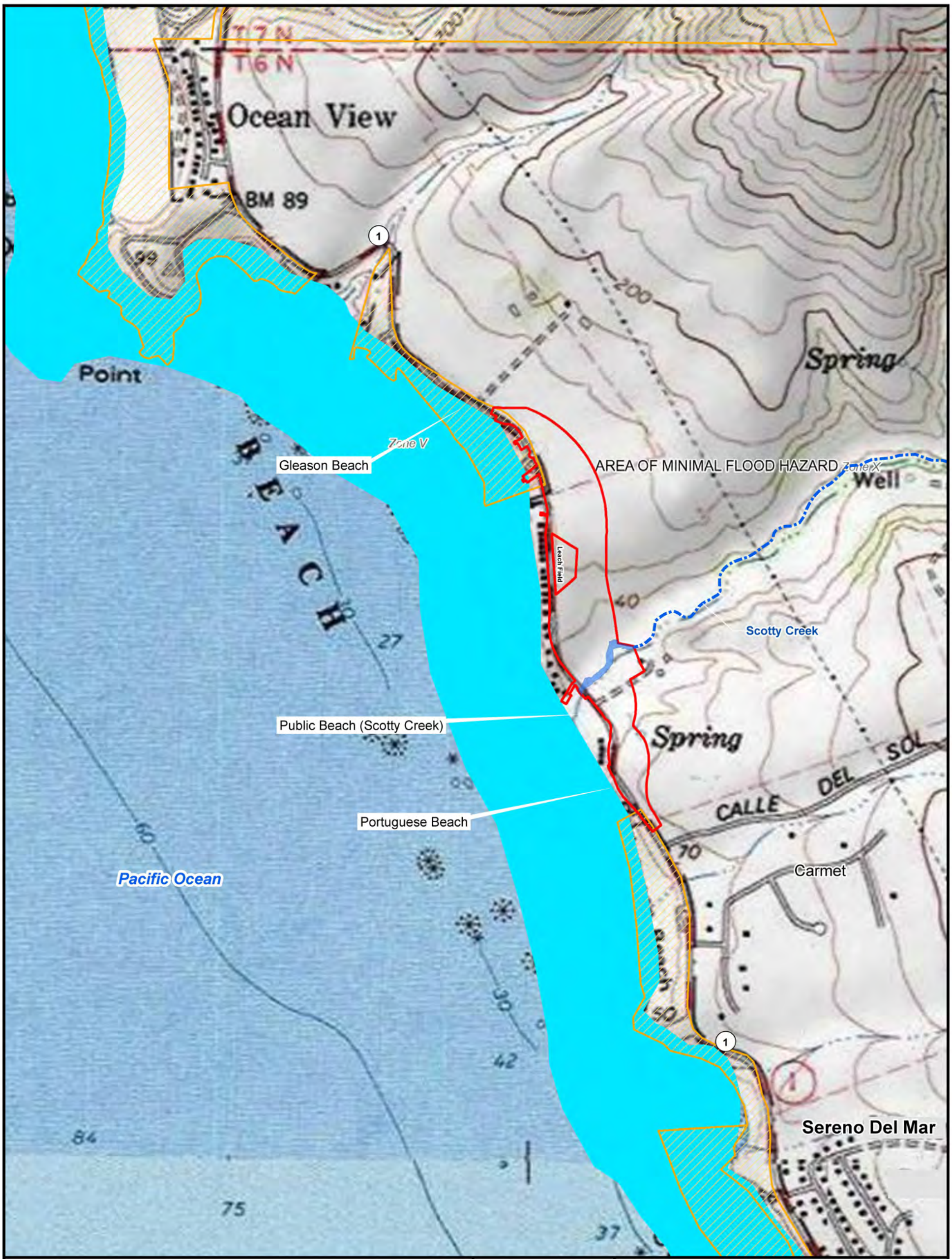
Tsunamis

A tsunami is a series of waves generated in a body of water by a rapid disturbance that vertically displaces the water. These changes can be caused by an underwater fault rupture (that generates an earthquake) or underwater landslides (typically triggered by earthquakes). Based upon the Tsunami Inundation Map for Coastal Evacuation (California Emergency Management Agency 2009), approximately 6 acres adjacent to and along Scotty Creek are located in a tsunami inundation area.

ENVIRONMENTAL CONSEQUENCES

The Floodplain Evaluation Report Summary, located in Appendix H, addresses the analysis that is required to comply with EO 11988. A “significant encroachment” as defined in 23 CFR 650.105 is a highway encroachment and any direct support of likely base floodplain development that would involve one or more of the following construction or flood-related effects:

- A significant risk (to life or property).



LEGEND

- Environmental Impact Report / Environmental Assessment Study Area
- Sonoma Coast State Park
- 100 Year Flood Zones

Service Layer Credits: Copyright:© 2013 National Geographic Society, i-cubed

N

0 750
Feet

Caltrans

FIGURE 2-25
FEDERAL EMERGENCY MANAGEMENT AGENCY FLOOD INSURANCE RATE MAP
Gleason Beach Roadway Realignment Project
Environmental Impact Report / Environmental Assessment
State Route1
Post Mile 15.1-15.7, EA 0A0200
Sonoma County, California

BAOFPP01 C:\PROJ\CALTRANS\666239_D4ENVONCALL2015-2018\TO6_GLEASONBEACH\GIS\MAPFILES\2016\EIR\MARCH\FIG2-16_FEMA.MXD 3/14/2016 12:54:28 PM

- The practicability of alternatives to any longitudinal encroachments.
- Support of incompatible floodplain development.
- A significant potential for interruption or termination of a transportation facility that is needed for emergency vehicles or provides a community's only evacuation route.
- A significant adverse effect on natural and beneficial floodplain values. Natural and beneficial floodplain values include fish, wildlife, plants, open space, natural beauty, scientific study, outdoor recreation, agriculture, aquaculture, forestry, natural moderation of floods, water quality maintenance, and groundwater recharge.

No-Build Alternative

Under the No-Build Alternative, the proposed project would not be implemented. Disruption of utilities and effects on roadway and emergency services resulting from flooding and erosion of transportation facilities during and after extreme storm events would be adverse and would continue.

Build Alternatives

Construction and Operation Phase

Under all Build Alternatives during Construction and Operation Phases, the proposed project would remove the restriction of tidal flow between the creek and ocean due to the existing embankment, which would re-establish full tidal exchange. This obstruction is discussed previously in the Tidal Exchange section. Because the changes in flow velocities are insignificant, the proposed project provides benefits to fish passage because the existing reinforced-concrete box culverts are a fish barrier.

The proposed project would therefore restore the Scotty Creek estuary closer to its previous natural condition. No long-term adverse effects to the natural and beneficial floodplain values are anticipated.

The existing roadway is identified as within a tsunami inundation area, and the proposed project would not change this tsunami inundation condition. There would be no change in potential effects from tsunamis and the proposed project would result in no effect relative to tsunamis (because tsunamis are unpredictable, tsunamis are not a factor incorporated into project design).

The proposed project would not change the amount of fill within the floodplain and the overall 100-year water surface elevation would decrease because of the proposed project. Therefore, alternatives to longitudinal encroachment are not proposed.

The proposed project would have no traffic interruptions from the base flood. The proposed bridge would have 6.4 feet of freeboard over the current 100-year Scotty Creek water surface elevation and therefore is not expected to have traffic interruptions because of the base flood.

The proposed project would not create new access to developed or undeveloped lands; therefore, the proposed project would not support incompatible floodplain development effects on the 100-year floodplain.

The potential flood risks associated with implementation of the Build Alternatives 19A, 19B and 20 include change in land use.

Land Use

The Build Alternatives 19A, 19B and 20 propose relocating SR 1 several hundred feet eastward and inland of the current alignment. This would result in land that is currently undeveloped being used for the construction of the new roadway. The existing roadway embankment would be removed. No other changes in land use are proposed. There would be no added risk due to changes in land use.

Fill

The proposed project would result in a net decrease of fill within Scotty Creek, which would decrease the overall 100-year water surface elevation of the creek. Therefore, the proposed project would result in a beneficial change from the existing condition, and no fill effects are expected from the proposed project.

Impervious Area

The proposed project would result in a maximum net increase of approximately 3.6 acres of impervious area (see Table 2-13, Alternative 19B). This increase of impervious area is insignificant relative to the size of the existing watershed (2,750 acres or 4.3 square miles]), a maximum increase of approximately 0.13 percent. Therefore, the risk of increased flow volume and velocities from the proposed project is insignificant. Additionally, vegetative measures, such as biofiltration strips and swales, or unlined vegetative ditches would be considered to decrease flow velocities and volumes by promoting infiltration, evapotranspiration, and retention of runoff.

Table 2-13 Proposed Project Added Impervious Areas

Watershed	Alternative 19A		Alternative 19B		Alternative 20	
	Net AIA (acres)	Compared to Watershed (%)	Net AIA (acres)	Compared to Watershed (%)	Net AIA (acres)	Compared to Watershed (%)
Scotty Creek	1.5	0.05	1.5	0.05	1.4	0.05
Pacific Ocean	2.0	0.07	2.1	0.08	1.6	0.06
Total	**3.5**	**0.12**	**3.6**	**0.13**	**3.0**	**0.11**

Note:
AIA = added impervious area

Water Surface Elevation

The current reinforced-concrete box culverts are overtopped by the 100-year water surface elevation. The proposed bridge would have a freeboard of 6.4 feet for the 2012 100-year event and a freeboard of 1.1 feet for the 2100 100-year event with sea level rise (SLR) of 4.6 feet. The Floodplain Evaluation Report prepared for the proposed project (Caltrans 2015c) concluded that the 100-year water surface elevation is decreased by 3.6 feet upstream of the existing reinforced-concrete box culverts for the entire extent of the model in the 2012 condition and by an insignificant amount in the 2100 condition with SLR. Therefore, the risk due to flooding would not increase because of the proposed project.

