3.8 Hydrology and Water Resources

Since publication of the Draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS), the following substantive changes have been made to this section:

- Additional information regarding the Navigable Waters Protection Rule was added to the Clean Water Act (CWA) (33 United States Code [U.S.C.] § 1251 et seq.) in Section 3.8.2.1, Federal.
- The description of the Rivers and Harbors Act of 1899 (RHA) in Section 3.8.2.1 was updated to clarify its requirements and to acknowledge that as the local sponsor, the Santa Clara Valley Water District (SCVWD) would be involved in the review and approval of the design plans for the Guadalupe River crossing in San Jose.
- Revisions were added to Section 3.8.2.2, State, to update the prioritization of groundwater basins and describe SCVWD's *2019 Groundwater Management Plan* in subsection Senate Bill 1168, Assembly Bill 1739, and Senate Bill 1319: Sustainable Groundwater Management Act and to clarify the conditions under which the San Francisco Bay Conservation and Development Commission (BCDC) is authorized to issue permits for fill in the San Francisco Bay under the McAteer-Petris Act (California Government Code § 66600 et seq.) subsection.
- The discussion of Federal Emergency Management Agency (FEMA) requirements in Section 3.8.4.5, Method for Determining Significance under CEQA was revised.
- Section 3.8.5.4, Groundwater, was revised to define principal aquifers, acknowledge artisanal conditions in the Santa Clara Valley Basin, acknowledge shallow groundwater near downtown San Jose, clarify recharge and infiltration processes, and incorporate information about a recently constructed San Francisco Public Utilities Commission (SFPUC) production well in Millbrae.
- Text, Figure 3.8-5, and Table 3.8-7 of Section 3.8.5.4 were updated to account for the latest basin boundary modification approved by the California Department of Water Resources (DWR).
- Aquatic resources in Section 3.8.5, Affected Environment, and the impact analysis in Section 3.8.6, Environmental Consequences, were revised to reflect additional coordination with the U.S. Army Corps of Engineers (USACE) in spring 2021. These changes occurred in Tables 3.8-6, 15, and 17 as well as in the discussion of Impact HYD#2, Permanent Impacts on Drainage Patterns and Stormwater Runoff.
- The impact analysis in Section 3.8.6 was revised to reflect the updated project footprint incorporating design modifications since publication of the Draft EIR/EIS, including but not limited to revisions to the East Brisbane light maintenance facility (LMF) lead track, the realignment of Lagoon Road farther north, and the removal of the roadway extension of Visitacion Avenue from Old County Road to Valley Drive.
- Analysis about the Diridon Design Variant (DDV), which was included in Section 3.19, Design Variant to Optimize Speed, in the Draft EIR/EIS, was incorporated into Section 3.8.6 and in the discussions of Impacts HYD#1, HYD#4, HYD#7, HYD#13, and HYD#14.
- Additional information was added to Table 3.8-18 under Impact HYD#2 to indicate the percentage of impervious areas the San Francisco to San Jose Project Section (Project Section, or project) would introduce within each watershed. The table was also updated to match the latest project footprint and remove modifications to the Atherton Station because the station closed in 2020, and modifications are no longer needed.
- Additional information was added to Impacts HYD#4 and HYD#8 to further characterize the hazardous materials, buried refuse, and soils in the area of the Brisbane LMF, and the effects of construction in these areas on surface water and groundwater quality.

- Additional information was added to Impact HYD#9 regarding waterproofing of subsurface structures and the effect of subsurface structure on groundwater levels.
- Impact HYD#13; Section 3.8.7, Mitigation Measures; Section 3.8.8, Impact Summary for NEPA Comparison of Alternatives; and Section 3.8.9, CEQA Significance Conclusions, were updated to reflect that the proposed mitigation (HYD-MM#1) to avoid an increase in surface elevation has been incorporated as part of the project design for Alternative A.
- Additional discussion and clarification about the potential effects of sea level rise on the project was added to Section 3.8.10, Vulnerability and Adaption to Sea Level Rise.

3.8.1 Introduction

This section describes surface water hydrology, surface water quality, groundwater, and floodplains in the resource study area (RSA), where hydrology and water resources are most susceptible to change as a result of construction and operation of the project. Critical hydrology and water resource issues along the project footprint include increases in stormwater runoff volumes from new impervious surfaces, reductions in surface water and groundwater quality, loss of groundwater recharge capacity, and floodplain encroachment. In the project footprint, the San Francisco to South San Francisco Subsection would face the greatest change to hydrology and water resources because both alternatives would build an LMF in Brisbane.

Primary Hydrology and Water Resources Impacts

- Drainage patterns and stormwater runoff
- Surface water quality
- Groundwater quality and volume
- Floodplain hydraulics

The *San Francisco to San Jose Project Section Hydrology and Water Resources Technical Report* (San Francisco to San Jose Hydrology and Water Resources Technical Report) (California High-Speed Rail Authority [Authority] 2020a) and, for the San Jose Diridon Station Approach Subsection, the *San Jose to Merced Project Section Hydrology and Water Resources Technical Report* (San Jose to Merced Hydrology and Water Resources Technical Report) (Authority 2020b) (Hydrology and Water Resources Technical Reports), support this hydrology and water resources analysis.[1] The following appendices in Volume 2, Technical Appendices, of this Final EIR/EIS provide additional details on hydrology and water resources:

- Appendix 2-D, Applicable Design Standards, describes the relevant design standards for the project.
- Appendix 2-E, Project Impact Avoidance and Minimization Features, provides the list of all impact avoidance and minimization features (IAMF) incorporated into the project.
- Appendix 2-I, Regional and Local Plans and Policies, provides a list by resource of all applicable regional and local plans and policies.
- Appendix 2-J, Policy Consistency Analysis, provides a summary by resource of project inconsistencies and reconciliations with local plans and policies.
- Appendix 3.1-B, San Francisco Bay Conservation and Development Commission Bay Plan Consistency Analysis, provides a summary of the project's consistency with San Francisco Bay Plan (Bay Plan) policies.
- Appendix 3.8-A, List of Aquatic Resources Crossed, provides a list of aquatic resources in the project footprint.

[1] Technical reports for the San Francisco to San Jose Project Section evaluate the portions of the HSR alignment between 4th and King Street Station in San Francisco and Scott Boulevard in Santa Clara, while technical reports for the adjacent San Jose to Merced Project Section evaluate the portions of the HSR alignment south of Scott Boulevard to the Project Section terminus at West Alma Avenue south of the San Jose Diridon Station.

- Appendix 3.8-B, Summary of Hydraulic Modeling, summarizes the methods and results of all hydraulic modeling performed for the project.
- Appendix 3.8-C, Basin Plan Water Quality Impact Assessment, summarizes impacts on beneficial uses, water quality objectives, and listed impairments from the project.

Hydrology and water resources, including hydrology, water quality, surface water, groundwater, and floodplains, are important to maintaining environmental quality and public health in the San Francisco Peninsula and Santa Clara Valley. The following four Final EIR/EIS resource sections provide additional information related to hydrology and water resources:

- Section 3.3, Air Quality and Greenhouse Gases, evaluates impacts of project construction and operation on short-term and long-term air quality and greenhouse gas emissions.
- Section 3.7, Biological and Aquatic Resources, evaluates impacts that would be associated with construction and operation of the project alternatives on wetlands, waters, and jurisdictional habitat.
- Section 3.9, Geology, Soils, Seismicity, and Paleontological Resources, evaluates impacts of the project alternatives on shallow groundwater, erosive soils, and seismicity.
- Section 3.10, Hazardous Materials and Wastes, evaluates impacts of the project alternatives on existing soil and groundwater contamination and cleanup operations.

3.8.2 Laws, Regulations, and Orders

This section presents federal, state, and local laws, regulations, orders, and plans applicable to hydrology and water resources. The Authority would develop the high-speed rail (HSR) system, including the Project Section, in compliance with all federal and state regulations. Regional and local plans and policies relevant to hydrology and water resources considered in the preparation of this analysis are provided in Volume 2, Appendix 2-I.

3.8.2.1 Federal

Federal Railroad Administration Procedures for Considering Environmental Impacts (64 Federal Register 28545)

These Federal Railroad Administration (FRA) procedures state that an EIS should consider possible impacts on water quality and flood hazards and floodplains.

Clean Water Act (33 U.S.C. § 1251 et seq.)

The CWA is the primary federal law protecting the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. The CWA prohibits any discharge of pollutants into the nation's waters unless specifically authorized by a permit. The following subsections discuss applicable sections of the CWA. On April 21, 2020, the USACE and the U.S. Environmental Protection Agency (USEPA) published the Navigable Waters Protection Rule, which narrowed the extent of waters of the U.S. regulated under the CWA. Implementation of this rule has been put on hold pursuant to an August 30, 2021, court order in the *Pascua Yaqui Tribe v. U.S. Environmental Protection Agency* case. Accordingly, as of September 2021, the USACE and USEPA are interpreting the extent of waters of the U.S. consistent with the pre-2015 regulatory regime.[2] The USACE and USEPA have announced their intent to revise the definition of waters of the U.S. to restore and build upon the pre-2015 regulatory definition and published a proposed rule in December 2021.

Basin Planning (33 U.S.C. § 1289) (CWA Section 102)

CWA Section 102 requires the planning agency of each state to prepare a basin plan to set forth regulatory requirements for protection of surface water quality, which include designated

[2] For additional information regarding the pre-2015 regulatory definition and practice, refer to the USEPA's website: https://www.epa.gov/wotus/current-implementation-waters-united-states#Pre-2015.

beneficial uses for aquatic resources, as well as specified water quality objectives to protect those uses. Basin plans also establish a program of implementation for achieving water quality objectives within the basin plan areas. Continued coordinated monitoring of water is necessary to confirm the degree to which discharges of project runoff may or may not adversely affect the beneficial uses of the receiving waters, how the receiving waters attain assigned water quality objectives, and the degree to which a project may affect water quality of existing surface waters.

In California, the State Water Resources Control Board (SWRCB) prepares statewide planning documents and the Regional Water Quality Control Boards (RWQCB) prepare regional planning documents. The project is in the jurisdiction of the San Francisco Bay RWQCB. The *Water Quality Control Plan for the San Francisco Bay Basin* (Basin Plan) (San Francisco Bay RWQCB 2017) is the applicable regional basin plan for the project.

Water Quality Impairments (33 U.S.C. § 1313(d)) (CWA Section 303)

Section 303 of the CWA requires states to adopt water quality standards for all waters of the U.S. within their jurisdictions. The water quality standards must identify all beneficial uses, protect the most sensitive beneficial uses of the aquatic resource, and provide antidegradation policies. Antidegradation policies pertain to situations where existing water quality exceeds levels needed to sustain and protect beneficial uses. If the state determines, through intergovernmental coordination and public participation provisions in the state's planning process, that allowing water quality to become degraded is necessary for economic or social development, then that degradation or lower water quality may not affect established beneficial uses.

Section 303(d) requires each state to develop a list of impaired surface waters that do not meet, or that the state expects would not meet, state water quality standards. It also requires each state to develop total maximum daily loads (TMDL) of pollutants for impaired aquatic resources. The TMDL must account for the pollution sources causing the water to be listed by the state. The SWRCB has combined its 303(d) List and the 305(b) Report into the California 2014–2016 Integrated Report—303(d) and 305(b) Report, known as the Integrated Report—303(d) List of Water Quality Limited Segments and 305(b) Surface Water Quality Assessment (SWRCB 2017).

Clean Water Quality Certification (33 U.S.C. § 1341) (CWA Section 401)

Under Section 401 of the CWA, applicants for a federal license or permit to conduct activities that may result in a discharge into waters of the U.S. must obtain certification that the discharge would not violate water quality standards, including water quality objectives and beneficial uses. The state in which the discharge will originate or the interstate water pollution control agency with jurisdiction over affected waters issues the certification. For the project, the SWRCB would issue the Section 401 certification.

Permit for Discharge of Dredged or Fill Material in Wetlands and Other Waters (33 U.S.C. § 1344) (CWA Section 404)

Under Section 404, the USACE and the USEPA regulate the discharge of dredged or fill materials into waters of the U.S. Project sponsors must obtain a permit from the USACE for discharges of dredged or fill materials into waters over which the USACE has jurisdiction. The Authority manages compliance with the USACE permitting process required for an individual permit under Section 404 through a memorandum of understanding (MOU) that establishes three checkpoint reports—one of which defines the project purpose and need, another establishes the range of alternatives for environmental review, and the last report identifies a preliminary least environmentally damaging practicable alternative (LEDPA) (FRA et al. 2010).

National Pollutant Discharge Elimination System Program (33 U.S.C. § 1342) (CWA Section 402)

Under Section 402 of the CWA, the National Pollutant Discharge Elimination System (NPDES) Program regulates all point-source discharges, including, but not limited to, construction-related runoff discharges to surface waters and some post-development discharges. In California, project sponsors must obtain an NPDES permit from the SWRCB.

In California, the SWRCB administers the NPDES program, and the RWQCBs have implementation and enforcement responsibilities. The NPDES program is applicable to all discharges to waters of the U.S., including stormwater discharges associated with construction activities, industrial operations, municipal drainage systems, and other point sources in order to protect surface water quality. In general, the NPDES permit program controls, minimizes, or reduces surface water impacts. Four types of the NPDES program stormwater permits would be relevant to the project and are discussed in the following sections—the Construction General Permit (CGP), Industrial General Permit (IGP), California Department of Transportation (Caltrans) NPDES permit, and municipal separate storm sewer system (MS4) NPDES permits. The Authority requested and received designation as a nontraditional permittee of the Phase II Small MS4 permit (Order No. 2013-0001-DWQ).

Stormwater Discharges: Construction General Permit

Under the federal CWA, entities discharging stormwater from construction sites must comply with the conditions of an NPDES permit. The SWRCB is the NPDES permit authority in California and has adopted the CGP that applies to projects resulting in 1 or more acre of soil disturbance. For projects that disturb more than 1 acre of soil, the SWRCB requires permittees to prepare a stormwater pollution prevention plan (SWPPP). The SWPPP specifies site management activities that permittees or their construction contractors must implement during site development. These management activities include construction stormwater best management practices (BMP), erosion and sediment controls, runoff controls, and construction equipment maintenance. These BMPs are part of the IAMFs that the Authority will include in design and construction of the project. Appendix 2-E in Volume 2 lists the IAMFs relevant to protection of hydrology and water resources.

Stormwater Discharges: Industrial General Permit

The CWA requires certain industrial facilities to comply with an NPDES permit, the California Statewide Industrial General NPDES and Waste Discharge Requirements (WDR) Permit (Order 2014-0057-DWQ), known as the IGP. The revised IGP took effect on July 1, 2015 and authorizes discharges of industrial stormwater to waters of the U.S. if those discharges comply with all requirements, provisions, limitations, and prohibitions in the permit. The IGP regulates discharges associated with 10 broad categories of industrial activities, including railroad transportation facilities.

Stormwater Discharges: California Department of Transportation Statewide Stormwater Permit

Caltrans operates under a statewide stormwater permit (Order No. 2012-0011-DWQ, NPDES No. CAS000003) that regulates stormwater and nonstormwater discharges from Caltrans properties, facilities, and activities, also known as the Caltrans NPDES permit. Additionally, the Caltrans NPDES permit requires Caltrans' construction activities to comply with the adopted statewide CGP (see the subsection Stormwater Discharges: Construction General Permit). The Caltrans permit is applicable to those portions of the project that would involve modifications to state highways, such as State Route (SR) 82/El Camino Real.

Stormwater Discharges: Municipal Separate Storm Sewer System Permits

The NPDES program requires that states develop and implement municipal stormwater management programs to meet the requirements for stormwater discharges from municipal separate storm sewer systems, also called MS4, because they do not contain sanitary waste. MS4 permits regulate the quality of water discharged from MS4s into aquatic resources. MS4 permits apply to drainage systems owned and operated by cities, counties, public agencies, and other entities. The SWRCB and the RWQCBs manage Phase I (for municipalities with more than 100,000 people) and Phase II (for municipalities with fewer than 100,000 people) programs.

The Authority is designated as a nontraditional permittee under the Phase II MS4 permit. This order is the only MS4 permit for which the Authority has obtained coverage as a discharger. The requirements of the Phase II MS4 permit apply to the Authority's right-of-way, as well as the Caltrain right-of-way and some areas within San Francisco. The Authority has developed an IAMF for stormwater management (HYD-IAMF#1: Stormwater Management) and would design stormwater BMPs per numeric sizing criteria.

The San Francisco Bay RWQCB developed a region-wide Phase I MS4 permit, locally known as the Municipal Regional Permit (MRP). Stormwater discharges from drainage systems in almost all cities and counties in the RSA are regulated by the MRP. Specifically, the portions of the project in municipal rights-of-way would be required to comply with the MRP. Provision C.6 requires permit holders, such as local cities and counties, to develop and implement a construction site inspection and monitoring program. This monitoring program allows permittees to inspect construction sites within their right-of-way at any time during the year. For the project, provision C.6 would allow local cities and counties to inspect construction site BMPs within temporary construction easements (TCE) in their right-of-way. Provision C.3 of the MRP specifically addresses the minimization of stormwater impacts from new development or redevelopment by requiring stormwater treatment and hydromodification management BMPs.

Approximately 90 percent of San Francisco does not drain into an MS4. Rather, most stormwater drains into a combined sewer system that carries both stormwater runoff and sanitary waste toward San Francisco Bay. This combined stormwater and sanitary waste is stored in large tanks along the waterfront, and then treated at wastewater treatment plants before it is discharged into San Francisco Bay. San Francisco is not regulated under the MRP; instead, Phase II MS4 permits apply to the areas within San Francisco that do not drain into the combined sewer system. Nevertheless, San Francisco has developed requirements similar to those of MS4 permits that require BMPs to control post-construction stormwater pollution in the entire city.

As part of MS4 permit compliance, municipalities and agencies implement stormwater management programs to limit to the maximum extent practicable the discharge of pollutants from storm sewer systems. A single state agency or a coalition, often consisting of more than one municipality (such as cities and counties), may implement these programs. Each program includes temporary construction site BMPs and permanent post-construction BMPs to reduce the quantity and improve the quality of stormwater discharged to the storm sewer system. Discharges to storm sewer systems must comply with the stormwater management program requirements. Improvements in TCEs must comply with local MS4 permit requirements. The MS4 permit requirements that apply to watersheds within the project footprint are shown in Table 3.8-1.

Table 3.8-1 Municipal Separate Storm Sewer System Permit Requirements

Jurisdiction(s) within Project Section	Stormwater Permit and Guidance Documents	Summary of Post Construction Requirements
Authority (San Francisco Bay RWQCB jurisdictions)	▪ Phase II MS4 permit ▪ Construction Site BMP Manual (Caltrans 2017a) ▪ Project Planning and Design Guide (Caltrans 2017b)	For planning purposes, assume general Phase II MS4 permit standards and BMPs apply: ▪ Stormwater treatment and baseline hydromodification management is required for projects that create or replace more than 5,000 square feet of impervious surface ▪ Full hydromodification management is required for projects that create or replace 1 acre or more of impervious surface
Caltrain	▪ Phase II MS4 permit ▪ Post-construction stormwater requirements are currently in development	For planning purposes, assume general Phase II MS4 permit standards and BMPs apply: ▪ Stormwater treatment and baseline hydromodification management is required for projects that create or replace more than 5,000 square feet of impervious surface ▪ Full hydromodification management is required for projects that create or replace 1 acre or more of impervious surface

Jurisdiction(s) within Project Section	Stormwater Permit and Guidance Documents	Summary of Post Construction Requirements
City and County of San Francisco combined sewer areas	▪ SMR (SFPUC 2016)	Projects that create or replace more than 5,000 square feet of impervious surface: ▪ Projects with existing imperviousness of less than or equal to 50% must maintain pre-development stormwater runoff rates and volumes for the 1- and 2-year, 24-hour design storms ▪ Projects with existing imperviousness of more than 50% must reduce the stormwater runoff rate and volume by 25% relative to pre-development conditions for the 2-year, 24-hour design storm ▪ Hydromodification management is not required
Port of San Francisco Mission Bay separate sewer areas	▪ Phase II MS4 permit ▪ SMR (SFPUC 2016)	Projects that create or replace more than 5,000 square feet of impervious surface: ▪ Implement source controls and BMPs to manage the 90th percentile, 24-hour storm ▪ Document BMPs in a Stormwater Control Plan ▪ Develop Maintenance Plan for all BMPs ▪ Hydromodification management is not required
Port of San Francisco	▪ Phase II MS4 permit ▪ SMR (SFPUC 2016)	Projects that create or replace more than 5,000 square feet of impervious surface: ▪ Implement source controls and BMPs to manage the 85th percentile, 24-hour storm ▪ Document BMPs in a Stormwater Control Plan ▪ Develop operations and maintenance verification documents for all BMPs ▪ Hydromodification management is not required
Brisbane, South San Francisco, San Bruno, Millbrae, Burlingame, San Mateo, Belmont, San Carlos, Redwood City, Atherton, Menlo Park, and San Mateo County	▪ MRP/Phase I MS4 permit ▪ SMCWPPP C.3 Regulated Projects Guide (2020)	▪ Stormwater management and treatment is required for projects that create or replace more than 10,000 square feet of impervious surface ▪ Hydromodification management is required for projects that create or replace 1 acre or more of impervious surface and are in susceptible areas identified in Section 3.8.5.2, Surface Water Hydrology ▪ Maintenance plans are required for regulated projects
Palo Alto, Mountain View, Sunnyvale, Santa Clara, San Jose, and Santa Clara County	▪ MRP/Phase I MS4 permit ▪ SCVURPPP C.3 Stormwater Handbook (2016)	▪ Stormwater management and treatment is required for projects that create or replace more than 10,000 square feet of impervious surface ▪ Hydromodification management is required for projects that create or replace 1 acre or more of impervious surface and are in susceptible areas identified in Section 3.8.5.2 ▪ Maintenance plans are required for regulated projects

Jurisdiction(s) within Project Section	Stormwater Permit and Guidance Documents	Summary of Post Construction Requirements
Caltrans	▪ Caltrans MS4 permit ▪ Construction Site BMP Manual (Caltrans 2017a) ▪ Project Planning and Design Guide (Caltrans 2017b) ▪ Hydromodification Requirements Guidance (Caltrans 2015)	▪ Stormwater management and treatment is required for highway projects that create 1 acre or more of new impervious surface ▪ Stormwater management and treatment is required for non-highway projects that create 5,000 square feet or more of new impervious surface ▪ Rapid stability assessments are required for projects that contain stream crossings or create 1 acre or more of new impervious surface to determine hydromodification management requirements

Sources: Caltrans 2015, 2017a, 2017b; SFPUC 2016; SMCWPPP 2020; SCVURPPP 2016
Authority = California High-Speed Rail Authority
BMP = best management practice
Caltrans = California Department of Transportation
MRP = Municipal Regional Permit
MS4 = municipal separate storm sewer system
RWQCB = Regional Water Quality Control Board
SCVURPPP = Santa Clara Valley Urban Runoff Pollution Prevention Plan
SMCWPPP = San Mateo Countywide Water Pollution Prevention Plan
SMR = San Francisco Stormwater Management Requirements and Design Guidelines

Rivers and Harbors Act of 1899 (33 U.S.C. § 401 et seq.)/General Bridge Act of 1946 (33 U.S.C. § 525 et seq.)

The RHA is the primary federal law regulating activities that may affect navigation on the nation's waterways. Sections 9 and 10 of the RHA (33 U.S.C. §§ 402 and 403, respectively) and Section 404 of the CWA govern the placement of obstructions and dredge and fill materials in navigable waters of the U.S., respectively, as follows.

- Section 9 of the RHA and Section 9 of the General Bridge Act require a U.S. Coast Guard permit for the construction of bridges and causeways over certain navigable waters of the U.S. to prevent impacts on marine traffic. Section 9 bridge permits are required only for waters that are currently or potentially navigable for commerce; general recreational boating is typically not sufficient to establish jurisdiction. Navigable waters are defined as aquatic resources subject to the ebb and flow of the tide or that are currently, potentially, or historically utilized in their natural condition or by reasonable improvements, as means to transport interstate or foreign commerce.
- Section 10 of the RHA requires authorization from USACE for the following: construction of any structure in or over any navigable waters of the U.S., excavating from or depositing material in such waters, or any other work affecting the course, location, condition, or capacity of such waters. The Section 10 permit application is the same as the CWA Section 404 Individual Permit application form (ENG Form 4345).
- Section 14 of the RHA (33 U.S.C. § 408) requires USACE's permission for the use, including modifications or alterations, of any flood control facility built by the United States to prevent impairment of the usefulness of the federal facility. The Authority manages Section 408 compliance through an MOU among the Authority, FRA, USEPA, and USACE (FRA et al. 2010). The MOU provides a process for the Authority to submit information early in the design process to confirm that the project as designed can feasibly achieve Section 408 compliance. The Guadalupe River crossing in San Jose would require Section 408 permission under each of the two project alternatives. As the local sponsor, SCVWD would be involved in review and approval of the design plans for the Guadalupe River crossing in San Jose. To the extent required under Section 408, the Authority would seek a "Statement of No Objection" from SCVWD regarding the request for Section 408 permission from USACE.

Protection of Wetlands (USEO 11990)

U.S. Presidential Executive Order (USEO) 11990 aims to avoid direct or indirect impacts on wetlands from federal or federally approved projects when a practicable alternative is available. If wetland impacts cannot be avoided, all practicable measures to minimize harm must be included.

Safe Drinking Water Act of 1974 (42 U.S.C. § 300 et seq.)

The Safe Drinking Water Act was originally passed by Congress in 1974 to protect public health by regulating the nation's public drinking water supply. The act authorizes the USEPA to set national health-based standards for drinking water to protect against both naturally occurring and human-produced contaminants that may be found in drinking water. The act applies to every public water system in the U.S.

The Sole Source Aquifer Protection Program is authorized by Section 1424(e) of the act. The Sole Source Aquifer designation is a tool to protect drinking water supplies in areas where there are few or no alternative sources to the groundwater resource and where, if contamination occurred, using an alternative source would be extremely expensive. All proposed projects receiving federal funds are subject to USEPA review so they do not endanger a water source.

Coastal Zone Management Act (16 U.S.C. §§ 1451 et seq.)

The objective of the Coastal Zone Management Act (CZMA) of 1972 is to "preserve, protect, develop, and, where possible, restore or enhance the resources of the nation's coastal zone." *Coastal zone* means "the coastal waters (including the lands therein and thereunder) and the adjacent shorelands (including the lands therein and thereunder, including the waters therein and thereunder), strongly influenced by each other and in proximity to the shorelines of the several coastal states, and includes islands, transitional and intertidal areas, salt marshes, wetlands, and beaches." This act also requires projects to be planned, located, designed, and engineered for the changing water levels and associated impacts that might occur over the duration of the development. The CZMA is administered by the California Coastal Commission in most areas in California; in the San Francisco Bay Area (Bay Area), the CZMA is administered by the BCDC. The CZMA requires federal actions, including permits and funding, that are reasonably likely to affect the use of land or water or natural resources within the coastal zone be consistent with policies within a state's federally approved coastal management program.

Floodplain Management and Protection (USEO 11988)

USEO 11988 (Floodplain Management) directs all federal agencies to avoid, to the extent possible, long- and short-term adverse impacts associated with the occupancy and modification of floodplains and direct and indirect support of floodplain development, wherever there is a practicable alternative. Requirements for compliance are outlined in 23 Code of Federal Regulations (C.F.R.) Part 650, Subpart A, titled "Location and Hydraulic Design of Encroachment on Floodplains" (2015).

Should the Preferred Alternative involve significant encroachment onto the floodplain, the final environmental document must include the following specific discussion of the floodplain:

- Reasons the proposed action must be located in the floodplain
- Alternatives considered and why they were not practicable
- A statement indicating whether the action conforms to applicable state or local floodplain protection standards

National Flood Insurance Act (42 U.S.C. § 4001 et seq.) and Flood Disaster Protection Act (42 U.S.C. §§ 4001–4128)

The purpose of the Flood Disaster Protection Act of 1973 was to identify flood-prone areas and provide insurance. The act requires purchase of insurance for buildings in special flood-hazard areas. The act is applicable to any federally assisted acquisition or construction project in an area identified as having special flood hazards. Projects should avoid construction in, or develop a design to be consistent with, FEMA-identified special flood-hazard areas.

FEMA oversees the National Flood Insurance Program (NFIP), which offers federally backed flood insurance to homeowners, renters, and business owners in communities that choose to participate in the program. Flood insurance studies (FIS) are typically published for each county. Within the RSA, the latest FISs were produced in 2019 for San Francisco County, 2019 for San Mateo County, and 2014 for Santa Clara County.

Based on the results of the FIS, FEMA develops Flood Insurance Rate Maps (FIRM) for participating communities. FIRMs divide communities into zones of relative flood risk severity. Flood hazard zones are areas inundated by the 100-year flood (i.e., 1 percent chance of annual flooding).

To be eligible for federally backed flood insurance, a community must participate in the NFIP. Participating communities must adopt and enforce floodplain management ordinances meeting or exceeding FEMA requirements for reducing the risks of future flood damage. FEMA has set a minimum national standard, allowing no more than a 1-foot increase in base flood elevations (BFE), whether mapped or not mapped, due to the cumulative impact of local development, and no increases in the BFE of regulatory floodways.

Should a project substantially alter the extent or depth of the base flood, the owner must submit supporting documentation and modeling. If the development proposal is approved by FEMA, they issue a Conditional Letter of Map Revision. After construction is complete, as-built construction plans and modeling are submitted to FEMA, who issues a Letter of Map Revision, which officially updates the FIRM.

3.8.2.2 State

This section describes California laws, regulations, and orders applicable to hydrology and water resources in the geographic area affected by the Project Section.

Porter-Cologne Water Quality Control Act (California Water Code § 13000 et seq.)

The Porter-Cologne Water Quality Control Act of 1969 (Porter-Cologne Act) provides for the regulation of all pollutant discharges, including wastes in project runoff that could affect the quality of the state’s water. Any entity proposing to discharge waste must file a Report of Waste Discharge with the appropriate RWQCB or the SWRCB. Because the California HSR System is a project of statewide importance, any Reports of Waste Discharge and CWA Section 401 water quality certifications would be filed with the SWRCB. The Porter-Cologne Act also provides for the development and periodic reviews of basin plans that designate beneficial uses of California’s major rivers and groundwater basins and establishes water quality objectives for those waters. The Project Section is in the jurisdiction of the San Francisco Bay RWQCB.

Streambed Alteration Agreement (California Fish and Game Code §§ 1601–1603)

The California Fish and Game Code requires the Authority to notify the California Department of Fish and Wildlife (CDFW) prior to implementing any HSR project that would divert, obstruct, or change the natural flow or bed, channel, or bank of any river, stream (including intermittent streams), or lake.

California Safe Drinking Water Act (California Health and Safety Code § 116270)

The federal Safe Drinking Water Act requires states to obtain and maintain primary enforcement responsibility for public water systems. Thus, the California Safe Drinking Water Act was developed to meet this criterion of its federal counterpart. The California Safe Drinking Water Act improves the minimum requirements of the federal Safe Drinking Water Act and establishes primary drinking water standards that are at least as stringent.

Senate Bill 1168, Assembly Bill 1739, and Senate Bill 1319: Sustainable Groundwater Management Act

On September 16, 2014, Governor Edmund G. Brown Jr. signed historic legislation to strengthen local management and monitoring of groundwater basins most critical to the state's water needs. The three bills, Senate Bill 1168 (Pavley), Assembly Bill 1739 (Dickinson), and Senate Bill 1319 (Pavley) together makeup the Sustainable Groundwater Management Act (SGMA). The act establishes phased requirements for high- and medium-priority basins to adopt groundwater sustainability plans, depending upon whether a basin is in critical overdraft. The SGMA requires locally controlled groundwater sustainability agencies to adopt groundwater sustainability plans by January 31, 2020, for all high- or medium-priority basins in overdraft condition and by January 31, 2022, for all other high- and medium-priority basins, unless the basin is legally adjudicated or otherwise managed sustainably.

The City and County of San Francisco and the SFPUC are the designated groundwater agencies for the Downtown San Francisco, Islais Valley, South San Francisco Basins. The City of San Francisco, SFPUC, and San Mateo County are the designated groundwater agencies for the Visitacion Valley Basin. These basins have a very low prioritization under the SGMA.

The Cities of San Francisco, Daly City, San Bruno, Burlingame, South San Francisco, and Millbrae, the town of Colma, the California Water Services Company, and SFPUC are the designated groundwater agencies for the Westside Basin. The *South Westside Basin Groundwater Management Plan* (City of San Bruno et al. 2012) addresses the long-term sustainability of the southern portion of the Westside Basin. Although the Westside Basin has a very low prioritization under the SGMA, the groundwater agencies are currently assessing groundwater sustainability for the basin.