Roadway Hydraulics

The general drainage pattern of the proposed project is from east to west. The realignment of the existing SR 1 roadway would require that existing drainage facilities be removed, abandoned, or modified, and that new drainage facilities be constructed. Existing cross culverts would be modified, replaced in kind, or added to maintain the overall hydrology of the area by conveying flows from areas outside of the proposed project to Scotty Creek and the ocean. Current planned improvements within the proposed project area and roadway include construction of a long roadway embankment in the path of stormwater flow, long lengths of ditch and culvert, and a downdrain system that is intended to alter natural drainage patterns in order to slow the pace of erosion. While these drainage improvements would alter or modify the local drainage pattern in the project area, the project would maintain the overall drainage pattern of discharging to Scotty Creek and the ocean. Because of proposed drainage improvements, the proposed project would have no adverse effect on

existing drainage patterns in the project vicinity and there would be no significant encroachment to the base floodplain.

AVOIDANCE, MINIMIZATION, AND/OR MITIGATION MEASURES

Under all Build Alternatives, no adverse effects would result to the floodplain and hydrologic study area; therefore, no avoidance, minimization, or mitigation measures are proposed related to flooding hazards.

2.2.2 Water Quality and Stormwater Runoff

REGULATORY SETTING

Federal Requirements: Clean Water Act

In 1972, Congress amended the Federal Water Pollution Control Act (also known as Clean Water Act [CWA]), making the addition of pollutants to the waters of the U.S. from any point source[3] unlawful unless the discharge is in compliance with a National Pollutant Discharge Elimination System (NPDES) permit. The goal of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." This act and its amendments are known today as the CWA. Congress has amended the act several times. In the 1987 amendments, Congress directed dischargers of stormwater from municipal and industrial/construction point sources to comply with the NPDES permit scheme. The following are important CWA sections:

- Sections 303 and 304 require states to issue water quality standards, criteria, and guidelines.
- Section 401 requires an applicant for a federal license or permit to conduct any activity that may result in a discharge to waters of the U.S. to obtain certification from the state that the discharge would comply with other provisions of the act. This is most frequently required in tandem with a Section 404 permit request (see below).
- Section 402 establishes the NPDES, a permitting system for the discharges (except for dredge or fill material) of any pollutant into waters of the U.S. The State Water Resources Control Board (SWRCB) administers this permitting program in California. Section 402(p) requires permits for discharges of stormwater from industrial/construction and municipal separate storm sewer systems (MS4s).

[3] A point source is any discrete conveyance, such as a pipe or a human-made ditch.

- Section 404 establishes a permit program for the discharge of dredge or fill material into waters of the U.S. This permit program is administered by the U.S. Army Corps of Engineers (USACE) and is addressed in Section 2.3.2, Wetlands and Other Waters.

The goal of the CWA is "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters."

The USACE issues the following two types of 404 permits: General and Standard permits. There are two types of General permits: Regional permits and Nationwide permits. Regional permits are issued for a general category of activities when they are similar in nature and cause minimal environmental effect. Nationwide permits are issued to allow a variety of minor project activities with no more than minimal effects.

Ordinarily, projects that do not meet the criteria for a Nationwide permit may be permitted under one of the USACE's Standard permits. There are two types of Standard permits: Individual permits and Letters of Permission. For Standard permits, the USACE decision to approve is based on compliance with United States Environmental Protection Agency's (USEPA's) Section 404(b)(1) Guidelines (USEPA CFR 40 Part 230), and whether the permit approval is in the public interest. The Section 404(b)(1) Guidelines (Guidelines) were developed by the USEPA in conjunction with the USACE, and allow the discharge of dredged or fill material into the aquatic system (waters of the U.S.) only if there is no practicable alternative which would have less adverse effects. The Guidelines state that USACE may not issue a permit if there is a least environmentally damaging practicable alternative (LEDPA) to the proposed discharge that would have lesser effects on waters of the U.S. and not have any other significant adverse environmental consequences. According to the Guidelines, documentation is needed that a sequence of avoidance, minimization, and compensation measures has been followed, in that order. The Guidelines also restrict permitting activities that violate water quality or toxic effluent[4] standards, jeopardize the continued existence of listed species, violate marine sanctuary protections, or cause "significant degradation" to waters of the U.S. In addition, every permit from the USACE, even if not subject to the Section 404(b)(1) Guidelines, must meet general requirements. See 33 CFR 320.4. A

[4] The USEPA defines "effluent" as "wastewater, treated or untreated, that flows out of a treatment plant, sewer, or industrial outfall."

discussion of the LEDPA determination, if any, for the document is included in the Wetlands and Other Waters section.

State Requirements: Porter-Cologne Water Quality Control Act

California's Porter-Cologne Act, enacted in 1969, provides the legal basis for water quality regulation within California. This act requires a "Report of Waste Discharge" for any discharge of waste (liquid, solid, or gaseous) to land or surface waters that may impair beneficial uses for surface and/or groundwater of the state. It predates the CWA and regulates discharges to waters of the state. Waters of the State include more than just waters of the U.S., like groundwater and surface waters not considered waters of the U.S. Additionally, it prohibits discharges of "waste" as defined and this definition is broader than the CWA definition of "pollutant." Discharges under the Porter-Cologne Act are permitted by Waste Discharge Requirements (WDRs) and may be required even when the discharge is already permitted or exempt under the CWA.

The SWRCB and Regional Water Quality Control Boards (RWQCBs) are responsible for establishing the water quality standards (objectives and beneficial uses) required by the CWA, and regulating discharges to ensure compliance with the water quality standards. Details about water quality standards in a project area are included in the applicable RWQCB Basin Plan. In California, regional boards designate beneficial uses for all water body segments, and then set criteria necessary to protect these uses. As a result, the water quality standards developed for particular water segments are based on the designated use and vary depending on that use. In addition, the SWRCB identifies waters failing to meet standards for specific pollutants. These waters are then state-listed in accordance with CWA Section 303(d). If a state determines that waters are impaired for one or more constituents and the standards cannot be met through point source or non-point source controls (NPDES permits or WDRs), the CWA requires the establishment of Total Maximum Daily Loads (TMDLs). TMDLs specify allowable pollutant loads from all sources (point, non-point, and natural) for a given watershed.

State Water Resources Control Board and Regional Water Quality Control Boards

The SWRCB administers water rights, sets water pollution control policy, and issues Water Board orders on matters of statewide application, and oversees water quality functions throughout the state by approving Basin Plans, TMDLs, and NPDES permits. RWQCBs are responsible for protecting beneficial uses of water resources within their regional jurisdiction using planning, permitting, and enforcement authorities to meet this responsibility.

National Pollutant Discharge Elimination System Program

Municipal Separate Storm Sewer Systems

Section 402(p) of the CWA requires the issuance of NPDES permits for five categories of stormwater discharges, including MS4s. An MS4 is defined as "any conveyance or system of conveyances (roads with drainage systems, municipal streets, catch basins, curbs, gutters, ditches, human-made channels, and storm drains) owned or operated by a state, city, town, county, or other public body having jurisdiction over stormwater, that is designed or used for collecting or conveying stormwater." The SWRCB has identified Caltrans as an owner/operator of an MS4 under federal regulations. Caltrans' MS4 permit covers all Caltrans rights-of-way, properties, facilities, and activities in the state. The SWRCB or the RWQCB issue NPDES permits for 5 years, and permit requirements remain active until a new permit has been adopted.

Caltrans' MS4 Permit (Order No. 2012-0011-DWQ) was adopted on September 19, 2012, and became effective on July 1, 2013. The permit has the three following basic requirements:

1. Caltrans must comply with the requirements of the Construction General Permit (see below).

2. Caltrans must implement a year-round program in all parts of the State to effectively control stormwater and non-stormwater discharges.

3. Caltrans stormwater discharges must meet water quality standards through implementation of permanent and temporary (construction) best management practices (BMPs), to the maximum extent practicable, and other measures as the SWRCB determines to be necessary to meet the water quality standards.

To comply with the permit, Caltrans developed the Statewide Stormwater Management Plan (SWMP) to address stormwater pollution controls related to highway planning, design, construction, and maintenance activities throughout California. The SWMP assigns responsibilities within Caltrans for implementing stormwater management procedures and practices, as well as training, public education and participation, monitoring and research, program evaluation, and reporting activities. The SWMP describes the minimum procedures and practices Caltrans uses to reduce pollutants in stormwater and non-stormwater discharges. It outlines procedures and responsibilities for protecting water quality, including the selection and implementation of BMPs. The proposed project would be programmed to follow the guidelines and procedures outlined in the latest SWMP to address stormwater runoff.

Construction General Permit

Construction General Permit (Order No. 2009-009-DWQ), adopted on September 2, 2009, became effective on July 1, 2010. The permit regulates stormwater discharges from construction sites that result in a disturbed soil area of 1 acre or greater, and/or are smaller sites that are part of a larger common plan of development. By law, all stormwater discharges associated with construction activity where clearing, grading, and excavation result in soil disturbance of at least 1 acre must comply with the provisions of the General Construction Permit. Construction activity that results in soil disturbances of less than 1 acre is subject to this Construction General Permit if there is potential for significant water quality impairment resulting from the activity as determined by the RWQCB. Operators of regulated construction sites are required to develop Stormwater Pollution Prevention Plans (SWPPPs); to implement sediment, erosion, and pollution prevention control measures; and to obtain coverage under the Construction General Permit.

The 2009 Construction General Permit separates projects into Risk Levels 1, 2, or 3. Risk levels are determined during the Planning and Design Phases, and are based on potential erosion and transport to receiving waters. Requirements apply according to the risk level determined. For all projects subject to the permit, applicants are required to develop and implement an effective SWPPP. In accordance with Caltrans' Standard Specifications, a Water Pollution Control Plan is necessary for projects with disturbed soil area less than 1 acre.