San Mateo County is the designated groundwater agency for the San Mateo Plain subbasin. The subbasin is currently being assessed for groundwater resources, current conditions, and potential groundwater management strategies. This assessment has been documented in the *San Mateo Plain Groundwater Basin Assessment* (County of San Mateo 2018). The subbasin has a very low prioritization under the SGMA; however, an addendum to *California's Groundwater Bulletin 118* proposes to change the prioritization to medium. The groundwater sustainability plan for the subbasin was not available during preparation of this document.

SCVWD is the designated groundwater sustainability agency for the Santa Clara subbasin. SCVWD's *2016 Groundwater Management Plan*, adopted on November 22, 2016 (SCVWD 2016a), addresses the long-term sustainability of the Santa Clara subbasin, and DWR has determined that it meets the intent of the SGMA. In 2019, DWR approved the SCVWD's *Groundwater Management Plan* as an alternative to a groundwater sustainability plan for the Santa Clara subbasin. This document was reviewed during preparation of this document.

Cobey-Alquist Flood Plain Management Act (California Water Code § 8400 et seq.)

The Cobey-Alquist Flood Plain Management Act encourages local governments to adopt and enforce land use regulations to implement floodplain management. It also provides state assistance and guidance for flood control.

McAteer-Petris Act (California Government Code § 66600 et seq.)

The McAteer-Petris Act vests the BCDC with the authority to plan and regulate activities and development in and around the San Francisco Bay, consistent with policies adopted in the Bay Plan. BCDC regulates the filling and dredging of the San Francisco Bay and any substantial change in use of any water or land within the area of BCDC's jurisdiction through the permitting process described in the Act. The Act affords BCDC jurisdiction over five areas in and around the San Francisco Bay: (1) "Bay" jurisdiction, (2) "shoreline" jurisdiction, (3) "saltponds" jurisdiction, (4) "managed wetlands" jurisdiction, and (5) "certain waterways" jurisdiction. Only two of these BCDC jurisdictional areas are relevant for the project: the Bay and shoreline jurisdictions.

The project includes areas within BCDC jurisdiction at Mission Creek and Islais Creek in San Francisco; Visitacion Creek, Guadalupe Valley Creek, and Brisbane Lagoon in Brisbane; Oyster Bay and Colma Creek in South San Francisco; and El Zanjon Creek in San Bruno.

The agency's decision to grant or deny a permit for the project is guided by the Act's provisions and the standards set out in the Bay Plan. BCDC is authorized to regulate fill or dredge in the San Francisco Bay and development of the shoreline band, which consists of the area within 100 feet of the shoreline. The McAteer-Petris Act creates broad circumstances under which a permit is required by providing that any person wishing to place fill, extract materials, or make any substantial change in the use of water, land, or structures within areas subject to BCDC's jurisdiction to obtain a permit. The term *fill* is defined broadly to include not only earth and other materials, but pilings, structures placed on pilings, and floating structures. BCDC is authorized to issue a permit for fill in the Bay if it determines that the issuance of the permit would be consistent with the provisions of the Act and with the policies established for the Bay Plan or if BCDC determines that the activity to be permitted is necessary for the health, safety, or welfare of the public in the entire Bay Area. Pursuant to Section 66605 of the McAteer-Petris Act, BCDC must determine if the proposed fill in the Bay: (1) is for a water-oriented use and provides public benefits that outweigh the adverse impacts from the loss of open water areas; (2) there is no alternative upland location available for the proposed action; (3) the fill would be the minimum amount necessary to achieve the purpose of the proposed action; (4) the nature, location, and extent of fill minimizes harmful effects on the Bay; and (5) the fill is constructed in accordance with sound safety standards. Volume 2, Appendix 3.1-B, sets out the Bay Plan policies pertinent to the project and an assessment regarding the consistency of the project with those policies.

The McAteer-Petris Act also provides that a permit must be obtained from BCDC prior to undertaking construction activities within the shoreline band jurisdiction. In addition, for permitting purposes, the Act allows for areas associated with the shoreline band to be designated by BCDC for priority uses. Within such areas, the proposed use must be consistent with the uses specified for the designated area. To obtain a permit for development within the shoreline band, the proposed project must provide for maximum feasible public access to the Bay and the shoreline.

Executive Order S-13-08: Climate Change Adaptation

On November 14, 2008, Governor Arnold Schwarzenegger signed California Executive Order (EO) S-13-08. This EO directs all state agencies planning to build projects in areas vulnerable to future sea level rise to consider a range of sea level projections for the years 2050 and 2100, assess project vulnerability, and, to the extent feasible, reduce expected risks and increase resiliency to sea level rise. The Authority is an agency of the State of California; therefore, this regulation applies to the Project Section.

3.8.2.3 Regional and Local

This section describes regional and local laws, regulations, and orders applicable to hydrology and water resources in the geographic area affected by the project. Volume 2, Appendix 2-I lists the regional and local plans and policies relevant to hydrology and water resources considered in the preparation of this analysis.

Dewatering Activities

Within the jurisdiction of the San Francisco Bay RWQCB, dewatering activities are often regulated under one of the following general NPDES WDR permits:

- Discharge or Reuse of Extracted and Treated Groundwater Resulting from the Cleanup of Groundwater Polluted by Volatile Organic Compounds (VOC), Fuel Leaks and Other Related Wastes (VOC and Fuel General Permit), Order No. R2-2012-0012, NPDES No. CAG912002
- Discharge or Reuse of Extracted Brackish Groundwater, Reverse Osmosis Concentrate Resulting from Treated Brackish Groundwater, and Extracted Groundwater from Structural Dewatering Requiring Treatment (Groundwater General Permit), Order No, R2-2012-0060, NPDES No. CAG912004

The VOC and Fuel General Permit is used for the treatment and discharge of groundwater contaminated with VOCs and petroleum hydrocarbons at construction or remediation sites. The Groundwater General Permit is typically used for long-term structural dewatering of more than 10,000 gallons per day or aquifer reclamation activities requiring reverse osmosis.

3.8.3 Consistency with Plans and Laws

As indicated in Section 3.1.5.3, Consistency with Plans and Laws, the California Environmental Quality Act (CEQA) and Council on Environmental Quality (CEQ) regulations require a discussion of inconsistencies or conflicts between a proposed undertaking and federal, state, regional, or local plans and laws. Accordingly, this Final EIR/EIS describes the inconsistency of the project alternatives with federal, state, regional, and local plans and laws to provide planning context.

A number of federal and state laws and implementing regulations, listed in Section 3.8.2.1 and Section 3.8.2.2, direct the use and treatment of waters, including surface water quality, stormwater runoff, storm sewer systems, groundwater, and protection from floods. Several adopted federal and state management plans and programs also pertain to hydrology and water resources and are applicable to this Final EIR/EIS. A summary of the federal and state requirements considered in this analysis follows:

- Federal and state acts and laws that provide comprehensive requirements for water-quality maintenance or improvement, including treatment and management of stormwater runoff, and preventing pollutants from entering waters. Applicable acts and laws include the federal CWA, the RHA, and the state Porter-Cologne Act.
- Federal and state acts and laws that provide comprehensive requirements for flood protection and floodplain management, including the National Flood Insurance Act, as well as the Floodplain Management and Climate Change Adaptation EOs.
- The California SGMA, which mandates improved local and regional management of groundwater improvements.
- Local groundwater management plans for the Westside Groundwater Basin and Santa Clara Valley Subbasin, which contain protection measures for groundwater recharge areas within these basins.
- Federal and state permit processes that require an applicant to demonstrate compliance with these acts, laws, and plans prior to, during, and after construction, including obtaining permits associated with the NPDES program, MS4 authorizations, and the state's CGP processes.

The Authority, as the lead agency proposing to build and operate the HSR system, is required to comply with all federal and state laws and regulations and secure all applicable federal and state permits prior to initiating construction on the selected alternative. Therefore, there would be no inconsistencies between the project alternatives and these federal and state laws and regulations.

The Authority is not required to comply with local land use and zoning regulations; however, it has endeavored to design and build the project to be consistent with land use and zoning regulations. For example, the project alternatives incorporate specific features that would control runoff and stormwater pollution. The Authority reviewed a total of 359 local and regional policies, goals, objectives, ordinances, and stormwater management programs. The project would be consistent with 359 local and regional policies, goals, objectives, ordinances, and stormwater management programs, and inconsistent with 2 policies and ordinances in the following regional and local plans. Refer to Volume 2, Appendix 2-I for an inventory of all local and regional policies, goals, objectives, and ordinances considered in this analysis, and refer to Volume 2, Appendix 2-J for detailed descriptions of inconsistencies with individual policies, goals, objectives, and ordinances.

- **South Westside Basin Groundwater Management Plan** (City of San Bruno et al. 2012)—Policy J1. Proposed radio communication towers along San Antonio Avenue in San Bruno would be located in a vegetated strip on the west side of the existing Caltrain corridor that facilitates groundwater recharge in the South Westside groundwater basin. The project cannot be relocated to avoid development in this area because the project follows the existing Caltrain corridor.

- **Belmont General Plan** (City of Belmont 2017)—Policy 6.2-3. The Authority would design drainage systems according to design criteria promulgated by the Authority and primarily based on Caltrans' *Highway Design Manual* (Caltrans 2018), which does not require designing drainage systems to convey the 100-year flow. However, if any of the project's proposed drainage facilities require a connection to Belmont's drainage facilities, the Authority would coordinate with Belmont to determine if an upgrade to the existing facility is required.

3.8.4 Methods for Evaluating Impacts

The evaluation of impacts on hydrology and water resources is a requirement of the National Environmental Policy Act (NEPA) and CEQA. The following sections summarize the RSAs and describe the methods used to analyze impacts of project construction and operations on hydrology and water resources.

3.8.4.1 Definition of Resource Study Area

As described in Section 3.1, Introduction, RSAs are the geographic boundaries in which the environmental investigations specific to each resource topic were conducted. The RSAs for impacts on hydrology and water resources encompass the areas that could potentially be directly or indirectly affected by construction and operation of the project. Each RSA contains the project footprint of each alternative, including the track, stations, and LMF, at a minimum, as well as additional geographic areas, depending upon the resource-specific characteristics.

The surface water hydrology, surface water quality, and floodplain RSAs share the same outermost boundary, which was defined by the Cal Water Planning Watersheds the project crosses. Because these RSAs share the same boundary, they are collectively referred to as the surface water RSA. Within the surface water RSA, the surface water hydrology and water quality impact analysis focuses on the aquatic resources within and downstream of the project footprint that would receive runoff from the project; for floodplains, the analysis focuses on the floodplains delineated by FEMA that are within and downstream of the project footprint. The groundwater RSA includes DWR Bulletin 118 groundwater basins and subbasins the project crosses. The limits of each RSA are defined in Table 3.8-2.

Table 3.8-2 Definition of Hydrology and Water Resources Resource Study Area

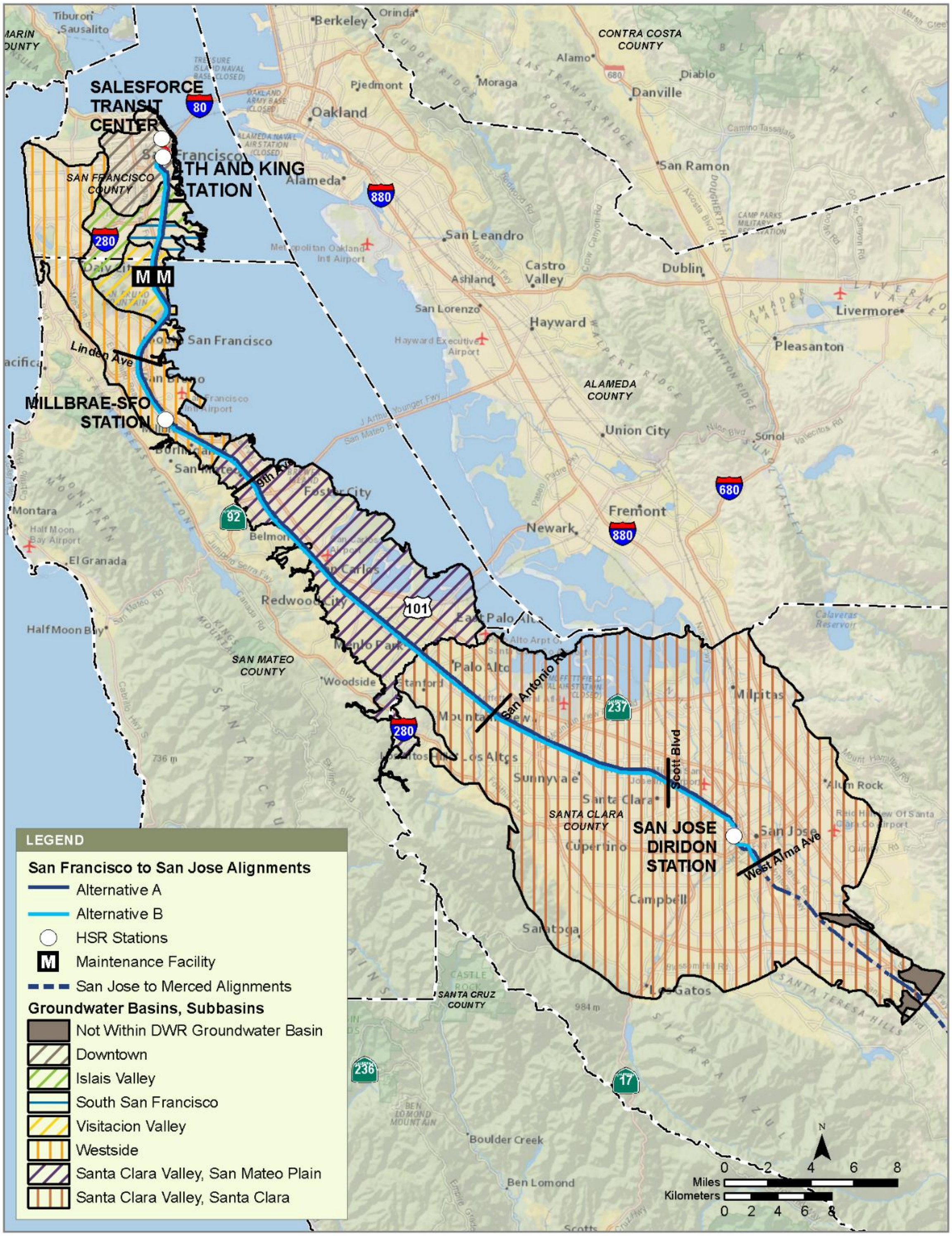
Type	General Definition	
	San Francisco to South San Francisco Subsection to Mountain View to Santa Clara Subsection	San Jose Diridon Station Approach Subsection
Surface water (Figure 3.8-1)	Cal Water Planning Watersheds the project crosses.	Cal Water Planning Watersheds the project crosses. The RSA was further defined by limiting it to portions of watersheds within 3 miles of the project footprint.
Groundwater (Figure 3.8-2)	Entire DWR Bulletin 118 groundwater basins and subbasins the project crosses. The RSA was further defined by limiting it to locations within 10 miles of the project footprint.	All subsurface areas within 1 mile of the project footprint, as well as portions of DWR Bulletin 118 groundwater basins and subbasins the project crosses that are within 2 miles of the project footprint.
Floodplains (Figure 3.8-1)	All FEMA floodplains within surface water RSA	All FEMA floodplains within surface water RSA

DWR = California Department of Water Resources
FEMA = Federal Emergency Management Agency
RSA = resource study area

Sources: CAL FIRE 2013; Authority 2020c, 2020d; CDFW 2016; USGS 2016; DataSF 2016; County of San Mateo Information Services 2016; SCVWD 2012; Oakland Museum of California 2005a–i, 2007a–l

SEPTEMBER 2019

Figure 3.8-1 Surface Water and Floodplain Resource Study Area



Sources: Authority 2019a, 2019b; DWR 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2006, 2020 NOVEMBER 2020

Figure 3.8-2 Groundwater Resource Study Area

3.8.4.2 Impact Avoidance and Minimization Features

IAMFs are project features that are considered to be part of the project and are included as applicable in each of the alternatives for purposes of the environmental impact analysis. Volume 2, Appendix 2-E provides the full text of the IAMFs that are applicable to the project. The following IAMFs are applicable to the hydrology and water resources analysis:

- HYD-IAMF#1: Stormwater Management
- HYD-IAMF#2: Flood Protection
- HYD-IAMF#3: Prepare and Implement a Construction Stormwater Pollution Prevention Plan
- HYD-IAMF#4: Prepare and Implement an Industrial Stormwater Pollution Prevention Plan
- AQ-IAMF#1: Fugitive Dust Emissions
- BIO-IAMF#5: Prepare and Implement a Biological Resources Management Plan
- GEO-IAMF#1: Geologic Hazards
- GEO-IAMF#10: Geology and Soils
- HMW-IAMF#1: Property Acquisition Phase I and Phase II Environmental Site Assessments
- HMW-IAMF#4: Undocumented Contamination
- HMW-IAMF#5: Demolition Plans
- HMW-IAMF#6: Spill Prevention
- HMW-IAMF#7: Transport of Materials
- HMW-IAMF#8: Permit Conditions
- HMW-IAMF#9: Environmental Management System
- HMW-IAMF#10: Hazardous Materials Plans

This environmental impact analysis considers these IAMFs as part of the project design. Within Section 3.8.6, each impact narrative describes how these project features are applicable and, where appropriate, effective at avoiding or minimizing potential impacts.

3.8.4.3 Methods for Impact Analysis

This section describes the sources and methods used to analyze potential project impacts on surface water hydrology, surface water quality, groundwater, and floodplains. These methods apply to both NEPA and CEQA analyses unless otherwise indicated. Refer to Section 3.1.5.4, Methods for Evaluating Impacts, for a description of the general framework for evaluating impacts under NEPA and CEQA. The Authority used the following information sources (and associated geographic information system [GIS] data) to describe the affected environment (Table 3.8-3).

Table 3.8-3 Summary of Data Sources

Data Source	Name/Description of Source(s)
Climate, Precipitation, and Topography	
California Geological Survey	*California Geological Survey: California Geomorphic Provinces* (2002)
U.S. Geological Survey	*The National Map Viewer* (2016)
Western Regional Climate Center	Climate summaries (2016a, 2016b)
Surface water hydrology	
California High-Speed Rail Authority	Hydrology and Water Resources Technical Reports (2020a, 2020b), Aquatic Resources Delineation Reports (2020c, 2020d)
California Department of Fish and Wildlife	California Streams GIS Data (2016)
California Department of Forestry and Fire Protection	Cal Water 2.2.1 Watershed Boundaries GIS data (2013)

Data Source	Name/Description of Source(s)
County of San Mateo Information Services	Natural Features GIS Layers (2016)
DataSF	Water bodies GIS Layer, Water bodies in San Francisco (2016)
Oakland Museum of California	Watershed maps (2005a–i, 2007a–l)
Santa Clara Valley Water District	Creeks and canals in Santa Clara County GIS database (2016a); Watching Our Watersheds Interactive Map Layers, Western Santa Clara County (2012)
Surface water quality	
U.S. Department of Agriculture, Natural Resources Conservation Service	Web Soil Survey (2010)
Regional Water Quality Control Board, San Francisco Bay Region	Water Quality Control Plan (Basin Plan) for the San Francisco Bay Basin (2017)
San Francisco Public Utilities Commission and Port of San Francisco	Meeting Notes. Stormwater Design Guidelines Open House #1 (2007)
San Mateo Countywide Water Pollution Prevention Program	*C.3 Regulated Projects Guide* (2020)
Santa Clara Valley Urban Runoff Pollution Prevention Program	Hydromodification Management Applicability Maps for Palo Alto, Mountain View, Sunnyvale, and Santa Clara (2010)
State Water Resources Control Board	CWA Section 303(d) lists of water quality-impaired reaches (2017)
Groundwater	
California High-Speed Rail Authority	Hazardous Materials and Wastes Technical Reports (2019c, 2019d)
California Department of Water Resources	*California's Groundwater Bulletin 118* and GIS Data (2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2006, 2020); *Water Management Planning Tool* (2015a)
City of San Bruno, California Water Service Company, and City of Daly City	*South Westside Basin Groundwater Management Plan* (2012)
Regional Water Quality Control Board, San Francisco Bay Region	*Basin Plan for the San Francisco Bay Basin* (2017)
County of San Mateo	*San Mateo Plain Groundwater Basin Assessment* (2018)
Santa Clara Valley Water District	Santa Clara County Groundwater Subbasins GIS Layer (2016b); *2016 Groundwater Management Plan* (2016a); *Annual Groundwater Report 2019* (2020)
State Water Resources Control Board	GeoTracker Database (2016)

Data Source	Name/Description of Source(s)
Floodplains	
Federal Emergency Management Agency	Preliminary Flood Insurance Study for San Francisco County (2019a); Flood Insurance Studies for San Mateo County (2019b), and Santa Clara County (2014)
California Emergency Management Agency, California Geological Survey, and University of Southern California	Tsunami Inundation Maps for Emergency Planning State of California (2009)
California Natural Resources Agency and California Ocean Protection Council	*State of California Sea-Level Rise Guidance*. 2018 Update (2018)

CWA = Clean Water Act
GIS = geographic information system

The Authority performed the following qualitative analyses to evaluate potential impacts on hydrology and water resources.

- Reviewed the project footprint for each of the project alternatives and compared the footprint and design plans with information on jurisdictional aquatic resources within the aquatic RSA, general locations of aquatic resources within the surface water RSA and habitat study area, groundwater basins, and floodplains. Refer to Section 3.7 for more information on the aquatic RSA and habitat study area.
- Identified and considered federal and state statutes regulating water resources as part of the analysis of potential hydrology, water quality, groundwater, and floodplain impacts. The applicable statutes establish water quality standards, regulate discharges and pollution sources, and protect drinking water systems, aquifers, and floodplain and floodway values. County and city general plans were also reviewed for applicable policies and regulations to determine if the project would result in potential impacts.
- Researched available documents from various agencies, including U.S. Geological Survey (USGS), San Francisco Bay RWQCB, DWR, and FEMA, to determine whether the project alternatives would affect hydrology, water quality, groundwater, and floodplains. These documents included floodplain and floodway maps from FEMA. The Authority identified and mapped FEMA-designated 100-year floodplain boundaries and areas and BFEs using GIS and FEMA's FIRMs for San Francisco, San Mateo, and Santa Clara Counties.

Potential impacts on hydrology, water quality, groundwater, and floodplains were subdivided into three main categories:

- Temporary construction impacts—Direct and indirect impacts resulting from project construction activities
- Permanent construction impacts—Direct and indirect impacts pertaining to the physical presence of the project and associated infrastructure in the environment
- Operations impacts—Direct and indirect impacts from interim, intermittent, or continuous routine maintenance activities

Additional details on the methods used to analyze impacts on hydrology and water resources resulting from the project can be found in the Hydrology and Water Resources Technical Reports (Authority 2020a, 2020b).

3.8.4.4 Method for Evaluating Impacts under NEPA

NEPA regulations (40 C.F.R. Parts 1500–1508) provide the basis for evaluating project impacts (as described in Section 3.1.5.4). As described in Section 1508.27 of these regulations, the criteria of context and intensity are considered together when determining the severity of the change introduced by the project.

- **Context**—For this analysis, the *context* for hydrology and water resources includes: the volume and timing of existing surface water flows; extent of impervious surface and density of drainage systems in affected watersheds; existing levels of biological, chemical, and physical contaminants in surface water and groundwater; beneficial uses and water quality standards of surface water and groundwater; depth to the groundwater table; the footprint, water surface elevation, and peak flow of existing floodplains; and the regulatory setting pertaining to hydrology and water resources.
- **Intensity**—For this analysis, *intensity* is determined by the severity of the impact on hydrology and water resources, such as changes in local and regional drainage patterns, stormwater runoff rates and volumes, capacities of existing or planned drainage systems, concentrations of pollutants in surface water and groundwater aquifers, elevation of the groundwater table, and 100-year floodplain and floodway water surface elevations, footprints, and peak flows.

Climate Change

At present, the CEQ does not have any specific guidance concerning addressing climate change under NEPA. This section includes an analysis of potential vulnerability to flooding associated with sea level rise for informational purposes and in relation to compliance with California EO S-13-08 and as background to support regulatory decision making by BCDC.

3.8.4.5 Method for Determining Significance under CEQA

For this analysis, the project would result in a significant impact on hydrology and water resources if it would:

- Violate any water quality standards or waste discharge requirements or otherwise substantially degrade surface or ground water quality.
- Substantially decrease groundwater supplies or interfere substantially with groundwater recharge such that the project may impede sustainable groundwater management of the basin.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river or through the addition of impervious surfaces, in a manner which would:
  - Result in substantial erosion or siltation on- or off-site.
  - Substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site.
  - Create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems or provide substantial additional sources of polluted runoff.
  - Impede or redirect flood flows.
- Risk release of pollutants due to project inundation in flood hazard, tsunami, or seiche zones.
- Conflict with or obstruct implementation of a water quality control plan or sustainable groundwater management plan.

State and federal agencies, including USEPA, SWRCB, and RWQCBs, have established basin plans, water quality standards, and waste discharge requirements that are relevant to the project. These standards and requirements have been developed to prevent the degradation of water quality pursuant to the CWA, including changes in hydrology associated with additions of impervious surfaces (hydromodification), as well as erosion and sedimentation that may result from hydromodification, and thus serve as appropriate thresholds for determining the significance of water quality impacts, as well as hydrology impacts related to hydromodification. The analysis of risk associated with release of pollutants from project inundation was focused on materials storage areas rather than non-point sources.

In 2014, California adopted the SGMA, which provides a regulatory framework for the management and use of groundwater in a manner that can be maintained through the planning horizon without causing undesirable results. Under this act, undesirable results are defined as the chronic lowering of the groundwater table, reduction of storage capacity, intrusion of seawater, degradation of groundwater quality, subsidence of land, and depletions of interconnected surface water; these conditions must be both significant and unreasonable to be considered an undesirable result. Therefore, compliance with the SGMA and avoidance of undesirable results are appropriate thresholds for determining the significance of groundwater impacts.

For impacts related to flood hazards, the analysis relies on standards established by FEMA and local agencies. FEMA oversees federal floodplain management policies and runs the NFIP adopted under the National Flood Insurance Act of 1968. FEMA prepares FIRMs that delineate the regulatory floodplain to assist local governments with land use and floodplain management decisions to avoid flood-related hazards. To avoid impacts related to flooding, FEMA and the local agencies require that an encroachment into a floodplain not increase the water surface elevation of the 100-year flood by more than 1 foot in floodplains and have no increase in floodways.

Climate Change

Although EO S-13-08 requires sea level rise to be considered during the planning of the HSR system, and both CEQA and the CEQA Guidelines require an EIR to analyze a project's greenhouse gas emissions, there is currently no specific requirement for an EIR to evaluate the potential impacts of the environment, including climate change and sea level rise, on a project itself (*Ballona Wetlands Land Trust et al. v. City of Los Angeles* (2011) 201 Cal. App. 4th 455 and *California Building Industry Association v. Bay Area Air Quality Management District* (2015) 62 Cal. 4th 369). This Final EIR/EIS provides information on sea level rise and the potential vulnerabilities of the project for informational purposes only, for compliance with EO S-13-08 requiring state projects to plan for and adapt to sea level rise and as background information relative to the project's permitting process with BCDC.

3.8.5 Affected Environment

The surface water hydrology, surface water quality, groundwater, and floodplains in the RSA are described in the following subsections from north to south, by subsection, and, where applicable, by facility. This information provides the context for the environmental analysis and the evaluation of impacts.

3.8.5.1 Climate, Precipitation, and Topography

The surface water, groundwater, and floodplain RSAs are in the Coast Ranges geomorphic province. Topography in the RSAs consists of flat or gently sloped terrain, except for a few locations in San Francisco, near San Bruno Mountain, and some areas near San Jose. Ground elevations along the existing Caltrain track alignment range from near sea level in areas close to San Francisco Bay to approximately 100 feet near Sunnyvale and San Jose in the alluvial Santa Clara Valley. In San Francisco, the existing Caltrain corridor utilizes tunnels to travel through hilly terrain where the ground surface has a maximum elevation of approximately 225 feet. In some areas in San Jose, the existing Caltrain corridor crosses areas with ground elevations ranging from 150 to 200 feet.

The climate of the surface water, groundwater, and floodplain RSAs is characterized by warm, dry summers and cool, relatively dry winters. Rain from Pacific storms is rare during summers. Snow falls very infrequently in the RSAs (Western Regional Climate Center 2016a). Table 3.8-4 provides a summary of climatic conditions in the RSAs. The climate within the surface water, groundwater, and floodplain RSAs, however, is changing because of increased carbon dioxide and other greenhouse gases in the atmosphere. Climate change has the potential to increase air temperatures and modify precipitation patterns in ways that would affect the hydrology of the project. Climate change projections indicate that temperatures could increase by 3 to 9 degrees Fahrenheit (California Natural Resources Agency [CNRA] 2009). Climate change may also create more variable weather patterns throughout California, potentially leading to an increased probability of high-risk, intense storm events, as well as longer, more severe droughts (DWR 2019). Refer to Section 3.3 of this Final EIR/EIS for more information on global climate change.

Table 3.8-4 Temperature and Precipitation Summary

Climate Summary	January	February	March	April	May	June	July	August	September	October	November	December	Annual
San Francisco, California (1981–2010)													
Mean maximum temperature (°F)	58.1	61.0	62.8	64.3	65.7	67.8	68.3	69.4	71.1	70.3	62.2	58.5	65.1
Mean minimum temperature (°F)	46.3	48.1	49.1	49.9	51.6	53.2	54.6	55.6	55.7	54.2	49.1	46.8	51.3
Mean total rainfall (inches)	4.49	4.57	3.17	1.53	0.68	0.19	0.02	0.06	0.22	1.19	3.10	4.52	23.73
San Jose, California (1981–2010)													
Mean maximum temperature (°F)	58.8	62.4	66.6	70.5	75.1	79.9	82.6	82.3	80.7	74.8	63.1	58.7	71.5
Mean minimum temperature (°F)	42.4	45.0	47.1	49.0	52.6	56.1	58.4	58.5	57.1	52.9	45.3	42.4	50.7
Mean total rainfall (inches)	2.97	3.23	2.42	1.19	0.54	0.13	0.02	0.03	0.19	0.80	1.71	2.63	15.83

Source: Western Regional Climate Center 2016b
°F = degrees Fahrenheit

3.8.5.2 Surface Water Hydrology

Hydrology is the study of the distribution, movement, and properties of water. In this analysis, surface water hydrology refers to the paths and flow rates of water flowing over the surface of the earth.

Hydrologic regions typically follow the drainage basin of a major river or the combined drainage areas of a series of rivers, such as a bay or coastline.

Hydrologic units encompass the area drained by a river system, a reach of a river, and its tributaries in that reach, or a group of streams forming a coastal drainage area.

Hydrologic areas subdivide the hydrologic unit according to major tributary areas.

Regional Hydrology

DWR has subdivided California into successively smaller hydrologic boundaries by unique characteristics influenced by climate, topography, land cover type, soil, and water supply infrastructure, among others. These hydrologic boundaries include hydrologic regions, units, and areas. The surface water RSA is in the San Francisco Bay Hydrologic Region. Within the San Francisco Bay Hydrologic Region, the RSA is in the South Bay and Santa Clara Hydrologic Units. Within the South Bay Hydrologic Unit, the RSA is in the San Mateo Bayside Hydrologic Area. Within the Santa Clara Hydrologic Unit, the RSA is in the Palo Alto Hydrologic Area. Table 3.8-5 describes which of these hydrologic boundaries occur in each subsection.

Table 3.8-5 Hydrologic Regions, Units, and Areas and Planning Watersheds in the Resource Study Area

Subsection	Hydrologic Region	Hydrologic Unit(s)	Hydrologic Area(s)	Planning Watersheds*
San Francisco to South San Francisco	San Francisco Bay	South Bay	San Mateo Bayside (HUC-8 18050004)	Bernal Heights, Candlestick Point, Oyster Point
San Bruno San Mateo	San Francisco Bay	South Bay	San Mateo Bayside (HUC-8 18050004)	Oyster Point, Coyote Point
San Mateo to Palo Alto	San Francisco Bay	South Bay, Santa Clara	San Mateo Bayside (HUC-8 18050004), Palo Alto (HUC-8 18050003)	Coyote Point, Undefined (Steinberger Slough Super Planning Watershed), Polhemus Creek, Undefined (Sunnyvale Super Planning Watershed)
Mountain View to Santa Clara	San Francisco Bay	Santa Clara	Palo Alto (HUC-8 18050003)	Undefined (Sunnyvale Super Planning Watershed)
San Jose Diridon Station Approach	San Francisco Bay	Santa Clara	Palo Alto (HUC-8 18050003)	Undefined (Sunnyvale Super Planning Watershed)
			Guadalupe River (HUC-8 18050003)	Undefined (San Jose West Super Planning Watershed)
			Coyote Creek (HUC-8 18050003)	Undefined (San Jose Super Planning Watershed)

Source: CAL FIRE 2013
HUC = hydrologic unit code
Super Planning Watersheds are comprised of multiple Planning Watersheds. For unnamed Planning Watersheds, the Super Planning Watershed name is also given for ease of reference within this document.