Section 401 Permitting

Under Section 401 of the CWA, any project requiring a federal license or permit that may result in a discharge to a water of the U.S. must obtain a 401 Certification, which certifies that the project would be in compliance with state water quality standards. The most common federal permits triggering 401 Certification are CWA Section 404 permits issued by USACE. The 401 permit certifications are obtained from the appropriate RWQCB, dependent on the project location, and are required before USACE issues a 404 permit.

In some cases, the RWQCB may have specific concerns with discharges associated with a project. As a result, the RWQCB may issue a set of requirements known as WDRs under the State Water Code (Porter-Cologne Act) that define activities, such as the inclusion of specific features, effluent limitations, monitoring, and plan submittals that are to be implemented for protecting or benefiting water quality. WDRs can be issued to address both permanent and temporary discharges of a project.

AFFECTED ENVIRONMENT

Water quality information for this section was provided from the Water Quality Study prepared for the project (Caltrans 2014h). The analysis focuses on potential effects to the water quality of the hydrologic study area, as defined in Section 2.2.1, Hydrology and Floodplain. The hydrologic study area is within the jurisdiction of the North Coast RWQCB, which implements water quality protection through the issuance of permits for projects found to be in compliance with the North Coast Regional Water Quality Control Board Basin Plan (RWQCB 2011).

Scotty Creek is designated as a minor, perennial coastal stream (see Photographs 2-1 and 2-2 from field visit on March 9, 2010). Scotty Creek is a small coastal stream on the western side of the central California coastal mountains. The drainage basin is a U-shaped canyon that becomes progressively more V-shaped in the headwater. The creek's watershed is 4.3 square miles (Figure 2-26) and is mostly meadowland covered in grass.

Photograph 2-1: Existing Scotty Creek box culverts (Photo taken March 9, 2010)

Photograph 2-2: Pacific Ocean at beach near Scotty Creek (Photo taken March 9, 2010)

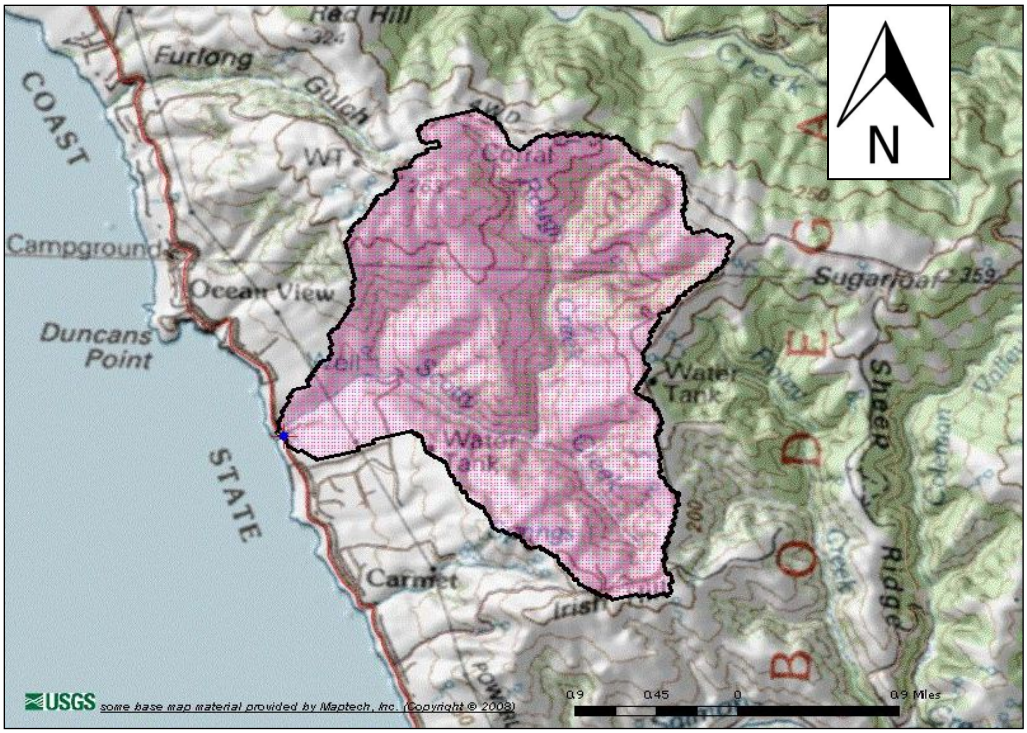


Figure 2-26 Scotty Creek Watershed Map

The proposed project is bounded to the west by the Pacific Ocean. The Pacific Ocean is located adjacent to the California Coast and is outside of enclosed bays, estuaries, and coastal lagoons, which are within the territorial limits of California. There are no *Areas of Special Biological Significance*, as designated by the North Coast RWQCB, within the EIR/EA study area.

Beneficial Uses

The existing beneficial uses listed for minor coastal streams are as follows: Municipal and Domestic Water Supply (MUN); Commercial and Sport Fishing (COMM); Wildlife Habitat (WILD); Rare, Threatened, or Endangered Species (RARE); and Estuarine Habitat (EST).

The existing beneficial uses listed for ocean waters are as follows: Navigation (NAV); Water Contact Recreation (REC-1); Non-Contact Water Recreation (REC-2); Commercial and Sport Fishing (COMM); Wildlife Habitat (WILD); Rare, Threatened, or Endangered Species (RARE); Marine Habitat (MAR); Migration of Aquatic Organisms (MIGR); Spawning, Reproduction, and/or Early Development (SPWN); Shellfish Harvesting (SHELL); and Aquaculture (AQUA).

A complete description of the sensitive plant and animal habitats known to occur within the hydrologic study area is included in Section 2.3, Biological Environment.

Water Supply

There are no known drinking water reservoirs or recharge facilities within the hydrologic study area. Although there is a leach field located nearby, there is no effect to water quality because the proposed project site is located upstream of the leach field (see Figure 1-3).

There is the potential for domestic water supply wells to be present within the project area. These wells and their sources would need to be protected during construction, and permanent BMPs and civil design measures will be necessary to avoid or minimize long-term effects Wells that cannot be avoided or that would be permanently effected by the project will be relocated or replaced in compliance with Sonoma County regulations from, both, the Permit and Resource Management Department (see Ordinance 25B – "Water Wells"), and the Department of Health Services.

Clean Water Act 303(d) List

The general water quality objectives are established for surface waters within the North Coast region include color, taste and odors, floating material, suspended material, settleable material, oil and grease, biostimulatory substances, sediment, turbidity, pH, dissolved oxygen, bacteria, temperature, toxicity, pesticides, chemical constituents, and radioactivity. Scotty Creek is not listed on the 2010 Integrated Report (CWA Section 303[d] List/305[b]). Scotty Creek is not a sediment-impaired watershed.

Groundwater

The hydrologic study area extends through the Bodega Bay Area Groundwater Basin (Groundwater Basin Number 1-57). The Bodega Bay Area Groundwater Basin encompasses 2,680 acres. The depth to groundwater varies across the site according to topography, geologic, and hydrologic conditions (Caltrans 2013a). The depth to groundwater is generally greatest in summer months and shallowest in winter months. Depth to groundwater would be determined prior to final design.

ENVIRONMENTAL CONSEQUENCES

Stormwater

No-Build Alternative

The No-Build Alternative would not result in any physical changes or operational improvements to SR 1. Existing stormwater treatment systems associated with SR 1 would remain unchanged. The No-Build Alternative would have no effect on stormwater.

Build Alternatives

Construction Phase

Effects to Waters

Alternatives 19A, 19B, and 20 would result in 12.6, 13.6, and 11.1 acres of soil disturbance within the 14.4 acres of the total construction site area (Table 2-14). The disturbed soil areas were estimated based on the proposed impervious work area and anticipated limits of earthwork. Construction would include ground disturbance such as grading and earth-moving activities; stockpiling of soils; and the loading, unloading, and transport of excavated and fill material. Heavy metals associated with vehicle tire and brake wear, oil and grease, and exhaust emissions are the primary pollutants associated with transportation corridors. Rainfall could carry loose soils into adjacent waterways, resulting in increased sedimentation and potential effects to water quality, such as an increase in turbidity.

Table 2-14 Soil Disturbance and Increased Impervious Area (acres)

Alternative	Area		Acres
Alternative 19A	Disturbed Soil Area		12.6
	Impervious Area	Existing (includes reworked)	1.8
		Added	3.5
		Reworked	0.3
	Total Post-project = Existing + Added		5.3
Total Construction Site Area			14.4
Alternative 19B	Disturbed Soil Area		13.6
	Impervious Area	Existing (includes reworked)	1.9
		Added	3.6
		Reworked	0.3
		Total Post-project = Existing + Added	5.5
	Total Construction Site Area		15.5
Alternative 20	Disturbed Soil Area		11.1
	Impervious Area	Existing (includes reworked)	1.5
		Added	3.0
		Reworked	0.3
		Total Post-project = Existing + Added	4.5
	Total Construction Site Area		12.6

As stated previously, the Construction General Permit separates projects into Risk Levels 1, 2, or 3. The proposed project is a Risk Level 3 (highest risk), because it has a high sediment risk and the Pacific Ocean has three applicable beneficial uses—fresh water habitat/cold water (COLD), fish migration (MIGR), and fish spawning (SPWN). Risk Level 3 projects require compulsory stormwater runoff pH and turbidity monitoring. For projects involving a disturbed soil area of greater than or equal to 30 acres, aquatic biological assessments are required before construction and after construction during specified seasonal windows; however, since the proposed project includes a disturbed soil area of only 12.6 acres (Table 2-14), this requirement does not apply to the proposed project.