San Francisco Bay Hydrologic Region

The San Francisco Bay Hydrologic Region includes all of San Francisco County and portions of Marin, Sonoma, Napa, Solano, San Mateo, Santa Clara, Contra Costa, and Alameda Counties. It occupies approximately 4,500 square miles from southern Santa Clara County to Tomales Bay in Marin County in the north and lies inland near the confluence of the Sacramento and San Joaquin Rivers. The eastern boundary follows the crest of the northern Coast Ranges, which constitutes a watershed divide, where the highest peaks are more than 4,000 feet above mean sea level. Freshwater inflows from the Sacramento and San Joaquin Rivers flow into the Sacramento–San Joaquin Delta and then into San Francisco Bay. The San Francisco Bay Hydrologic Region includes the South Bay Hydrologic Unit and the Santa Clara Hydrologic Unit.

South Bay Hydrologic Unit

The South Bay Hydrologic Unit is in the southern portion of San Francisco Bay. Streamflow originates in the mountainous terrain flanking San Francisco Bay, which is the ultimate receiving water for all surface waters in the unit. Within the surface water RSA, the larger streams in the South Bay Hydrologic Unit are Colma Creek and San Mateo Creek. Many of the smaller creeks and drainages are conveyed through a mixture of natural channels, underground culverts, and storm drain systems. Flood control and drainage improvements have altered the course of many streams through widening, straightening, channelization, and undergrounding.

Within the South Bay Hydrologic Unit, the surface water RSA is in the San Mateo Bayside Hydrologic Area. Within the San Mateo Bayside Hydrologic Area, the surface water RSA includes the following Planning Watersheds: Bernal Heights, Candlestick Point, Oyster Point, Coyote Point, Steinberger Slough, and Polhemus Creek.

Santa Clara Hydrologic Unit

The Santa Clara Hydrologic Unit is in the southern Bay Area. The larger streams in the Santa Clara Hydrologic Unit that are also within the surface water RSA include San Francisquito Creek, Calabazas Creek, Stevens Creek, Permanente Creek, San Tomas Aquino Creek, and Guadalupe River; other streams include Los Gatos Creek. Streamflow originates in the Santa Cruz Mountains to the west and southwest and the Diablo Range to the east and southeast. Flood control and drainage improvements have altered the course of many streams through widening, straightening, channelization, and undergrounding.

The surface water RSA is in the Palo Alto, Guadalupe River, and Coyote Creek Hydrologic Areas, which comprise a portion of the Santa Clara Hydrologic Unit. Within the Palo Alto Hydrologic Area, the surface water RSA includes an undefined portion of the Sunnyvale Super Planning Watershed. Within the Guadalupe River Hydrologic Area, the surface water RSA includes an undefined portion of the San Jose West Super Planning Watershed. Within the Coyote Creek Hydrologic Area, the surface water RSA includes an undefined portion of the San Jose Super Planning Watershed.

Aquatic Resources and Drainage Systems

The Planning Watersheds that comprise the RSA contain more than 450 aquatic features, including creeks, streams, drainage ditches, wetlands, reservoirs, ponds, lakes, and other aquatic resources (Figure 3.8-1). However, aquatic features in the RSA many miles upstream or downstream from the project would not be affected by construction and operations, because potential impacts would occur in aquatic resources within and immediately upstream and downstream of the project footprint.

There are 68 aquatic resources in the project footprint of Alternative A, and 69 in the project footprint of Alternative B. Many of the linear aquatic resources in the RSA, including streams, creeks, and ditches, cross the north-south alignment of the existing Caltrain corridor along an east-west axis, resulting in relatively short reaches of these creeks in the project footprint. However, several ditches and aquatic resources are oriented parallel to the existing Caltrain railbed, and some streams and wetland features are in areas where the footprint extends beyond the existing Caltrain corridor, such as at the East and West Brisbane LMF sites, the passing track under Alternative B, and a new viaduct crossing under Alternative B (with either viaduct option). These aquatic resources include Visitacion Creek, an open channel within the limits of the East Brisbane LMF site, several clusters of wetlands along Visitacion Creek in the East and West Brisbane LMF sites, as well as Leslie Creek, Borel Creek, Laurel Creek, Belmont Creek, Brittan (Arroyo) Creek, Pulgas Creek, and Cordilleras Creek, along the proposed passing track under Alternative B, and Guadalupe River, which is at the proposed viaduct crossing the San Jose Diridon Station Approach Subsection. Table 3.8-6 shows the aquatic resource types within the project footprint by subsection.

Table 3.8-6 Aquatic Resources by Subsection

Resource	San Francisco to South San Francisco	San Bruno to San Mateo	San Mateo to Palo Alto	Mountain View to Santa Clara	San Jose Diridon Station Approach
Constructed basin	Visitacion Creek Constructed Basin 1, 2, 3, and 4, Brisbane Lagoon Constructed Basins+	Not present	Not present	Not present	Not present
Constructed watercourse	Drainage Ditch 1, 2, and 13, Visitacion Creek, Visitacion Creek Tributary, Guadalupe Valley Creek, Oyster Point Channel, Colma Creek	Drainage Ditch 3, 4, 5, 6, 7, and 8, El Zanjon, Highline Creek, Highline Creek Tributary, El Portal Canal, Mills Creek, Easton Creek, Sanchez Creek, Sanchez Creek Tributary, Burlingame Creek	Drainage Ditch 9, 11, and 12, Leslie Creek, Borel Creek, Laurel Creek, Laurel Creek Tributary, Brittan (Arroyo) Creek, Pulgas Creek, Cordilleras Creek, Arroyo Ojo de Agua, Redwood Creek, Atherton Channel, Constructed Watercourse 1, Matadero Creek, Barron Creek, Adobe Creek	Permanente Creek, Sunnyvale East Channel, Calabazas Creek, El Camino Storm Drain, San Tomas Aquino Creek	Guadalupe River
Freshwater emergent wetland	Wetland 1 3, 6, 7, 8, and 9, Drainage Ditch 2 Wetlands, Brisbane Wetlands, Visitacion Creek Tributary Wetland, Visitacion Creek Wetlands	Wetland 4, Highline Creek Tributary Wetlands, Mills Creek Tributary Wetland, Sanchez Creek Tributary Wetland	Wetland 5, Fiesta Creek, Laurel Creek Tributary Wetland	Not present	Not present
Natural watercourse	Guadalupe Valley Creek	San Mateo Creek	Borel Creek, Belmont Creek, Cordilleras Creek, San Francisquito Creek	Stevens Creek	Los Gatos Creek
Open water	Brisbane Lagoon	Not present	Not present	Not present	Not present
Palustrine forested wetland	Not present	Not present	Not present	Not present	Palustrine Forested Wetland 6
Saline emergent wetland	Guadalupe Valley Creek Saline Wetland, Visitacion Creek Saline Wetlands, Brisbane Lagoon Saline Wetlands, Saline Wetland 1	Not present	Not present	Not present	Not present

Sources: Authority 2020c, 2020d

In addition to aquatic resources that provide drainage of surface water through the project footprint, numerous drainage systems within the surface water RSA have heavily modified the historic drainage patterns that existed prior to urban development. Cities within the surface water RSA that have storm drain systems that cross or are parallel to the project footprint include San Francisco, Brisbane, South San Francisco, San Bruno, Millbrae, Burlingame, San Mateo, Belmont, San Carlos, Redwood City, unincorporated San Mateo County, Atherton, Menlo Park, Palo Alto, Mountain View, Sunnyvale, Santa Clara, and San Jose. The Caltrain corridor also contains drainage systems, including longitudinal trench drainage via earthen ditches and underdrains, track drainage at stations and roadway crossings, drainage systems for station platforms and parking lots, bridge deck drainage, and drainage for other structures, such as buildings and underpasses. Refer to Volume 2, Appendix 3.8-A for more information on the aquatic resources within the project footprints.

Hydromodification Susceptibility

Figure 3.8-3 illustrates where the MRP requires hydromodification management in San Mateo County and Santa Clara County due to permanent net increases in impervious surfaces that have the potential to accelerate erosion and sedimentation downstream. Within the surface water RSA, hydromodification requirements apply to areas that drain to earthen channels and catchments less than 65 percent impervious surface by area. For both alternatives, a small area immediately adjacent to and west of Stevens Creek in the Mountain View to Santa Clara Subsection is shown as being susceptible to hydromodification impacts in the project footprint. For Alternative B, an additional area near the intersection of West Hillsdale Boulevard and El Camino Real is susceptible to hydromodification impacts (San Mateo Countywide Water Pollution Prevention Program 2016; Santa Clara Valley Urban Runoff Pollution Prevention Plan 2010).

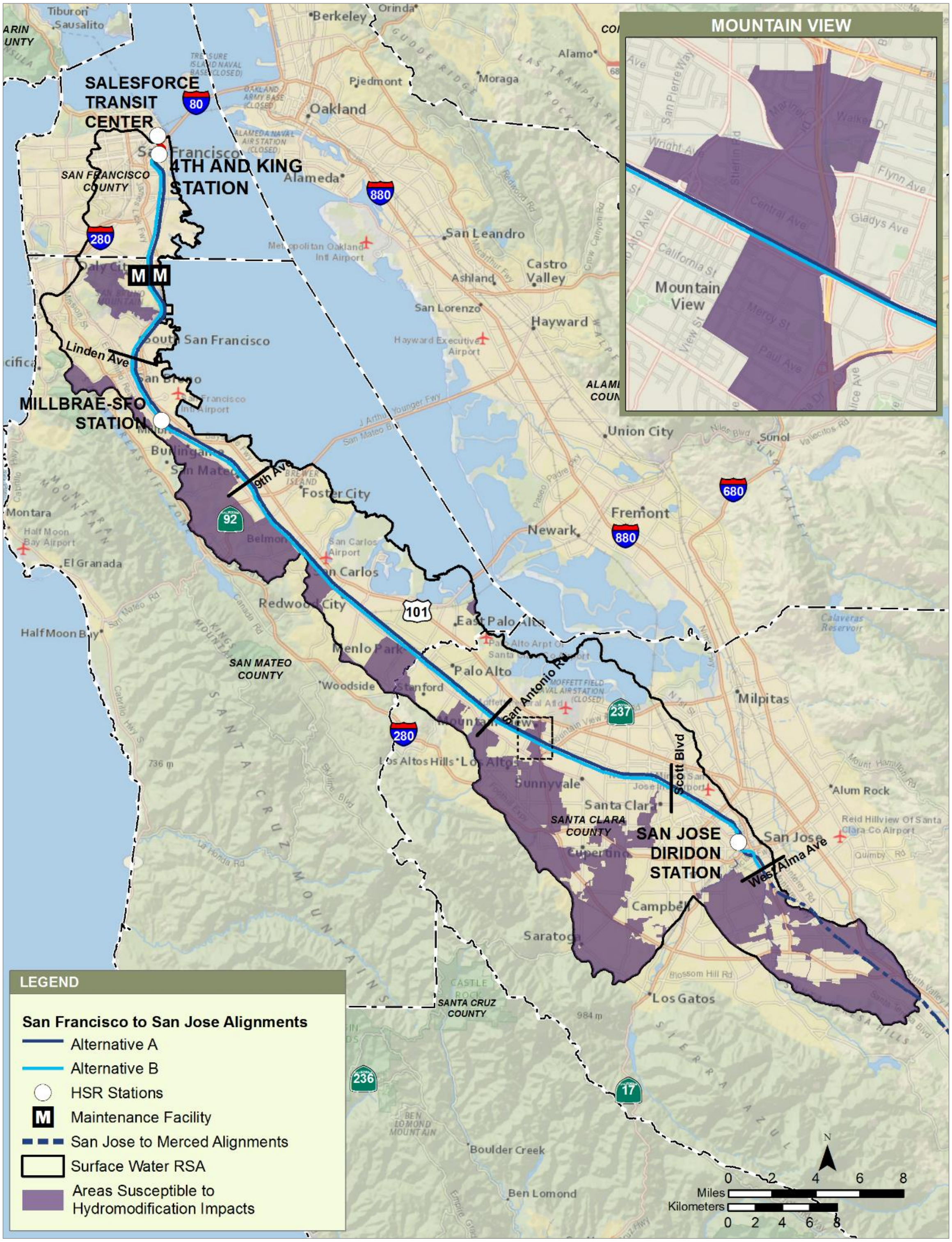
What is hydromodification?

Hydrograph modification, or *hydromodification*, refers to a change in the hydrology of a stream, river, or watershed. Hydromodification can result from the addition of impervious surfaces to the landscape. Rather than allow rain to percolate into soil, impervious surfaces quickly convey runoff to piped storm drains without the opportunity for infiltration. In this way, hydromodification can affect the timing and magnitude of peak flows in the receiving waters. These changes in flow dynamics can cause erosion and sedimentation.

Hydromodification management is not required in many parts of San Francisco because most stormwater runoff is detained in the combined sewer system prior to being released into receiving waters, and San Francisco is not regulated under the MRP. Small areas in San Francisco drain to separate sewers, which are regulated under the Phase II MS4 Permit; these areas include the Port of San Francisco and Mission Bay. In San Francisco, areas that drain to separate sewer systems are generally not required to implement hydromodification management because San Francisco does not contain sensitive creeks that are susceptible to erosion (SFPUC and Port of San Francisco 2007).

Water Districts

A number of water districts operate in the surface water RSA. These entities own and operate facilities, such as canals, diversion facilities, pumps, percolation basins, and treatment facilities, in the surface water RSA for the purpose of providing surface water and groundwater for domestic and agricultural uses, as well as groundwater management. The Authority is required to coordinate with these districts if there is potential for a proposed project to affect any of their facilities. These entities often have design standards for structures that cross their facilities, such as minimum heights between the surface of an aquatic resource and the underside of a bridge. SCVWD, California Water Service Company, Mid-Peninsula Water District, City of Burlingame Public Works—Water Division, City of Millbrae Public Works—Engineering, City of San Bruno Public Works—Water Division, City of Brisbane Water District, and SFPUC have been identified as operating in the surface water RSA (DWR 2015a).



Sources: Authority 2019a, 2019b; SMCWPPP 2020; SCVURPPP 2010

FEBRUARY 2020

Figure 3.8-3 Hydromodification Impact Susceptibility Map

3.8.5.3 *Surface Water Quality*

The San Francisco Bay RWQCB developed a watershed planning document, called the Basin Plan (San Francisco Bay RWQCB 2017), that establishes a list of beneficial uses for aquatic resources. Beneficial uses are the useful resources, services, and qualities that certain aquatic resources provide. In addition, the Basin Plan lays out standards, called *water quality objectives*, that all aquatic resources must meet to preserve the established beneficial uses. When aquatic resources consistently fail to meet a water quality objective, the San Francisco Bay RWQCB must develop and implement a program designed to control sources of pollution through regulatory mechanisms and allow aquatic resources to attain water quality objectives and support its beneficial uses. Refer to Volume 2, Appendix 3.8-C for a complete inventory of the beneficial uses, water quality objectives, and impairments of each aquatic resource identified in the surface water RSA.

Beneficial Uses

Due to the vast number of aquatic resources in the jurisdiction of the San Francisco Bay RWQCB, the San Francisco Bay RWQCB does not identify beneficial uses for each aquatic resource in its Basin Plan. Existing beneficial uses that have not been formally designated in a Basin Plan are protected by water quality objectives whether or not they are identified in a Basin Plan. In general, the beneficial uses of an aquatic resource identified by the Basin Plan apply to all its tributaries.

The following beneficial uses are supported by one or more aquatic resources within the surface water RSA: AGR, COLD, COMM, EST, FRSH, GWR, MIGR, MUN, NAV, RARE, SPWN, WARM, WILD, REC-1, and REC-2 (San Francisco Bay RWQCB 2017). Most aquatic resources provide warm freshwater habitat (WARM) for wildlife, as well as recreational opportunities for humans (WARM, WILD, REC-1, REC-2). However, certain aquatic resources also provide cold freshwater habitat (COLD), which is important habitat for salmon. Aquatic resources that experience tidal influence or are connected with San Francisco Bay by deep waters may also contain estuarine habitat (EST) or have the potential to be used by boats for navigation (NAV). Several aquatic resources in the surface water RSA provide habitat for rare or endangered species (RARE), and these species may use aquatic habitats for reproduction (SPWN) or during seasonal migrations (MIGR). Certain aquatic resources are also used for the active management of groundwater resources (GWR, FRSH) or as a water supply for agricultural and commercial enterprises (AGR, COMM). One aquatic resource in the surface water RSA is used for the municipal and domestic water supply (MUN).

Water Quality Objectives

Water quality objectives are the control and management criteria that are used by the RWQCBs to preserve the beneficial uses of aquatic resources. Water quality objectives include qualitative and quantitative standards. The San Francisco Bay RWQCB has established narrative water quality objectives for pathogenic bacteria, the bioaccumulation of toxic substances in aquatic life, biostimulatory substances, discoloration, depleted oxygen levels, floating materials, oil and grease, protection of wildlife populations and community ecology, pH, radioactivity, salinity, sediment, settleable material, suspended material, sulfide, tastes and odors, temperature, toxicity, turbidity, un-ionized ammonia, and various other specific chemical constituents. In general, these narrative objectives qualitatively describe desirable conditions that all waters of the state should have. These narrative water quality objectives, as well as numerous quantitative standards that

Definitions:

Bioaccumulation is a process wherein chemicals become concentrated in the bodies of living organisms.

Biostimulatory substances are compounds, such as fertilizers containing nitrates and phosphates, that encourage the growth of algae and other microbes.

Population and community ecology refers to alterations of water quality that result in mortality or changes in wildlife.

pH measures the acidity (low pH) or alkalinity (high pH) of water.

Turbidity is the cloudiness of a liquid.

apply to a variety of specific chemical constituents, are stated in Chapter 3 of the Basin Plan (San Francisco Bay RWQCB 2017).

Clean Water Act Section 303(d) List and Total Maximum Daily Loads

A TMDL is a regulatory response initiated by an RWQCB to quantify and enforce the maximum amount of a pollutant that may be discharged to an aquatic resource such that it continues to meet water quality objectives and support its beneficial uses. If an RWQCB can address the impairment through other regulatory means, a TMDL may not be developed and implemented. Figure 3.8-4 presents the locations of impaired aquatic resources within the surface water RSA.

Many aquatic resources in the surface water RSA are listed as impaired for one or more contaminants. Aquatic resources in historically industrial or commercial areas tend to have more impairments than those solely located in or near residential areas. Aquatic resources in historically industrial or commercial areas tend to have impairments related to legacy contaminants. These contaminants include chlordane, dieldrin, dichlorodiphenyltrichloroethane (DDT), and diazinon, as well as other synthetic compounds, like polychlorinated biphenyls (PCB), and some heavy metals, such as lead and mercury. The largest sources of mercury and selenium, another heavy metal, in San Francisco Bay waters are oil refineries, agricultural drainage from the San Joaquin Valley, and historical mining activities. However, areas in Santa Clara County are also known to naturally contain mercury and selenium in geologic formations, which has resulted in water quality impairments in local creeks.

Definitions:

Legacy contaminants are chemicals that bioaccumulate or persist in the environment long after the use, manufacture, and storage of the chemical has been banned or regulated.

Mercury bioaccumulates in the food chain. Too much mercury in water can make the fish that live there unsafe to eat.

Diazinon, **chlordane**, **dieldrin**, and *dichlorodiphenyltrichloroethane* **(DDT)** are particularly toxic pesticides that persist in the environment.

Selenium is a heavy metal found in San Francisco Bay waters and local creeks as a result of natural geologic formations and discharges from oil refineries.

Trash is another impairment that is relatively common within the surface water RSA. Litter discarded onto private residences, public roadways, and parks can be carried into a storm drain inlet and subsequently discharged into a stream or lagoon and eventually into San Francisco Bay. In some locations, often in estuarine areas along San Francisco Bay, levels of bacterial pathogens exceed levels deemed safe for human recreation. Impairments related to sedimentation and siltation are typically established because of degradation of salmon habitat.

Soil Erosion Potential

Erosion and sedimentation are major contributing factors to water quality degradation associated with activities that cause soil disturbances. In general, sediment is transported by water as either a suspended load or a bedload. The K factor represents a soil’s susceptibility by erosion and the amount and rate of runoff. Fine-textured soils high in clay have low K factors, about 0.02 to 0.15, due to cohesive particles that resist detachment by water. Coarse-textured soils, such as sandy soils, also have low K factors, about 0.05 to 0.2, because of low runoff potential even though soil particles are cohesionless. Medium-textured soils have moderate K factors, about 0.25 to 0.4, because they are moderately susceptible to erosion and produce moderate runoff. Soils with high silt content are the most erodible and typically have K factors greater than 0.4. Highly erodible soils are present west of the San Jose Diridon Station. Refer to Section 3.9 of this Final EIR/EIS for more information on soils.

Sources: Authority 2020a, 2020b; SWRCB 2017

MAY 2019

Figure 3.8-4 2014–2016 Clean Water Act Section 303(d) List Impairments

3.8.5.4 Groundwater

Within the groundwater RSA, most groundwater occurs in material deposited by streams, called alluvium. Groundwater also may occur in fractured rocks. Some aquifers in the groundwater RSA occur in shallow alluvium underlain by bedrock, near San Francisco, while some aquifers are quite deep near San Mateo and Santa Clara, extending more than 1,000 feet below ground surface (bgs) before reaching bedrock. Natural recharge occurs primarily in stream channels and on coarse alluvial fans, where the streams exit their montane headwaters and enter the valley floor, but also occurs beneath pervious surfaces from direct precipitation or runoff. Incidental recharges occur through leaking water and sewer systems and landscape irrigation. In addition, the SCVWD manages a groundwater recharge system that includes releases from dams and raw water pipelines to in-stream and off-stream managed recharge facilities.

Definitions:

Alluvium consists of coarse sediment, such as sand and gravel, and finer-grained particles, such as clay and silt, deposited in layers by a river or stream. Layers of alluvium may alternate between coarse-grained sediment (aquifers) and fine-grained sediment (aquitards).

Aquifers are deposits of coarse alluvium that contain water between grains of sediment. Aquifers within the RSA are alluvial, although groundwater may also be found within fractured.

Aquitards, or confining layers, are deposits of fine-grained alluvium. These deposits impede the movement of water deeper into the subsurface. Consequently, aquitards may isolate aquifers into shallow and deeper layers.

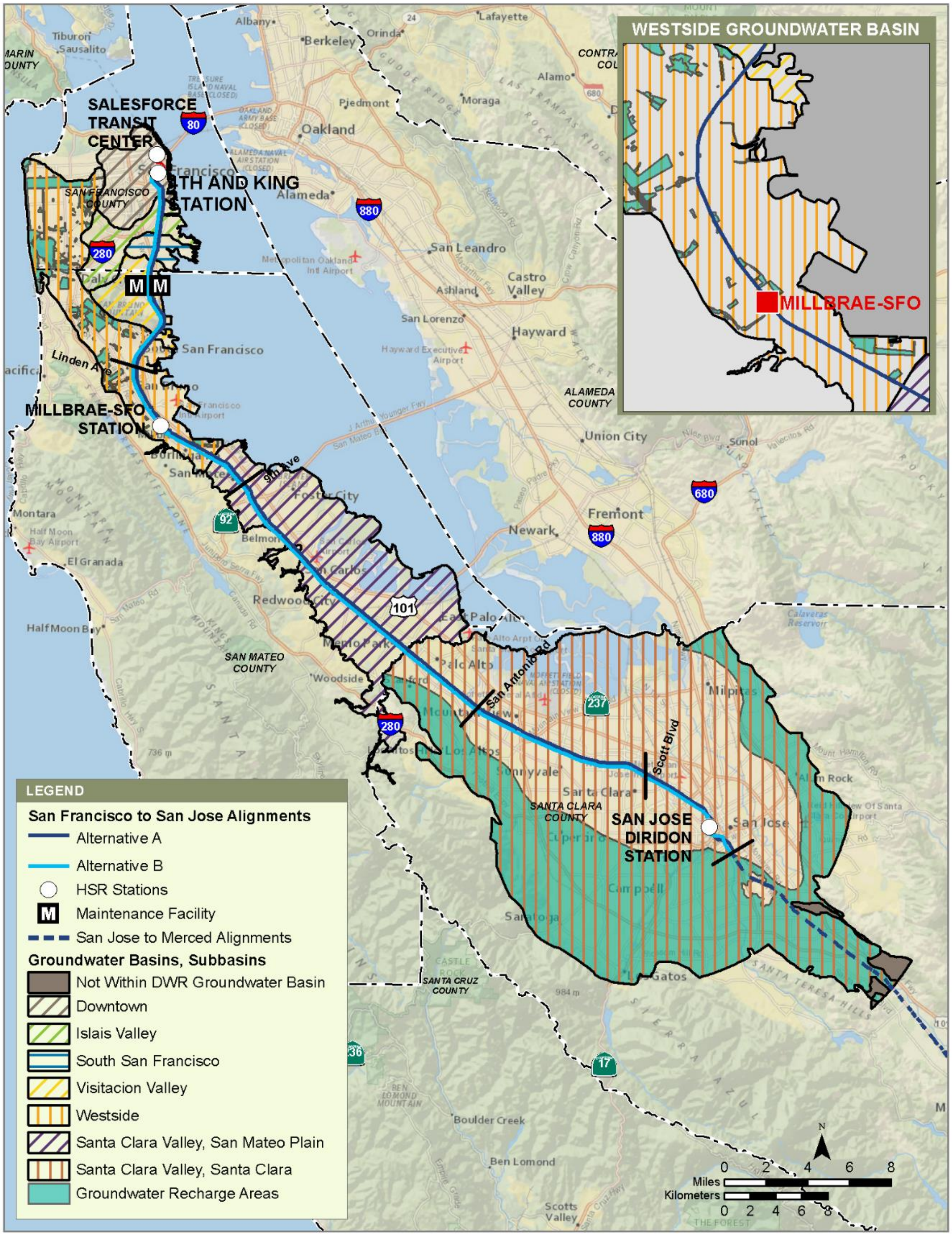
Groundwater Basins and Subbasins

The groundwater RSA consists of the Downtown San Francisco, Islais Valley, South San Francisco, Visitacion Valley, Westside, and Santa Clara Groundwater Basins. Table 3.8-7 shows the area of the project footprint in each basin and subbasin from north to south. In addition, the table shows the area of each groundwater subbasin within the project footprint of each alternative. Figure 3.8-5 illustrates the location of the groundwater basins and subbasins and their associated recharge areas in the RSA. No sole source aquifers are in the groundwater RSA.

Table 3.8-7 Groundwater Basins and Subbasins in the Resource Study Area

Groundwater Basin	Groundwater Subbasin	Subbasin Area (acres)	Subbasin Area in RSA (acres)	Area in Alternative A (acres)	Area in Alternative B (acres)
Downtown San Francisco	N/A	7,639.0	7,639.0	41.4	41.4
Islais Valley	N/A	5,940.5	5,940.5	24.7	24.7
South San Francisco	N/A	2,176.2	2,176.2	15.6	15.6
Visitacion Valley	N/A	5,830.3	5,830.3	243.9	203.2
Westside	N/A	25,400.8	25,400.8	163.3	163.3
Santa Clara Valley[1]	San Mateo Plain	37,860.4	37,860.4	156.6	204.3
	Santa Clara	189,564.6	168,630.7	330.2	437.1/466.4
Total		**274,411.8**	**253,477.9**	**975.7**	**1,089.6/1,118.9**

Sources: Authority 2020a, 2020b; DWR 2004a, 2004b, 2004c, 2004d, 2004e, 2004f, 2006, 2020
I- = Interstate
N/A = not applicable
RSA = resource study area
[1] Values are presented for Alternative B (Viaduct to I-880) first, followed by Alternative B (Viaduct to Scott Boulevard).



Sources: Authority 2020a, 2020b; SCVWD 2016a; City of San Bruno et al. 2012 NOVEMBER 2020

Figure 3.8-5 Groundwater Basins, Subbasins, and Designated Recharge Areas

Downtown San Francisco Groundwater Basin

The Downtown San Francisco Groundwater Basin is in the northeastern portion of San Francisco. Within the Downtown San Francisco Groundwater Basin, groundwater occurs in shallow, unconsolidated alluvium that overlies less permeable bedrock. Depending upon location, bedrock varies from 200 to 300 feet bgs, indicating low storage capacity and minimal protection from contamination (DWR 2004a). Natural groundwater recharge occurs through the infiltration of rain. More than half of the total recharge that occurs is from human activity, including landscape irrigation and water and sewer system leaks (DWR 2004a). Groundwater generally flows to the northeast according to surface terrain (DWR 2004a).

Islais Valley Groundwater Basin

The Islais Valley Groundwater Basin is in the central and eastern portions of San Francisco in the valley drained by Islais Creek. Groundwater occurs in shallow, unconsolidated alluvium that overlies less permeable bedrock. The maximum thickness of these deposits is approximately 200 feet, indicating low storage capacity and minimal protection from contamination (DWR 2004b). Groundwater recharge occurs through the infiltration of rain, landscape irrigation, and water and sewer system leaks. Groundwater flows to the northeast toward San Francisco Bay (DWR 2015b).

South San Francisco Groundwater Basin

The South San Francisco Groundwater Basin is in the southeastern portion of San Francisco. Groundwater occurs in shallow, unconsolidated alluvium that overlies bedrock. The maximum thickness of these deposits is approximately 200 feet, indicating low storage capacity and minimal protection from contamination (DWR 2004c). Groundwater recharge occurs through the infiltration of rain, landscape irrigation, and water and sewer system leaks. Due to confining bedrock ridges in the hilly areas, groundwater flows to the east toward San Francisco Bay (DWR 2015b).

Visitacion Valley Groundwater Basin

The Visitacion Valley Groundwater Basin is in the southeastern portion of San Francisco and northern San Mateo County. Groundwater occurs in shallow, unconsolidated alluvium that overlies Franciscan Complex bedrock. The maximum thickness of these deposits is approximately 200 feet, indicating low storage capacity and minimal protection from contamination (DWR 2004d). Groundwater recharge occurs through the infiltration of rain, landscape irrigation, and water and sewer system leaks. Groundwater flows to the east toward San Francisco Bay (DWR 2015b).

Westside Groundwater Basin

The Westside Groundwater Basin is in the western portion of San Francisco and extends to a bedrock ridge near Burlingame that separates it from the Santa Clara Valley Groundwater Basin. The Westside Groundwater Basin is divided into the North Westside Basin in San Francisco and the South Westside Basin in San Mateo County; only the South Westside Basin is within the project footprint. Groundwater occurs in unconsolidated alluvium that overlies Franciscan Complex and Great Valley Sequence bedrock. Groundwater generally flows to the south and San Francisco Bay (SFPUC 2008: page 6.5-12; DWR 2015b). Groundwater recharge occurs through the infiltration of rain, landscape irrigation, and water and sewer system leaks (DWR 2006).

Santa Clara Valley Groundwater Basin

The Santa Clara Valley Groundwater Basin extends from Richmond, on the east shore of San Francisco Bay in the north, east to Morgan Hill in Coyote Valley in the south, and to Burlingame on the San Francisco Peninsula in the west (DWR 2004e). The Santa Clara Valley Groundwater Basin is divided into four distinct subbasins: Niles Cone, San Mateo Plain, East Bay Plain, and Santa Clara. The groundwater RSA crosses the San Mateo Plain and Santa Clara Subbasins.

The San Mateo Plain Subbasin is in the Santa Clara Valley Groundwater Basin. Within the subbasin, groundwater occurs in alluvial deposits associated with the tributaries of San Francisco Bay (DWR 2004e). The maximum thickness of the water-bearing formations is approximately

1,250 feet. Groundwater recharge in the basin occurs through the deep percolation of irrigation water applied to turf, such as at golf courses, deep percolation of rainfall in non-irrigated areas (e.g., open spaces, parks) and irrigated areas, as well as percolation streamflow through coarse substrate (DWR 2004e). The average annual recharge is 7,900 acre-feet per year (County of San Mateo 2018).