In compliance with the Construction General Permit and the Caltrans SWMP, the proposed project is required to develop and implement an effective SWPPP, as the disturbed soil area is greater than 1 acre. The SWPPP will detail the implementation of temporary Construction Site BMPs during all phases of construction to avoid or minimize stormwater and water quality effects to surface water, groundwater, or domestic water supplies. Temporary Construction Site BMPs that will be considered for the project include soil stabilization measures at stockpiles and disturbed slopes, sediment control measures to address sediment from run-on to and runoff from the proposed project, tracking control measures including street sweeping, wind erosion control measures, non-stormwater management, and waste management and materials pollution control. The contractor will be required to implement temporary Construction Site BMPs in accordance with the Caltrans Standard Plans and Standard Specifications. The SWPPP will also include a construction site monitoring program detailing the monitoring and sampling to be completed during construction to verify the effectiveness of the temporary Construction Site BMPs.

With proper implementation of BMPs and adherence to the Permit requirements, potential temporary effects to water quality would be minimal.

Accidental spills or releases of hazardous materials, such as fuel or water with high pH from concrete work associated with bridge construction, could degrade the quality of stormwater runoff or reach a stream during dry-weather conditions. This contamination could affect the water quality of Scotty Creek and the Pacific Ocean. The potential for an accidental spill or release would be low and, if one did occur, proper protocol will govern its management.

Effects to Groundwater

Depth to groundwater is currently not known. Although Caltrans has recently installed piezometers near the southern bridge abutment location, no data are available on the groundwater throughout the project area. If groundwater is encountered during construction and dewatering operations are necessary, then the methods used would be designed in a manner to protect groundwater quality. Water stored during dewatering would be stored and released in accordance with the permit requirements and, therefore, potential effects would be minimal.

Effects to Wells

Wells within the project area would be identified on the project plans and in the field prior to the start of construction. During construction, dewatering operations have the potential to temporarily lower the water table and affect the water source to wells. The dewatering operations would be designed in consideration of these domestic water supply wells and include measures identified below (such as SWPPP and RWQCB and other permit requirements) to avoid or minimize temporary effects to these wells, their sources, and to users of the wells. Additionally, temporary Construction Site BMPs would be placed to prevent construction waste or potentially contaminated runoff from affecting the well or its supply. The project's effect on wells would be minimal.

Effects from Temporary Fill in Scotty Creek

Under all Build Alternatives, the proposed project could adversely affect Scotty Creek due to temporary fill resulting from installation of a temporary cofferdam for removal of the existing box culverts. As a result, a 401 Certification would be required. For a discussion of temporary and permanent effects on wetlands, please see Section 2.3.2, Wetlands and Other Waters, which would also be covered in the 401 Certification.

Operation Phase

Fill Effects to Surface Water

Since no permanent fill would be placed into Scotty Creek, the project (under all Build Alternatives) would not result in a permanent effect from fill within a surface water. There would be no effect on surface water.

Groundwater

All Build Alternatives would increase the impervious area and thus reduce the available unpaved area that currently allows runoff to infiltrate into the native soils. The reduction of runoff infiltrating through native soils has the potential to result in

the loss in volume or amount of water that previously recharged localized aquifers and reduce regional groundwater volumes. However, the increase in impervious area associated with the Alternatives 19A, 19B and 20 would be minimal because it is not expected to result in a measurable change to groundwater recharge, when compared to the overall size (2,680 acres) of the Bodega Bay Groundwater Basin.

The increase in impervious area can result in the modification of existing receiving water body hydrographs by increasing the flow volumes and rates and peak durations from the loss of unpaved overland flow and native infiltration. These potentially adverse effects could cause increased bed and bank erosion, loss of habitat, increased sediment transport and deposition, and increased flooding. BMPs would be used to reduce effects per permits and regulatory requirements.

Changes in Impervious Area

Alternatives 19A, 19B, and 20 would add approximately 3.5, 3.6, and 3.0 acres, respectively, of new impervious area through the new roadway alignment. The values were estimated based on the planning level geometrics for each alternative. Table 2-14 provides acreages for changes in impervious area for each Build Alternative. Additional impervious area from new paved areas would reduce infiltration into the ground and increase sheet flow. The additional flow would have the potential to transport an increased amount of sediment and pollutants to Scotty Creek. Permanent stormwater treatment measures would be constructed to minimize these potential effects. These treatment measures include biofiltration swales and strips. These biofiltration measures remove pollutants by vegetated filtration and infiltration through the soil. Where biofiltration swales and strips are not feasible due to site constraints, the proposed side slopes and the existing natural ditches would treat the roadway runoff by natural dispersion from infiltration in or near roadside areas.

The increase in impervious areas could potentially increase the volume and velocity of stormwater flow to downstream receiving water bodies. The proposed stormwater treatment measures would address potential increases in volume of flow by promoting infiltration of runoff, and vegetation within or along the treatment measures would reduce flow velocity. Additionally, design pollution prevention measures would be used to dissipate the velocity of flows. With implementation of permanent stormwater treatment and design pollution prevention BMPs, effects to existing water quality are anticipated to be minimal.

Effects to Wells

The proposed grading would result in cut and fill that has the potential to alter the existing water table flow pattern and supply. The roadway and grading design would be designed to avoid or minimize these effects and civil works and permanent infrastructure would be coordinated to prevent long-term effects, such as compromising the piezometric head (i.e. water surface elevation) or penetrating an artesian well. Treatment BMPs would be designed so as not to act as injection wells. The BMPs would adequately filter pollutants prior to any discharge to groundwater resources. If necessary, wells that cannot be avoided or that may be permanently effected would be abandoned, removed, adjusted, relocated, and/or replaced in kind in compliance with all local, state, and federal requirements, including, Sonoma County regulations from, both, the Permit and Resource Management Department (see Ordinance 25B – "Water Wells"), and the Department of Health Services.

AVOIDANCE, MINIMIZATION, AND/OR MITIGATION MEASURES

AMMs are proposed for project construction to minimize potential project effects.

Construction Phase

- **Measure WATER-1: Stormwater Pollution Prevention Plan.** A SWPPP will be developed and implemented for the project and will comply with the Construction General Permit and the Caltrans SWMP, which includes measures to protect sensitive areas and to prevent and minimize stormwater and non-stormwater discharges. Water quality inspector(s) will inspect construction areas to determine if the BMPs are adequate and adjust them, if necessary. The SWPPP will be prepared by the contractor and approved by Caltrans.

  The temporary Construction Site BMPs specified in the SWPPP will be implemented throughout the duration of construction activities to avoid and minimize pollutant loads in potential stormwater/non-stormwater discharges. Construction Site BMPs strategies applicable to this project may include the following:

  - Soil Stabilization: Temporary Fence (Type ESA); Move-In/Move-Out; Hydroseeding; Geotextiles, Mats, Plastic Covers, and Erosion Control Blankets; Hydraulic Mulch

  - Sediment Control: Fiber Rolls, Silt Fence, Sediment Trap, Gravel Bag Berm, Check Dams, Drainage Inlet Protection

- Tracking Control Practices: Temporary Construction Entrance/Exit
- Wind Erosion Controls: Temporary Cover
- Non-Stormwater Management: Dewatering Operations; Material and Equipment Use Over Water; Avoidance of Potable Water Use; Reclaimed Water Use for Irrigation
- Waste Management and Materials Pollution Control: Concrete Waste Management, Material Delivery and Storage, Material Use, Stockpile Management, Spill Prevention and Control, Soil Waste Management, Hazardous Waste and/or Contaminated Soil Management, and Liquid Waste Management

- **Measure WATER-2: Temporary Creek Diversion.** A temporary creek diversion will be installed during construction to minimize the export of sediment and pH issues from disturbed soil areas as a result of removal of the box culverts.
- **Measure WATER-3: Stockpile Area.** Stockpile areas for construction materials, equipment, and debris will be placed greater than 150 feet away from Scotty Creek, as well as covered to minimize/avoid effects to Scotty Creek.
- **Measure WATER-4: Regional Water Quality Control Board Agreements (Construction Phase).** The 401 Certification will detail specific temporary effects to waters of the State, require actions to be used to avoid and/or minimize effects, as well as mitigation efforts to enhance or restore these areas. Temporary effects may include dewatering, temporary creek diversion, and pile driving. The permits obtained for the project may include dewatering rate limitations, and monitoring, testing, and effluent limitations or conditions for discharge of water from dewatering and temporary creek diversion operations. The permits for the project could include scheduling and vibration limits for pile driving operations during construction.

Operation Phase

The design features to address water quality effects are a condition of Caltrans' NPDES permit. These design features, or BMPs, will be developed and incorporated into the final design of the Preferred Build Alternative. Design features will include the following:

- **Measure WATER-5: Regional Water Quality Control Board Agreements (Operation Phase).** The 401 Certification will detail specific temporary and permanent effects to waters of the State, require actions to avoid and/or minimize effects, as well as mitigation efforts to enhance or restore these areas. Any effects on domestic wells will be avoided or minimized in compliance with the permits obtained by Caltrans for the proposed project. Any effects to the special-status species associated with the waterways within the hydrologic study area will be reduced or avoided with re-vegetation, compensatory measures, or other requirements as designated by the relevant permits (see Section 2.3, Biological Environment, for additional discussion as it relates to Biological Resources).