The Santa Clara Subbasin is also in the Santa Clara Valley Groundwater Basin. The primary water-bearing formations within the Santa Clara Subbasin consist of deep unconsolidated to semi-consolidated alluvial deposits, likely exceeding 1,500 feet in depth. The northern portion of the subbasin contains a confined zone, where confining layers of clay with low permeability impede recharge. The southern portion of the subbasin is generally unconfined, without layers of clay to restrict recharge (DWR 2004f). Artesian conditions may be encountered in confined portions of the subbasin. Groundwater recharge is provided through infiltration of surface water through streambeds, direct percolation of precipitation through the basin floor, and managed recharge facilities operated by SCVWD. Groundwater in the Santa Clara Subbasin typically flows according to ground surface topography, toward the interior of the subbasin and north toward San Francisco Bay (SCVWD 2010).

Groundwater Quality

Beneficial Uses

The San Francisco Bay RWQCB's Basin Plan identifies beneficial uses for groundwater basins and subbasins, in addition to aquatic resources. The Basin Plan (San Francisco Bay RWQCB 2017) informally subdivides the Islais Valley and Westside Groundwater Basins into several subbasins for the purpose of maintaining consistency with the 1995 Basin Plan; these subdivisions do not represent subbasins recognized by DWR. The beneficial uses of groundwater basins and subbasins from north to south in the groundwater RSA are provided in Table 3.8-8.

Table 3.8-8 Beneficial Uses of Groundwater Basins

		Beneficial Uses			
Basin	Subbasin	Municipal Water Supply	Industrial Process Supply	Industrial Service Supply	Agricultural Water Supply
Downtown San Francisco	N/A	Existing	Potential	Potential	Existing
Islais Valley A	N/A	Potential	Existing	Existing	Potential
Islais Valley B	N/A	Potential	Potential	Potential	Existing
South San Francisco	N/A	Potential	Existing	Existing	Potential
Visitacion Valley	N/A	Potential	Existing	Existing	Potential
Westside A	N/A	Existing	Potential	Potential	Existing
Westside B	N/A	Potential	Potential	Potential	Existing
Westside C	N/A	Existing	Potential	Potential	Existing
Westside D	N/A	Existing	Existing	Existing	Potential
Santa Clara Valley	San Mateo Plain	Existing	Existing	Existing	Potential
	Santa Clara	Existing	Existing	Existing	Existing

Source: San Francisco Bay RWQCB 2017
N/A = not applicable

Groundwater Quality Objectives

As with beneficial uses, the San Francisco Bay RWQCB's Basin Plan also identifies water quality objectives for groundwater resources. The San Francisco Bay RWQCB has established narrative water quality objectives for groundwater, including pathogenic bacteria, organic chemical constituents, inorganic chemical constituents (e.g., metals, radioactivity, taste, and discoloration). Additionally, the Basin Plan also provides quantitative water quality objectives for groundwater. The narrative water quality objectives previously mentioned, as well as numerous quantitative standards that apply to a variety of specific chemical constituents, are stated in Chapter 3 of the Basin Plan (San Francisco Bay RWQCB 2017). These water quality objectives apply to discharges of runoff to groundwater from dry wells, infiltration basins, and injection wells. Refer to Volume 2, Appendix 3.8-C for a description of the narrative groundwater quality objectives.

Groundwater Contamination

Prior unpublished site assessments conducted for the Authority in May 2010 determined that groundwater along the existing Caltrain corridor is contaminated with petroleum hydrocarbons. At the site of the proposed West Brisbane LMF, investigations at the former Bayshore freight yard revealed that the groundwater is contaminated with halogenated organic solvents. On the site of the proposed East Brisbane LMF, groundwater at the SFPP Kinder Morgan Brisbane Terminal facility is contaminated with aviation fuel, diesel, gasoline, benzene, and fuel oxygenates. The East Brisbane LMF also overlies the former Brisbane Class II Landfill, and leachate of VOCs and metals, such as barium and nickel, from the former landfill in Brisbane has been affecting the quality of shallow and deep aquifers (City of Brisbane 2013). In addition to contamination associated with existing railroad, petroleum industry, and landfill operations, groundwater within the RSA may be contaminated near airports, airstrips, and heliports, as well as in historic agricultural areas, where petroleum, gas, pesticides, and other pollutants could leak or infiltrate into the groundwater table. Refer to Section 3.10 for more information about groundwater contamination, potential impacts on existing groundwater, and cleanup operations.

Depth to Groundwater

Table 3.8-9 presents the anticipated depth of groundwater below the ground surface in each subsection. These values are based on the average and standard deviation of groundwater depths in environmental monitoring wells recorded over a 10-year period between 2006 and 2016. Thus, it is anticipated that these depths represent typical groundwater conditions in each subsection. Shallow groundwater is known to occur in the Santa Clara subbasin, especially near downtown San Jose.

Table 3.8-9 Depth to Groundwater (2006–2016)

San Francisco to South San Francisco	San Bruno to San Mateo	San Mateo to Palo Alto	Mountain View to Santa Clara	San Jose Diridon Station Approach
Near surface to 15 feet	Near surface to 30 feet	Near surface to 20 feet	Near surface to 30 feet	Near surface to 20 feet

Source: SWRCB 2016

Groundwater Recharge

Areas designated for groundwater recharge by the groundwater basin's or subbasin's managing agency in the applicable groundwater management plan are illustrated on Figure 3.8-5 and summarized in Table 3.8-10.

Table 3.8-10 Groundwater Recharge Areas

Basin	Subbasin	Description of Designated Recharge Area
Downtown San Francisco	N/A	Recharge areas have not been designated
Islais Valley	N/A	Recharge areas have not been designated
South San Francisco	N/A	Recharge areas have not been designated
Visitacion Valley	N/A	Recharge areas have not been designated
South Westside	N/A	Pervious areas, such as open spaces and the numerous parks, cemeteries, and golf courses in the basin
Santa Clara Valley	San Mateo Plain	Recharge areas have not been designated
	Santa Clara	Along the edges of the subbasin adjacent to the foothills

Sources: *SFPUC n.d.; City of San Bruno et al. 2012; County of San Mateo 2018; SCVWD 2016a, 2016b*
N/A = not applicable

Drinking Water Supply

Public water systems provide water for human consumption through pipes or other constructed conveyances that have 15 or more service connections or regularly serve at least 25 individuals daily at least 60 days out of the year. Within the groundwater RSA, groundwater is used as a source for public water systems, as well as for other purposes, such as irrigation. The Westside Groundwater Basin underlies both northern San Mateo County and the City and County of San Francisco. The basin is jointly managed by the cities of Daly City, San Bruno, Burlingame, South San Francisco, Millbrae, the Town of Colma, California Water Services Company, and SFPUC as a source of public drinking water. Additionally, SCVWD manages the entire Santa Clara subbasin for municipal water supply. The principal aquifer within the Santa Clara subbasin is defined as aquifer materials more than 150 feet below the ground surface (SCVWD 2020).

The SWRCB (2016) has identified 354 groundwater supply wells associated with public water systems within the groundwater RSA, including wells in the Westside and Santa Clara Valley Groundwater Basins. None of these wells are in the project footprint; however, a production well recently constructed by the SFPUC is immediately adjacent to the project footprint in Millbrae. This well is part of the SFPUC's Regional Groundwater Storage and Recovery Project. DWR Bulletin 118 provides the maximum, minimum, and average depth of municipal, domestic, and irrigation supply wells in the Santa Clara Valley Basin (Table 3.8-11).

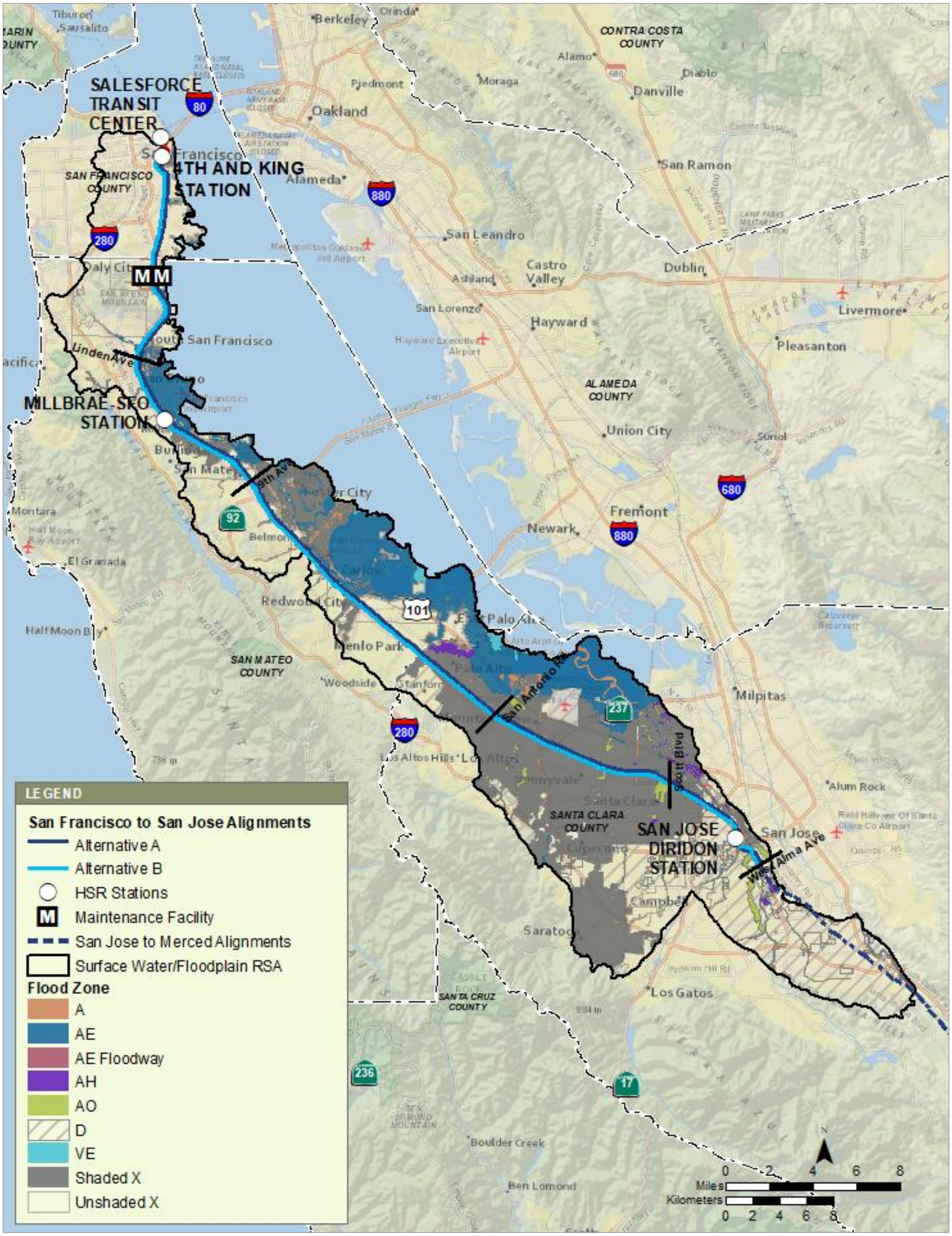
Table 3.8-11 Depths of Drinking Water Supply Wells by Groundwater Subbasin

		Bulletin 118 Production Well Depth Characteristics	
Basin	Subbasin	Domestic Wells (Range/Average)	Municipal/Irrigation Wells (Range/Average)
Santa Clara Valley	Santa Clara	15 to 800 feet/263 feet	17 to 1,186 feet/278 feet

Source: DWR 2004f

3.8.5.5 Floodplains

Creeks and streams in the floodplain RSA periodically overtop their banks and flood adjacent low-lying land. Moreover, flat areas with poor drainage may accumulate water during storms, resulting in shallow ponding, whereas gently sloped areas may experience shallow sheet flows. Coastal areas may also experience flood hazards from storm surges and waves. These areas that collect and store water during storms are known as *floodplains*. Figure 3.8-6 illustrates all of the FEMA floodplains in the RSA.



Sources: Authority 2020a, 2020b; FEMA 2014, 2019a, 2019b

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Figure 3.8-6 Floodplains in the Resource Study Area

Federal Emergency Management Agency Floodplains

Floodplains delineated by FEMA on FIRMs are in the RSA. Table 3.8-12 shows each FEMA flood zone present in the floodplain RSA, as well as the total area of each flood zone within the RSA. Most of the floodplain RSA and the project footprint would not experience flooding during the 100-year flood, as indicated by the large areas of Zone X and D floodplains; impacts on these flood zones were not studied for this project. While coastal flood hazards exist in the floodplain RSA, neither alternative has the potential to experience coastal flooding. However, both alternatives contain areas designated as 100-year floodplains. These areas, indicated as Zones A, AE, AH, and AO, have a 1 percent chance of getting flooded each year. However, the different types of 100-year floodplains in the floodplain RSA and project footprint indicate that certain areas experience different types of flooding or that detailed studies have been performed to quantify the hydraulic characteristics of the floodplain. Although there are regulated floodways in the floodplain RSA, none are in the project footprint for either alternative.

Table 3.8-12 FEMA Flood-Hazard Zones in the Floodplain Resource Study Area

Zone	Flood Hazard	Area within RSA (acres)	Area within Alternative A (acres)	Area within Alternative B[1] (acres)
High-Risk Areas				
A	Areas with a 1% annual chance of flooding (i.e., these areas are expected to be flooded during the 100-year storm). The depths of flooding or BFEs are not known.	2,010.8	8.8	10.9/10.9
AE	The 100-year floodplain where BFEs are provided. Zone AE also includes the stillwater elevation of San Francisco Bay, which includes a high tide and storm surge.	26,616.6	16.9	14.9/14.9
AE (floodway)	The description of Zone AE in the preceding row applies. In addition, these areas must be reserved to convey the 100-year flood without increasing the water surface elevation.	340.6	0	Same as Alternative A
AH	Areas that experience shallow flooding during the 100-year flood, usually in the form of a pond, with an average depth ranging from 1 to 3 feet.	1,501.9	23.8	45.6/47.7
AO	River or stream flood-hazard areas, and areas that are flooded during the 100-year flood, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet.	1,832.2	42.3	49.4/49.2
Moderate to Low–Risk Areas				
X (shaded)	Area of moderate flood hazard, usually the area between the limits of the 100-year and 500-year floods. This zone also includes areas protected from flooding by levees.	58,198.3	257.6	323.2/358.3
X (unshaded)	Area of minimal flood hazard, described as areas above the 500-year flood.	59,431.0	439.2	384.6/384.6

Zone	Flood Hazard	Area within RSA (acres)	Area within Alternative A (acres)	Area within Alternative B[1] (acres)
Coastal Areas				
VE	Areas within 100-year coastal floodplains that have hazards associated with storm surges and waves. Detailed hydraulic analyses are performed for these areas.	1,270.3	0	Same as Alternative A
Undetermined Risk Areas				
D	Areas with possible, but undetermined, flood risks. No analysis of flood hazards has been performed in these zones.	36,712.8	20.4	179.1/171.4

Sources: Authority 2020a, 2020b; FEMA 2003, 2014, 2019a, 2019b
BFE = base flood elevation
I- = Interstate
RSA = resource study area
[1] Results are presented for Alternative B (Viaduct to I-880) first, followed by Alternative B (Viaduct to Scott Boulevard).

Direct and indirect impacts on floodplains would result from activities performed in the project footprint. Table 3.8-12 also shows the FEMA flood-hazard zones present in the project footprints. It is at these specific locations where direct and indirect impacts on floodplains from project construction and operation would occur.

Existing Caltrain Floodplain Crossings

In certain locations within the existing Caltrain corridor, floodplains may cause inundation of the railbed, bridges, and at-grade crossings during the 100-year flood. Where these existing flooding conditions do not meet the Authority's hydraulic performance standards and no improvements are proposed as part of the blended system, the existing condition and flood risk would be maintained by the project, and the project would not include measures to improve floodplain hydraulics. Furthermore, impacts of these existing hydraulic conditions on project construction and operation are not considered to be impacts under CEQA; therefore, this information is provided for informational purposes only.

Table 3.8-13 summarizes the locations along the railbed that do not meet the Authority's performance standards for floodplains and are therefore considered to be at risk of flooding. According to the *California High-Speed Train Project Design Criteria Rev. 1* (Authority 2014), the minimum recommended water depth should be 2 feet below the bottom of subballast or bottom of bridge girder/soffit. Many of the locations in Table 3.8-13 cannot meet this criterion because the track profile is not sufficiently raised above the 100-year flood elevation from the FEMA FIRM or the 100-year flood elevation from the existing condition hydraulic analysis. In addition, the existing San Tomas Aquino Creek bridge would not have freeboard during the 100-year flood, causing flood flows to overtop the railroad track, and the existing Los Gatos Creek bridge would be overtopped during the 100-year flood.