- **Measure WATER-6: Design Pollution Prevention Measures.** Design Pollution Prevention BMPs are permanent measures implemented to improve stormwater quality by reducing erosion, stabilizing disturbed soil areas, and maximizing vegetated surfaces. Strategies include the following:

  - Erosion control features for stormwater conveyance features and to stabilize slopes

  - Preservation of vegetation

  - Flow attenuating devices (e.g., flared-end-section, outlet protection/ velocity dissipation devices)

- **Measure WATER-7: Treatment Measures.** Permanent Treatment Measures are used to remove pollutants from stormwater runoff prior to being discharged from Caltrans' right-of-way. Treatment Measures that are applicable to the proposed project are vegetated biofiltration swales and biofiltration strips. These biofiltration measures remove pollutants by filtration through grass, adsorption to soil or grass, and infiltration through the soil. These measures are effective at removing debris and solid particles as well as some dissolved constituents. Stormwater treatment measures include sheet flow over the proposed side slopes and the use of existing natural ditches that provide infiltration in or near roadside areas. Seed mixes and/or plants used for erosion control, biofiltration, and similar functions would be regionally native and appropriate for the project site.

2.2.3 Geology/Soils/Seismic/Topography

REGULATORY SETTING

For geologic and topographic features, the key federal law is the Historic Sites Act of 1935, which establishes a national registry of natural landmarks and protects "outstanding examples of major geological features." Topographic and geologic features are also protected under the California Environmental Quality Act (CEQA).

This section also discusses geology, soils, and seismic concerns as they relate to public safety and project design. Earthquakes are prime considerations in the design and retrofit of structures. Caltrans' Office of Earthquake Engineering is responsible for assessing the seismic hazard for Caltrans projects. Structures are designed using Caltrans' Seismic Design Criteria (SDC; Caltrans 2013b). The SDC provides the minimum seismic requirements for highway bridges designed in California. A bridge's category and classification will determine its seismic performance level and which methods are used for estimating the seismic demands and structural capabilities. For more information, please see Caltrans' Division of Engineering Services, Office of Earthquake Engineering Seismic Design Criteria.

Alquist-Priolo Earthquake Fault Zoning Act (Public Resources Code Section 2621 et seq.). This Act provides policies and criteria to assist cities, counties, and state agencies in the exercise of their responsibility to prevent the location of developments and structures for human occupancy across the trace of active faults.

Seismic Hazards Mapping Act (Public Resources Code Sections 2690 to 2699.6). This Act requires that site-specific geotechnical investigations be conducted within the zones of required investigation to identify and evaluate seismic hazards and formulate mitigation measures prior to permitting most developments designed for human occupancy.

The *Sonoma County General Plan 2020* includes a Public Safety Element that addresses geologic risk such as the potential for seismic activity, liquefaction, and landslides. Policy PS-1 "encourage[s] the strong enforcement of State seismic safety requirements for design and construction of buildings and facilities subject to State and Federal standards," including bridges.

AFFECTED ENVIRONMENT

A Preliminary Geotechnical Report (Caltrans 2013a) was prepared for this proposed project. The following information is derived from this report and other cited references.

Geologic Setting

The proposed project alignment is located in the coastal terrace directly above the Pacific Ocean at Gleason and Portuguese Beaches, California, north of Bodega Bay and approximately 4.5 miles south of Jenner. The Coast Ranges are generally characterized by northwest-trending ridges and valleys that generally run parallel to the surrounding geologic structures, including the major fault systems. Coastal plains are often and marine terraces are commonly, but not always, found between the Coast Range and the Pacific Ocean. Natural landmarks listed on the national registry and outstanding examples of major geologic features are not present. Figure 2-27 shows the local geology.

Most of the realigned roadway is in what is mapped as coastal marine terraces (Qt), which are typically flat or gently slope toward the shore, and include marine deposits overlain with more recent alluvial deposits. The marine terrace deposits typically consist of a wide range of unconsolidated fine to coarse sand, to fine to coarse sand with a silty matrix, with more gravelly material occasionally present (California Department of Water Resources [DWR] 2003). These terraces represent offshore planes (often wave cut platforms) that were tectonically uplifted (Harden 2004).

Exposed by incision in the Scotts Creek ravine and in hillslope areas east of the proposed project area are Cretaceous-Jurassic age (Franciscan) greywacke and mélange deposits (KJfs), with some Tertiary-Cretaceous age sandstones and shale (TKfs) on the south side of Scotts Creek (Blake et al. 1971, Blake et al. 2005, and California Geological Survey [CGS] 2006). The mélange is undifferentiated in available geological maps, but may include, but not limited to, siltstone, sandstone, shale, greenstone, or serpentinite (Harden 2004). The only other deposits in the vicinity of the work area are Quaternary-Holocene beach/dune sands (Qhbs) downslope of the work area at the shoreline and Quaternary-Holocene alluvium (Qha) along Scotts Creek. Quaternary landslide (Qls and Qols), Quaternary colluvium and alluvium (Qc and Qac), and Quaternary earth flows (Qef) geological units are present outside the project area but within a 1-mile radius.

Physiography and Topography

The project alignment is situated on the relatively flat marine terrace above the Pacific Ocean except where it crosses a ravine eroded by Scotty Creek. The elevation of the marine terrace in the project area is approximately 60 to 80 feet North Geodetic Vertical Datum 1929 (NGVD 29), while the floor of Scotty's Creek ravine is 10 feet NGVD 29 (Caltrans 2013a and USGS 1979).

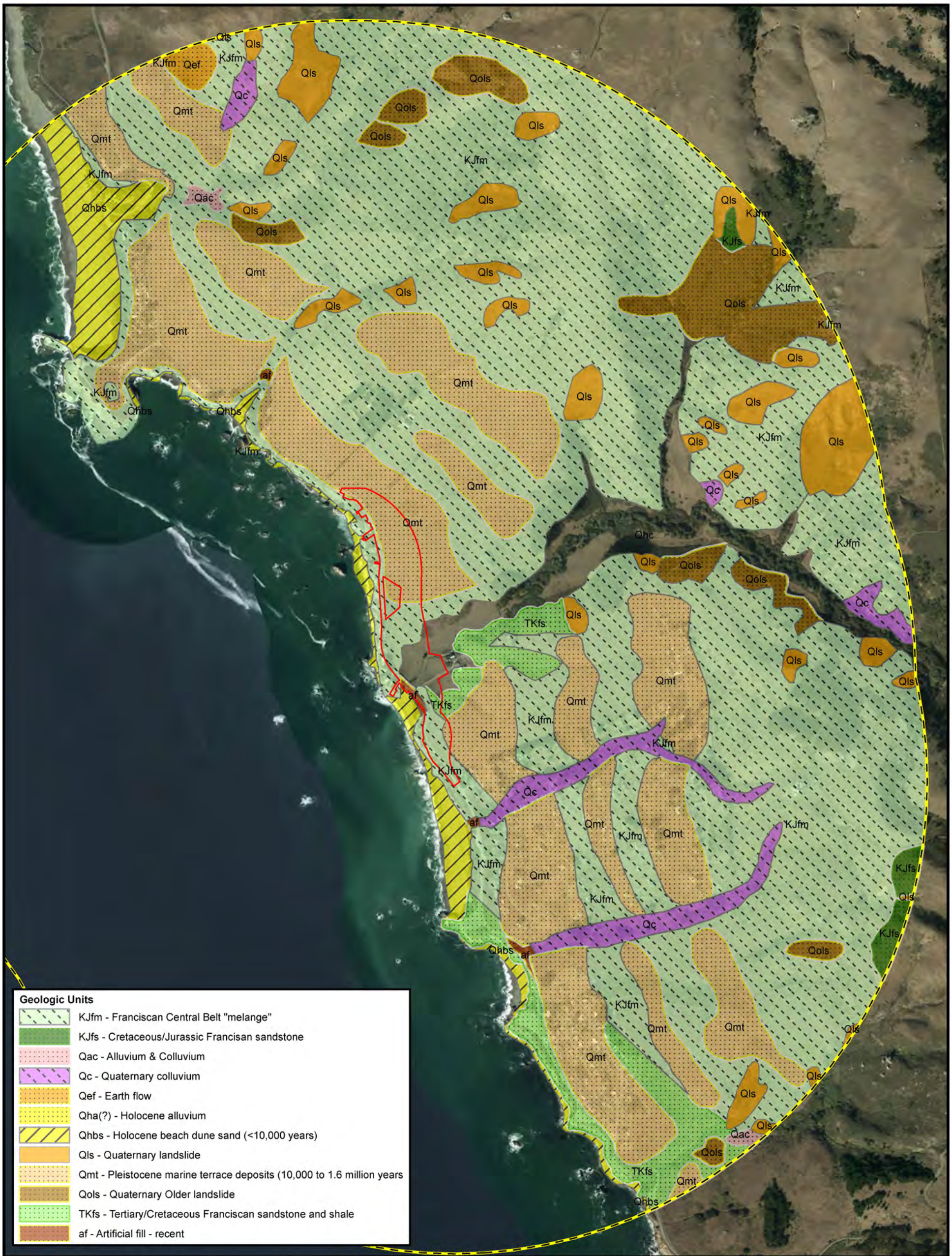
Faults and Seismicity

The project alignment is located in a seismically active part of northern California. Many of the faults in the coastal region north of San Francisco Bay area are capable of producing earthquakes that may result in strong ground shaking. The nearest major active fault to the project alignment is the San Andreas Fault, which is parallel to the coastline and estimated at roughly 0.7 mile offshore near the project area and can be observed approximately 0.7 mile southeast of the project area (California Divisions of Mines and Geology [CDM&G] 1974a and 1974b). The closest mapped active fault to the project area is a small, unnamed, Alquist-Priolo Fault Hazard Zone-designated fault located less than 1,000 feet east of the south end and approximately 2,000 feet east of the north end of the project area. This small active fault is associated with a large number of faults (including the San Andreas Fault) at Bodega Head, many of which are mapped as having ruptured during the 1906 earthquake. Table 2-15 summarizes the nearby active faults and approximate distance from the project alignment.

Table 2-15 Active Faults in Vicinity of Proposed Project Alignment

Fault	Largest Historic Event Magnitude[a, b]	Year of Largest Event[a, b]	Fault Distance/ Direction[a, b, c]	Probability M ≥6.7 between 2007 to 2036[d]
San Andreas	7.8 to 8.0	1906	0.7 mile west and south	21%
Unnamed – associated with San Andreas Fault Zone at Bodega Headlands[c]	Not available	Not available	0.2 mile east	Not available
Hayward – Rogers Creek	6.8 to 7.0	1868	Hayward: ~40 miles southeast; Rogers Creek: ~20 miles east	31%
Green Valley – Concord	6.4	1892	Green Valley: ~50 miles southeast; Concord: ~55 miles southeast	3%
Calaveras	6.5	1911	67 miles southeast	7%
San Gregorio	Not available	Not available	70 miles south	6%
Mount Diablo Thrust	Not available	Not available	70 miles southeast	1%

Notes:
Sources:
[a] *Earthquake Hazard Program* (USGS 2014).
[b] *Significant California Earthquakes* (CGS 2014) http://www.consrv.ca.gov/cgs/rghm/quakes/Pages/eq_chron.aspx.
[c] *State of California. Special Studies Zones. Duncan Mills Quadrangle (Official Map)* (CDM&G 1974a); *State of California. Special Studies Zones. Bodega Bay Quadrangle (Official Map)* (CDM&G 1974b); and *District Preliminary Geotechnical Report* (Caltrans 2013a).
[d] *The Uniform California Earthquake Probabilities* (USGS 2008).



LEGEND

Environmental Impact Report/
Environmental Assessment Study Area

1 Mile from BSA

Source:
California Geological Survey
Geology of the Highway 1 Corridor between Bodega Bay and Fort Ross, Sonoma County, California
M.W. Manson, C.M. Huyette, C.J. Wills, M.G. Smelser, M.E. Fuller, C. Domrose and C. Gutierrez, 2006

N

0 1,000
Feet

Caltrans

FIGURE 2-27 GEOLOGIC UNITS IN THE PROJECT VICINITY
Gleason Beach Roadway Realignment Project
Environmental Impact Report / Environmental Assessment
State Route 1
Post Mile 15.1-15.7, EA 0A0200
Sonoma County, California

Surface Fault Rupture and Ground Shaking

Surface fault rupture is a slip of the earth's surface along a fault plane. The faults in the proposed project vicinity are primarily strike-slip faults and have moderate to high potential for surface rupture. Based on the Earthquake Fault Zone Map for the Duncan Mills Quadrangle (CDM&G 1974a), the proposed project alignment is not within an Alquist-Priolo hazard zone; therefore, the potential for seismic-induced surface rupture along the proposed project alignment is low.

However, due to proximity to the San Andreas and other nearby active faults, strong to violent ground shaking is likely along the proposed project alignment (Sonoma County 2011c, ABAG 2014, and USGS 2007 and 2014). Although no active fault is mapped in the proposed project area, and the potential for direct fault rupture is not indicated, ground surface rupture or slope failure due to intense shaking can occur as a result of an earthquake. The *Preliminary Geotechnical Report* (Caltrans 2013a) indicates that the potential is low for seismic-induced cracking.

Liquefaction

Liquefaction is a process whereby strong ground shaking causes loose, saturated, unconsolidated sediments to lose strength and to behave as a fluid. This subsurface process can cause ground deformation at the surface, including lateral spreading and differential compaction or settlement and sand boils. Loss of bearing strength and ground movements associated with liquefaction may result in damage to structures/roadways. Loose, saturated sandy and silty soils are particularly susceptible to liquefaction.

The Sonoma County General Plan 2020 does not rate the liquefaction potential of the proposed project area. The *Preliminary Geotechnical Report* (Caltrans 2013a) indicates that the potential is low for liquefaction in the proposed project area (also see Sonoma County 2011a and 2011b).

Seismically Induced Landslides and Non-seismic Earth Movement

No natural hillsides are located within the proposed project alignment. Landslide potential is highest along the coastal bluffs and on the hillslopes east of the proposed project alignment. Because the proposed project is located inland and away from the coastal bluffs and hillslopes, the seismic and non-seismic landslide hazard is low, and therefore, landslides in the coastal bluffs and hillslopes are not expected to negatively affect the proposed alignment (Caltrans 2013a, Sonoma County 2011d). Moderate slopes are present near Scotty Creek and landslides may be possible. Seismically induced or non-seismic earth movements would be considered in the design of

retaining wall structures and embankment slopes that would be constructed as part of the proposed project. The greatest earth movement and landslide potential is along the current, pre-construction condition, where the existing roadway is threatened by erosion of the coastal bluffs.

Settlement and Subsidence

Settlement is defined as downward movement of the ground surface due to application of a load, such as a building or soil fill. The effects of settlement are generally localized to the area of loading. Subsidence generally refers to a more regional settlement that may result from activities such as groundwater extraction for drinking water or agricultural uses. Based on the low potential for liquefaction and age of existing fill, the potential for differential compaction/settlement is low (Caltrans 2013a). However, the potential for subsidence due to differential loading and moisture changes on soft and/or expansive clays that may be present near Scotty Creek (Blucher Clay Loam) (NRCS 2014 and CGS 2006) will be addressed during the Design Phase.

Soils

The proposed project area is underlain by the following five soil types (NRCS 2014):

- **Blucher Clay Loam (BlA) – 0 to 2 percent slope** soil underlies portions of alignment in the lowland/wetland area along and south of Scotty Creek. The Blucher Clay Loam is found on 0 to 2 percent slopes and is considered "prime farmland if irrigated." This soil is typically somewhat poorly drained and is a lean-clay (CL) as defined by the United Soil Classification System (USCS). Engineering properties of this soil indicate it may have shrink/swell potential and/or differential settlement. This soil unit is typically found on alluvial fans and flood plains (NRCS 2014).

- **Blucher Clay Loam (BlB) – 2 to 5 percent slope** soil underlies portions of the project area along Scotty Creek. In description, this soil unit is largely similar to the "Blucher Clay Loam – 0 to 2 percent slope," other than it has a greater slope and occurs on alluvial fans and upland areas above flood plains (NRCS 2014).

- **Rohnerville Loam – 0 to 9 percent slope (RrC)** soils underlie slightly roughly half of the project area at the northern and southern ends of the project alignment. The Rohnerville Loam is found on 0 to 9 percent slopes and is considered "prime farmland if irrigated." This soil is typically somewhat poorly drained and is a lean-clay (CL) with sandy clay (SC) layers as defined by the USCS. This soil

unit is typically formed as residuum from weathering of bedrock in upland areas (NRCS 2014).

- **Rohnerville Loam – 9 to 15 percent slope (RrD)** soils underlie a small portion of the project area in the center of the alignment. The Rohnerville Loam is found on 9 to 15 percent slopes and is considered "farmland of statewide importance," a slightly lower designation because of the limitations associated with the slope of these soils. This soil is typically somewhat poorly drained and is a lean-clay (CL) with sandy clay (SC) layers as defined by the USCS. This soil unit is typically formed as residuum from weathering of bedrock in upland areas (NRCS 2014).

- **Kneeland Loam – 30 to 50 percent slope** soils underlie a small portion of the project area in the center of the alignment. The Kneeland Loam is found on 30 to 50 percent slopes and are considered "not prime farmland," largely due the limitation of slope. This soil is typically somewhat poorly drained and is a lean-clay (CL) as defined by the USCS. This soil unit is typically formed as residuum from weathering of bedrock in upland areas (NRCS 2014).

- **Terrace Escarpment (Te), Coastal Beaches (ChA)**, and other soil types are only found at the margins or outside the project area and would not be impacted by the project; and are therefore not described in this document.

ENVIRONMENTAL CONSEQUENCES

The geology and seismic-related consequences associated with Alternatives 19A, 19B, and 20 are the same. The proposed project would result in realignment of the existing roadway inland to mitigate the effects of natural erosion of the coastal bluffs.

No-Build Alternative

Under the No-Build Alternative, SR 1 would continue to deteriorate in response to erosive forces. Failure of SR 1 could be accelerated as a result of ground shaking during an earthquake and would be considered an adverse effect.

Build Alternatives

Impacts from all Build Alternatives would be identical and, therefore, they are evaluated jointly below.

Construction Phase

Construction could include soil movement due to instability of temporary cut slopes and retaining structures and initial settlement of fill. These potential effects would be

addressed in the construction and design requirements for the project. Implementing construction and design requirements reduces the risk of soil movement during construction to a minimal level. The risk would be elevated if an earthquake were to occur during construction but the likelihood of a large earthquake during construction is considered low because of the relatively short duration of construction relative to the frequency of large earthquakes.

Operation Phase

The San Andreas Fault is approximately 0.7 mile from the site and ground shaking could be "violent" according to the Sonoma County General Plan 2020. Violent shaking could damage structures, such as the bridge over Scotty Creek, or cause structure failure. The project design would incorporate SDC requirements to design the bridge to the appropriate standard to prevent bridge failure. With implementation of design features the potential effects from ground shaking is minimal. Because the potential for fault ruptures in the project area is low, it is unlikely that the bridges, roadway, slopes, and embankments would be damaged by fault ruptures.

Liquefaction could result in settlement and failure of land or structures over the liquefiable soil layers. According to the Liquefaction Susceptibility Map for Sonoma County (Caltrans 2013a and Sonoma County 2011b), the project is in an area with a low to very low liquefaction susceptibility. The nature of the sediments and observation of shallow depth to bedrock in the project area is consistent with an indication of a very low potential for liquefaction (Caltrans 2013a). Because of the low potential for liquefaction, it is unlikely that the bridges, roadway, slopes, and embankments would be damaged by liquefaction. Furthermore, the project design would incorporate standard engineering features that would not increase the potential for liquefaction in the proposed project area. The project would have no effect on liquefaction potential in the project area.

Settlement from placement of foundation, embankment or earth fill loads is anticipated to occur after construction. The bridge design would account for settlement. In addition, geotechnical observations and monitoring during construction would allow for modifications to the recommendations if differing soil conditions are locally encountered during construction. Incorporating engineering design features that address settlement reduces the potential for effects from settlement to a minimal level.

Natural hillslope movement or embankment slopes and retaining walls could slide, settle, or fail after construction under static or seismic conditions. The project design

would incorporate features that minimize the potential for slopes or retaining walls to slide, settle, or fail.

Shrink-swell soils could result in fracturing or buckling of the roadway surface. Shrink-swell soil have a low potential to affect the bridge span as they are supported by deep foundations. The project design would incorporate features that minimize the potential for shrink-swell soils to affect the roadway surface.

AVOIDANCE, MINIMIZATION, AND/OR MITIGATION MEASURES

The following AMMs are proposed to minimize potential effects of the proposed project:

- **Measure GEO-1: Topography.** A geotechnical investigation will be conducted for the Preferred Build Alternative to further characterize subsurface soil and groundwater conditions. The investigation will consist of soil borings, soil sampling, and field and laboratory tests. The results of this investigation will be used to confirm and develop design features to address geologic and seismic hazards.

- **Measure GEO-2: Fault Rupture and Ground Shaking.** Engineering design of overcrossings, retaining walls, embankments, and roadways will be carried out in accordance with Caltrans design standards, which vary, for example, to address proximity to a fault. Because of the high potential for strong ground shaking, Caltrans will perform a detailed seismic demand analysis and the bridges, embankments, slopes, and roadway will be designed to withstand strong ground shaking. The measures to protect structures from ground shaking may include structural improvements/strengthening and soil improvements.

- **Measure GEO-3: Settlement.** Structures are designed with an allowance for settlement. Where the predicted settlement exceeds the allowable settlement, measures are necessary. Estimates of settlement are developed based on proposed design elements such as the height of proposed soil fill; the weight of structures, such as bridges and retaining walls; and site-specific geotechnical data. Excessive settlement from the project can be reduced by preloading the site prior to construction of structures, pavement, or retaining walls to allow settlement to occur before construction. Ground improvements such as compaction to densify the soil; deepening of foundations; excavation and removal of soft, loose, or expansive soils; and other ground improvement techniques are typical methods used to reduce settlement. The construction and design requirements will include

measures to address settlement, as necessary based on the site-specific geotechnical investigation. Both total settlement and differential settlement will be evaluated.

- **Measure GEO-4: Earth Movement or Slope Failure.** A constructability review and analysis will be performed for temporary cut slopes and placement and compaction of fill soil. Project construction and design plans will incorporate features to minimize the risk of failure of cut slopes and retaining structures. The embankment fills will be constructed in accordance with the guidelines provided in the Caltrans *Highway Design Manual* (Caltrans 2012a). Design features to prevent lateral movement; deformation; or failure of cut slopes, embankment fills, and retaining walls include the use of soldier pile walls, tiebacks, compaction of fill to 95 percent relative compaction, mechanically stabilized earth walls, and drainage. Slope and wall stability analyses under static and seismic loadings will be performed in accordance with the guidelines in the Caltrans *Highway Design Manual* (Caltrans 2012a) and Caltrans Design Information Bulletins.

- **Measure GEO-5: Shrink-swell Soils.** One option is to excavate and replace soils that represent the highest risk. In locations where shrink-swell potential is only marginally unacceptable, soil additives can be mixed with existing soil to reduce the shrink-swell potential. The decision whether to remove or treat the soil is made on the basis of specific shrink-swell potential, the additional costs for treatment versus excavation and replacement, as well as the long-term performance characteristics of the treated soil.

2.2.4 Paleontology

REGULATORY SETTING

Paleontology is a natural science focused on the study of ancient animal and plant life as it is preserved in the geologic record as fossils. A number of federal statutes specifically address paleontological resources, their treatment, and funding for mitigation as a part of federally authorized projects.

16 USC 461-467 (the National Registry of Natural Landmarks) establishes the National Natural Landmarks (NNL) Program. Under this program property, owners agree to protect biological and geological resources such as paleontological features. Federal agencies and their agents must consider the existence and location of

designated NNLs, and of areas found to meet the criteria for national significance, in assessing the effects of their activities on the environment under NEPA.

23 USC 305 authorizes the appropriation and use of federal highway funds for paleontological salvage as necessary by the highway department of any state, in compliance with 16 USC 431-433 above and state law.

Under California law, paleontological resources are protected by CEQA.

No policies in the Sonoma County General Plan pertain to paleontological resources.

AFFECTED ENVIRONMENT

Caltrans District 4 prepared a Paleontological Identification Report (PIR) for this proposed project (Caltrans 2013c). A paleontological reconnaissance of the proposed project site was performed on March 6, 2013, as part of the PIR. Geologic conditions observed were found to be consistent with Figure 2-27 and no fossils were observed.

Physiographic and Geologic Setting

The proposed project corridor is located on the relatively narrow coastal platform between the hills and the sea occupied by SR 1, in Sonoma County, California between PMs 15.1 and 15.7. The proposed project corridor is mostly on marine terraces at 50 to 100 feet above sea level. The southern part of the project corridor dips down to near sea level at the mouth of Scotty Creek. North of the floodplain/littoral confluence at the mouth of the creek, a sea cliff rises to separate the beach from the platform traversed by the roadway. Immediately to the east rise the western-most hills that form the piedmont of the Northern Coast Ranges. The mouth of the Russian River is located about 4.8 miles north-northwest of the proposed project area.

The bedrock of this part of California, and of the proposed project area, is composed of various members or facies of the Franciscan Formation. Franciscan rocks are generally altered (metamorphosed) sea-floor sediments, affected first by burial at crushing depths, and then by tectonic forces as plate collisions crammed fragments of oceanic crust onto the western margin of the North American plate. The accretionary nature of the western margin of North America, and of coastal northern California in particular, strongly affects the underlying geology of the area.

The following geologic units underlie or occur in the vicinity the proposed project corridor (Manson et al. 2006; CGS 2006):

- **Artificial Fill (af)**: Artificial fill includes roadway base and fill from nearby and more distant sources, which is laid down during roadway and bridge construction. Artificial fill is also used for drainage diversion and erosion mitigation. Its depth can be expected to vary substantially along the proposed project corridor.

- **Holocene Beach Deposits (Qhbs)**: These are modern paralic deposits composed predominantly of beach sand and gravels. Away from the high-tide line, toppled rock deposits, talus, and dune sand can be found, while estuarine and even lagoonal deposits occur near the mouths of streams, such as near Scotty Creek. Current sea level was reached only about 6,000 to 10,000 years ago, and the current beach zone sediments likely rest on a wave-cut bedrock shelf.

- **Quaternary Stream Channel Deposits (Qc)**: Fluvial deposits line Scotty Creek and typically include unconsolidated sand and sandy gravel with some layers of finer grained materials. At the surface and at shallow depths within the current stream channel they are of Holocene age. At greater depths, and along elevated terraces, these sediments are likely of Late Pleistocene age or older than 10,000 years old.

- **Quaternary and Older Quaternary landslide deposits (Qls, Qols)**: These sediments typically occur in the hills, although they may occasionally be found along beach cliffs where older material has failed. Regardless, neither older nor younger Quaternary landslide deposits are mapped near the proposed project corridor (Figure 2-27). Therefore, these sediments will not be considered further in this analysis.

- **Quaternary Marine Terrace Deposits (Qmt)**: The sand and gravel deposits mantling these wave-cut terraces are generally the result of Quaternary sea level high stands superimposed on a tectonically uplifting coast. When sea level rises, older shorelines are eroded unless the coast is uplifted fast enough to preserve them. In this area, the time between sea-level high stands and shoreline uplift is relatively brief, and therefore these wave–cut platforms are preserved tens to hundreds of feet above current sea level. Each terrace is analogous to the modern littoral zone, with a gentle seaward tilting platform and a (frequently very eroded) cliff face. Terraces are covered by a veneer of near-shore marine and

paralic[5] sediments, terrestrial colluvium and alluvium, and aeolian dune sands deposited after being uplifted. These terraces typically range in age from about 50,000 years to just before more than 2 million years ago, with the youngest terraces at the lowest elevations, such as that crossed by the current project corridor.

- **Central and Coastal Belt Franciscan Mélange (KJfm, KJfs, and TKfs)**: Depending on location, these bedrock units consist of dark gray, highly sheared schist, serpentinite, and greywacke (metamorphosed sandstone). Outcrops commonly show highly contorted rock that is so sheared and metamorphosed that bedding cannot be discerned. Fractured zones are common, and soil development (weathering) can be extreme where these outcrops have been exposed for many millennia. The marine sediments from which these rocks are derived range from Jurassic through Cretaceous to early Paleogene in age or, very roughly, from 55 million to about 170 million years ago.

METHODOLOGY

Sensitivity Criteria

The Caltrans Standard Environmental Reference criteria were considered to assess the paleontological sensitivity of the geologic units within the proposed project footprint (Caltrans 2012b). Caltrans criteria use the following three categories to describe the likelihood that a geologic unit contains significant fossil materials: high potential, low potential, and no potential, defined in Table 2-16.

Society of Vertebrate Paleontology (SVP) guidelines were also considered in assessing the degree of paleontological sensitivity of the proposed project corridor (SVP 2010). The SVP guidelines are compatible with Caltrans guidelines but allow for somewhat more nuanced assessments because they include an additional category of "undetermined" potential. SVP categories of paleontological sensitivity are as follows:

- **High Potential**: Sediments from which vertebrate or significant invertebrate, plant, or trace fossils have been recovered are considered to have a high potential for containing additional significant paleontological resources.

[5] "Paralic" refers to the complex of sediments or facies that typify a beach area, consisting not only of beach sand but near-shore surf zone sediments, estuarine muds, dune deposits and lagoonal sediments.

- **Undetermined Potential**: Sediments that, based on their nature and setting, may yield scientifically important fossils, but for which little information is available concerning their actual fossil content, are considered to have undetermined potential. Further field study can help to determine if these rock units have high or low potential to contain significant paleontological resources. Until additional data on their specific fossil potential becomes available, sediments of undetermined potential are normally treated as if they possess "high" paleontological sensitivity.

- **Low Potential**: Rock units or sediments that are poorly represented by fossil specimens in institutional collections, or based on general scientific consensus only preserve fossils in rare circumstances and the presence of fossils is the exception not the rule, e.g., volcanic ash flows or recent colluvium. The highly fractured and metamorphosed rocks of the Franciscan Mélange are another example, as will be discussed below.

Table 2-16 Caltrans' Paleontological Sensitivity Criteria

Caltrans Potential/ Sensitivity Designation	Characteristics of Geologic Units in this Category
High	This category consists of rock units, which, based on previous studies, contain or are likely to contain significant vertebrate, significant invertebrate, or significant plant fossils. These units include, but are not limited to, sedimentary formations that contain significant nonrenewable paleontological resources anywhere within their geographical extent, and sedimentary rock units temporally or lithologically suitable for the preservation of fossils. These units may also include some volcanic and low-grade metamorphic rock units. Fossiliferous deposits with very limited geographic extent or an uncommon origin (e.g., tar pits and caves) are given special consideration and ranked as highly sensitive. High sensitivity includes the potential for containing: 1) Abundant vertebrate fossils 2) A few significant fossils (large or small vertebrate, invertebrate, or plant fossils) that may provide new and significant taxonomic, phylogenetic, ecologic, and/or stratigraphic data 3) Areas that may contain datable organic remains older than Recent, including *Neotoma* (sp.) middens 4) Areas that may contain unique new vertebrate deposits, traces, and/or trackways. Areas with a high potential for containing significant paleontological resources require monitoring and mitigation

Table 2-16 Caltrans' Paleontological Sensitivity Criteria

Caltrans Potential/ Sensitivity Designation	Characteristics of Geologic Units in this Category
Low	This category consists of sedimentary rock units that are: 1) Potentially fossiliferous but have not yielded significant fossils in the past 2) Have not yet yielded fossils but have potential for containing fossil remains 3) Contain common and/or widespread invertebrate fossils if the taxonomy, phylogeny, and ecology of the species contained in the rock are well understood Sedimentary rocks expected to contain vertebrate fossils are not placed in this category because vertebrates are generally rare and found in more localized stratum. Rock units designated as low potential generally do not require monitoring and mitigation. However, as excavation for construction gets underway, it is possible that new and unanticipated paleontological resources might be encountered. If this occurs, a Construction Change Order must be prepared to have a qualified Principal Paleontologist evaluate the resource. If the resource is determined to be significant, monitoring and mitigation is required.
No Potential	This category consists of rock units of intrusive igneous origin, most extrusive igneous rocks, and moderately to highly metamorphosed rocks that are classified as having no potential for containing significant paleontological resources. For projects encountering only these types of rock units, paleontological resources can generally be eliminated as a concern when the Preliminary Environmental Analysis Report is prepared and no further action is required.

Note:
Source: *Standard Environmental Reference, Volume 1, Chapter 8: Paleontology* (Caltrans 2012b).

- **No Potential**: Rock units with no potential to contain significant paleontological resources, such as high-grade metamorphic rocks (e.g., gneiss and schist) and plutonic igneous rocks (e.g., basalt flows or granite).

Paleontological Sensitivity

Based on the information provided previously and the results of a paleontological records search and literature review focused on the proposed project corridor, the paleontological sensitivity of sediments potentially affected by project implementation is presented below. As noted previously, because Quaternary landslide deposits do not occur within or close to the proposed project corridor, they are not considered further in this analysis.

Franciscan Mélange. Though Franciscan Mélange, as part of the Franciscan complex, occurs extensively throughout the Coast Ranges, macrofossil finds in it have been rare. The University of California at Berkeley, Museum of Paleontology (UCMP) database holds just two records of vertebrate fossils, two records of plant

fossils, and 21 records of invertebrate fossils from the Franciscan complex statewide, none of which are from Sonoma County (UCMP 2014). The Franciscan complex is known to contain microfossils; however, the microfossil bearing rock is abundant and common. Therefore, the Franciscan Mélange is considered to have low potential to contain significant paleontological resources.

Marine Terrace Deposits. Fossil invertebrates, such as mollusks and fossil vertebrates may be found in marine terrace deposits (Lajoie et al. 1991). Though UCMP has a number of fossil records from the Sonoma Coast, Pleistocene and early Holocene records are sparse. With one exception, all invertebrate records are listed as being from the recent period (UCMP 2014). One Pleistocene-age plant fossil site was recorded as being found in marine terrace deposits at Bodega Head, within 2 miles of the proposed project corridor. No vertebrate fossils have been recorded with UCMP as having been found along the Sonoma Coast or in marine terrace deposits. Therefore, these sediments are considered to have an undetermined potential to contain significant paleontological resources.

Quaternary stream channel deposits. In some instances, the aggradational terraces of fluvial systems have been known to yield vertebrate fossils (Dundas and Cunningham 1993). However, lidar remote sensing data of the proposed project corridor shows no evidence of fluvial terrace deposits in the Scotty Creek floodplain. Therefore, these deposits are considered to have a low potential to contain significant paleontological resources at shallow depths. However, at depths exceeding 10 feet, fluvial sediments may exceed 10,000 years in age, and are therefore of undetermined paleontological potential.

Holocene Beach Deposits: Holocene beach deposits are generally too young to contain scientifically significant fossils, except in extraordinary circumstances. They are therefore considered to be of low paleontological sensitivity.

Artificial Fill: Previously excavated sediment is not considered paleontologically sensitive because, even if fossils are present in the excavated soil, they would be out of stratigraphic context. Without stratigraphic context, there is no certainty regarding a specimen's origin or age, and consequently it lacks scientific value. Therefore, artificial fill possesses no paleontological sensitivity.

ENVIRONMENTAL CONSEQUENCES

All potential project effects to paleontological resources would occur during the construction of the proposed project.

Potential Paleontological Resources and Comparison of Alternatives

Geologic units underlying the proposed project corridor for all three project Build Alternatives are principally marine terrace deposits of undetermined paleontological sensitivity. These possess low paleontological sensitivity at depths of less than 10 feet, and undetermined paleontological sensitivity at greater depth. Holocene beach deposits lie immediately adjacent to the proposed project corridor, and they have low paleontological sensitivity. Franciscan Mélange is exposed by erosion on either side of the Scotty Creek channel, and those rocks possess low paleontological sensitivity. Finally, artificial fill is expected to occur along the proposed project corridor, and it is of no paleontological sensitivity.

The northern portion of the proposed project area is principally located on marine terrace deposits of Pleistocene age possessing undetermined paleontological sensitivity. Depending on the depth of open excavation, potential to encounter buried paleontological resources exists. Excavations may penetrate the mantel of alluvial, colluvial, and aeolian material that likely overlies these sediments, and reach potentially fossiliferous marine terrace deposits. The southern portion of Alternative 19B would also cross marine terrace deposits and has similar potential to encounter paleontological resources.

Pile drilling for bridge construction would occur in all three Build Alternatives, and would presumably extend to depths sufficient to affect these deeper sediments of undermined sensitivity. However, pile drilling does not bring sediment to the surface; paleontological resources would not be recoverable, even if affected by this activity. Open excavations, however, may expose recoverable paleontological resources. Therefore, implementation of the proposed project would potentially result in adverse effects to paleontological resources.

AVOIDANCE, MINIMIZATION, AND/OR MITIGATION MEASURES

Because sediment of undetermined paleontological sensitivity has the potential to be disturbed, the following avoidance and minimization measures will be incorporated into the proposed project:

- **Measure PALEO-1:** Preparation of a Paleontological Resources Awareness Module (PRAM). A PRAM is a project-specific worker training module for all construction personnel, designed to be integrated into the worker environmental awareness training program for the project. The PRAM provides pictures of fossils that might be encountered, a review of the laws and regulations protecting paleontological resources, the name of a qualified paleontologist to contact if

fossils are discovered, description of the role of monitors, and measures to be taken until discoveries can be assessed and recovered. Administration of the PRAM to construction workers will help to ensure that fossils are recognized and handled properly in the event they should be encountered.

- **Measure PALEO-2:** Preparation of a Paleontological Evaluation Report (PER)/Proposed Mitigation Plan (PMP). The PER/PMP will be prepared using detailed design plans of the Preferred Build Alternative. The PER/PMP will include a monitoring plan, if necessary, that will provide (1) instructions for monitoring excavations, (2) a determination of the level of monitoring necessary at each excavation based on paleontological sensitivity of the sediment and excavation type, and (3) prescriptions for dealing with paleontological discoveries.

2.3 Biological Environment

The following analysis is based on the Natural Environment Study (NES) prepared for the Gleason Beach Roadway Realignment Project (Caltrans 2015d) and various other surveys completed for this project including wetland delineations and rare plant surveys. These studies and reports serve as the basis for establishing the environmental baseline for the proposed project.

2.3.1 Natural Communities

This section of the document discusses natural communities of concern. The focus of this section is on biological communities, not individual plant or animal species. This section also includes information on wildlife corridors and habitat fragmentation. Wildlife corridors are areas of habitat used by wildlife for seasonal or daily migration. Habitat fragmentation involves the potential for dividing sensitive habitat and thereby lessening its biological value.

Habitat areas that have been designated as critical habitat under the federal Endangered Species Act are discussed below in the Threatened and Endangered Species Section 2.3.5. Wetlands and other waters are also discussed below in Section 2.3.2.