Table 3.8-13 Flood Risks Posed to Existing Caltrain Bridges, Culverts, and Railbed Sections

Location	Alignment Stationing (approximate)	Top of Rail Elevation (feet)	Bottom of Subballast or Bridge[1] Girder/Soffit Elevation[2] (feet)	Maximum Allowable WSE to Meet Freeboard Criteria (feet)	100 year Flood Elevation (feet)
Colma Creek	620+00 to 648+40	13.0 to 17.8	9.9 to 14.6	7.9 to 12.6	12.6
Highline Creek tributary, near San Francisco International Airport	734+00 to 747+00	15.2 to 15.8	11.9 to 12.5	9.9 to 10.5	16 to 17
	753+60 to 757+00	15.1	11.8	9.8	10
	768+00 to 775+80	14.9 to 16.2	11.7 to 13	9.7 to 11	11
Mills Creek	872+00 to 898+00	15.9	12.7	10.7	14
Sanchez Creek and tributary	905+00 to 939+00	16.1 to 20.8	12.9 to 17.6	10.9 to 15.6	16
Borel Creek	1117+00 to 1122+00	14.4 to 17.2	11.2 to 14.0	9.2 to 12.0	12
Adobe Creek	1881+00	44.0	41.5	39.5	40.0
Permanente Creek	1965+00	62.0	59.5	57.5	58.0
Stevens Creek	2034+50	87.5	85.0	83.0	83.7
San Tomas Aquino Creek	2345+00 to 2346+00	55.7	53.2	51.2	55.8
Los Gatos Creek (Alternative A only)	3107+00 to 3109+00	99.8	91.6	89.6	100.1

Sources: Authority 2020a, 2020b; FEMA 2019b
FEMA = Federal Emergency Management Agency
FIRM = Flood Insurance Rate Map
WSE = water surface elevation
The extents of flooding for the areas above tidal elevation were based on the extents shown in the FEMA FIRM.
[1] Bottom of subballast elevation was assumed to be 3.25 feet below the top of rail elevation (2.5 feet between top of rail to top of subballast and 0.75 feet between top and bottom of subballast layer).
[2] Bottom of bridge girder/soffit elevation was assumed to be 2.5 feet below the top of rail elevation.

Tsunami and Seiche

Tsunami inundation maps of San Francisco, San Mateo, and Santa Clara Counties indicate that the portions of the floodplain RSA could be inundated by a tsunami (California Emergency Management Agency et al. 2009a–g). However, the project would not change the existing flooding potential due to tsunamis from the Pacific Ocean. Therefore, inundation of the project alternatives from tsunami is not discussed further.

There is no immediate risk of seiche in the floodplain RSA (Peninsula Corridor Joint Powers Board [PCJPB] 2015). Therefore, inundation of the alternatives due to seiche is not discussed further.

Definitions:

Tsunamis are created when water is displaced from oceans and other large bodies of water by seismic activities or underwater landslides.

Seiches are waves created when strong winds, rapid changes in air pressure, landslides, or earthquakes cause water levels to build up on one side of an aquatic resource. Eventually, the water rushes back toward the opposite side of the aquatic resource.

3.8.6 Environmental Consequences

3.8.6.1 Overview

This section discusses the potential impacts on hydrology and water resources that would result from construction and operation of the project alternatives arranged by topic: surface water hydrology, surface water quality, groundwater, and floodplains. Each topic area discusses potential impacts from the No Project Alternative and the project alternatives. For this resource topic, there are no differences in the impacts for Alternative A with or without the DDV.

The Authority has incorporated project features (IAMFs) into the project that set out specific actions that will be undertaken to address potential impacts on hydrology and water resources (see Volume 2, Appendix 2-E). A stormwater management and treatment plan (HYD-IAMF#1) and flood protection plan (HYD-IAMF#2) will be developed to comply with federal, state, regional, and local permits and design criteria, including CWA Section 402 NPDES permits and the National Flood Insurance Act.

The stormwater management and treatment plan (HYD-IAMF#1) requires evaluating each receiving stormwater drainage system's capacity to accommodate project runoff and identifying stormwater BMPs designed to capture runoff from impervious surfaces and provide treatment prior to discharge. The flood protection plan (HYD-IAMF#2) will be developed such that the project will remain operational during a 100-year flood event and potential changes to existing floodplain profiles, footprints, and peak flows will be minimized. Additionally, SWPPPs developed for the project will comply with the CGP (HYD-IAMF#3) and IGP (HYD-IAMF#4). The SWPPPs will require stormwater and nonstormwater BMPs for construction and operation activities to control the quantity and quality of runoff from the project. These project features will maintain drainage capacity; manage and treat stormwater runoff with permanent BMPs; minimize development in floodplains and changes in flood elevations; limit increases in sediment transport and the release of materials and waste during construction; and manage and control pollution from stormwater discharges from industrial activities at stations and the LMF.

These project features reduce, but not always avoid, construction and operations impacts on hydrology and water resources. Significant temporary and permanent construction impacts on hydrology and water resources would result from work in aquatic resources to extend, replace, or modify existing bridges and culverts, including the use of temporary stream diversion systems and the permanent filling or relocation of aquatic resources. Substantial intermittent operations impacts on hydrology and water resources would be avoided during intermittent maintenance activities on bridges and culverts or other maintenance activities conducted in or near surface waters, such as vegetation management. Additionally, mechanical train maintenance at the LMF would be conducted indoors and would not intermittently affect hydrology or water resources during operations. Although continuous operations impacts on hydrology and water resources would result from the incremental increase of contaminants released by electric trains, such as brake dust and polycyclic aromatic hydrocarbons (PAH), the impacts would not be substantial.

3.8.6.2 Surface Water Hydrology

Construction and operations would avoid substantial impacts on surface water hydrology associated with altered drainage patterns and stormwater runoff rates and volumes. Construction impacts would result from earthwork, work in aquatic resources, temporary stream diversion, relocating or filling aquatic resources, modifying bridges and culverts, drainage improvements, and new impervious surfaces. The change in alignment or footprint associated with the DDV would not result in impacts on waterbodies. Operations impacts would be caused by bridge or culvert maintenance activities or other activities conducted in or near aquatic resources.

No Project Impacts

The population in the Bay Area is expected to grow through 2040 (see Section 2.6.1.1, Projections Used in Planning). Development in the region to accommodate the population and employment increase would continue under the No Project Alternative. The analysis of potential impacts of the No Project Alternative considers the impacts of conditions forecasted by current land use and transportation plans in the vicinity of the project, including planned improvements to the highway, aviation, conventional passenger rail, freight rail, and port systems through the 2040 planning horizon. Without the HSR project, the forecasted population growth would increase pressure to expand highway and airport capacities. The Authority estimates that additional highway and airport projects (up to 4,300 highway lane miles, 115 airport gates, and 4 airport runways) would be needed to achieve equivalent capacity and relieve the increased pressure (Authority 2012). Section 3.18, Cumulative Impacts, identifies planned and other reasonably foreseeable future projects anticipated to be built in the region to accommodate the projected growth in the area, including shopping centers, industrial parks, transportation projects, and residential developments.

Under the No Project Alternative, recent development trends would be anticipated to continue. Infrastructure and development projects built under the No Project Alternative would require ground disturbance and some amount of earthwork. Earthwork would consist of creating level surfaces for the construction of impervious surfaces, buildings, and infrastructure, as well as contouring slopes. Earthwork can have permanent impacts on drainage patterns by modifying the topography of the ground surface. The construction of new impervious surfaces associated with these developments would also increase the total volume of runoff generated during storm events, known as hydromodification (see Hydromodification Susceptibility in Section 3.8.5.2, Surface Water Hydrology). Impervious surfaces built by residential developments would be distributed throughout the surface water RSA. Highway projects that may require earthwork and build new impervious surfaces from roadway widening would include the following: SR 92 between Interstate 280 and U.S. Highway (US) 101, as well as US 101 between Whipple Avenue and Millbrae in San Mateo County; Woodside Road (SR 84) between El Camino Real and Broadway in Redwood City; and San Tomas Expressway from El Camino Real to Williams Road and SR 237 from Mathilda Avenue to SR 85 in Santa Clara County. Highway projects that modify existing roadway interchanges could also require earthwork and build new impervious surfaces. Some of these projects include the following US 101 interchanges: Sierra Point Parkway in San Mateo County; Candlestick Point in Brisbane; Broadway in Burlingame; Holly Street in San Carlos; Woodside Road in Redwood City; Willow Road in Menlo Park; and SR 237/Mathilda Avenue in Sunnyvale. The SR 92/El Camino Real interchange in San Mateo also would be rebuilt in the surface water RSA. Terminal improvements at Norman Y. Mineta San Jose International Airport, which includes the extension of runways, as well as new transit centers in Hunters Point in San Francisco and San Mateo County, would also result in new impervious surfaces. Additionally, the construction of a new ferry terminal in Redwood City would require dredging a deep channel in San Francisco Bay to allow ferries to access the new terminal. These projects requiring earthwork and resulting in new impervious surfaces have the potential to affect surface water hydrology.

Several linear transit projects under the No Project Alternative cross over one or more aquatic resources. Where these linear projects require widening the existing facility, there is a potential need for the project to widen or reconstruct bridges and culverts, which could require temporary stream diversion systems and dewatering in each aquatic resource. One of these linear transit projects that involves widening and traversing several aquatic resources is the widening of US 101 from Whipple Avenue to Millbrae in San Mateo County.

Under the No Project Alternative, building these projects would potentially result in impacts on drainage patterns and stormwater runoff in the surface water RSA. Planned development would, however, be required to comply with existing laws and regulations that protect surface water hydrology, including local drainage design criteria and CWA Section 402 NPDES permits, most notably the MRP and Caltrans NPDES permit.

Project Impacts

Construction Impacts

Building the project alternatives would generate temporary and permanent impacts on drainage patterns and stormwater runoff. Construction would involve earthwork, work in aquatic resources, temporary stream diversion, relocating or filling aquatic resources, modifying and building new bridges and culverts, drainage improvements, and new impervious surfaces that would affect surface water hydrology. Construction activities are described in Chapter 2, Alternatives.

Impact HYD#1: Temporary Impacts on Drainage Patterns and Stormwater Runoff during Construction

Temporary impacts on surface water hydrology would result from earthwork, minor disturbances to aquatic resources, work in aquatic resources, and temporary stream diversion. These impacts would occur under both project alternatives; however, temporary construction impacts on surface water hydrology would be greater under Alternative B because of the passing track. The amount of construction effort for Alternative A with the DDV would be approximately the same as Alternative A without the DDV; therefore, the potential for erosion/sedimentation/construction material spills that may occur during construction would be approximately the same.

Minimal grading and earthwork would be required to build the proposed railbed under both alternatives because the project would utilize a blended corridor with Caltrain that contains an existing railbed. However, construction of both project alternatives would require shifting the existing tracks to straighten curves and adjust the superelevation for HSR's higher travel speeds; these modifications would occur along 36 to 44 percent of the corridor, depending upon the alternative, and would take several years to complete. Some of these track shifts would require small adjustments in the location of the existing railbed, so the tracks run through the central portion of the railbed, requiring small amounts of grading and earthwork. These minor adjustments in the location of the railbed to support track shifts would maintain overall drainage patterns in the RSA during the construction phase.

In order to shift the existing tracks and railbed, there would be soil disturbances near the banks of streams or the edge of delineated wetlands, as well as the trimming or removal of nearby vegetation. Table 3.8-14 lists the aquatic resources that may experience minor disturbances from track shifts and vegetation management under both alternatives. Direct impacts on these aquatic resources are not anticipated at this time. However, depending on the construction means and methods of the design-build contractor, construction activities may need to be performed within some of the aquatic resources quantified in Table 3.8-14 or impacts on some of these aquatic resources may be avoided entirely. More aquatic resources would experience these minor disturbances under Alternative A. Although fewer aquatic resources under Alternative B would only experience minor disturbances, Alternative B would require more substantial impacts on aquatic resources (such as working within aquatic resources and temporary stream diversion and dewatering) when compared to Alternative A. Refer to Section 3.7 of this Final EIR/EIS and Volume 2, Appendix 3.8-C for a description of impacts on aquatic resources.

Beyond minor grading and earthwork associated with track shifts, both alternatives would require more substantial quantities of grading and earthwork to build the East or West Brisbane LMF. Alternative B would require additional earthwork to widen the railbed to support the 6-mile-long passing track in the San Mateo to Palo Alto Subsection, while Alternative A would require widening and shifting the existing railbed to construct the new MT3 track in the San Jose Diridon Station Approach Subsection. In the LMF, passing track areas, and MT3 track areas, temporary drainage systems are anticipated to be used to prevent erosion and sedimentation from runoff flowing over the disturbed soil. These temporary drainage systems would be designed and described in a staging plan or drainage report. Although local changes in drainage routing may occur near the East or West Brisbane LMF, the passing track under Alternative B, and MT3 track under Alternative A, no large-scale drainage diversions (i.e., that would cross watersheds), are expected during construction. Therefore, overall drainage patterns to the receiving waters would be maintained during the construction of these project elements.

Table 3.8-14 Aquatic Resources Anticipated to Experience Minor Disturbances

Alternative A	Alternative B[1]
San Francisco to South San Francisco Subsection	
Drainage Ditch 1 Drainage Ditch 2 and Wetlands Saline Wetland 1 Drainage Ditch 13 Wetland 3	Same as Alternative A
San Bruno to San Mateo Subsection	
Drainage Ditch 3 Wetland 4 Drainage Ditch 4 Drainage Ditch 5 Drainage Ditch 6 Drainage Ditch 7 Mills Creek Easton Creek Sanchez Creek Tributary and Wetland Burlingame Creek San Mateo Creek	Same as Alternative A
San Mateo to Palo Alto Subsection	
Drainage Ditch 9 Leslie Creek Drainage Ditch 11 Borel Creek Wetland 5 Drainage Ditch 12 Fiesta Creek Laurel Creek Laurel Creek Tributary Laurel Creek Tributary Wetland Belmont Creek Cordilleras Creek Atherton Channel San Francisquito Creek Constructed Watercourse 1 Matadero Creek Barron Creek	Drainage Ditch 12 Fiesta Creek Atherton Channel San Francisquito Creek Constructed Watercourse 1 Matadero Creek Barron Creek
Mountain View to Santa Clara Subsection	
Stevens Creek Sunnyvale East Channel	Same as Alternative A

Alternative A	Alternative B[1]
San Jose Diridon Station Approach Subsection	
Palustrine Forested Wetland 6	Los Gatos Creek Guadalupe River Palustrine Forested Wetland 6
Total	
36	**28**

Sources: Authority *2019a, 2019b, 2020a, 2020b, 2020c, 2020d*
[1] Impacts are the same for Alternative B (Viaduct to I-880) and Alternative B (Viaduct to Scott Boulevard).

Definitions:

Temporary stream diversion refers to the process of collecting clean surface water upstream of a project site, transporting it around the work area with pipes and pumps, and discharging it downstream of the work with minimal water quality degradation.

Dewatering refers to removing water from a construction site and may involve pumping, diversion, impounding, or gravity flow systems. Dewatering would be performed for excavations that extend into the groundwater table, as well as work within the channel or banks of aquatic resources that contain water year-round.

Additionally, construction of the East or West Brisbane LMF, the passing track under Alternative B, Guadalupe River crossing in Alternative A, and improvements shared between both alternatives, such as improvements at the Millbrae Station and radio communication towers, would require modifying existing bridges and culverts, building new culverts, and filling or realigning aquatic resources. Building these proposed improvements would require performing construction activities in aquatic resources. Temporary impacts associated with performing construction activities in an aquatic resource would include: destabilizing the bed and banks caused by foot traffic of the contractor's personnel; the operation of equipment in the aquatic resource; and modifications to the banks of an aquatic resource to gain access to the channel. Some of these aquatic resources would be dry during the summer, when construction activities in aquatic resources are anticipated to occur, but a portion would contain water year-round (perennially). Temporary stream diversions and dewatering would be needed to complete these construction activities in perennial aquatic resources. Temporary stream diversions would result in temporary fluctuations in water surface elevation and flow velocity.

Table 3.8-15 lists the locations where the contractor is anticipated to perform construction activities in aquatic resources both with and without temporary stream diversions and dewatering. Work is required in more aquatic resources under Alternative B primarily due to the construction of the passing track. Refer to Impact HYD#2 for more detailed information regarding the construction of culverts and bridges and relocation and filling of aquatic resources. Additionally, refer to Section 3.7 of this Final EIR/EIS and Volume 2, Appendix 3.8-C for a detailed description of impacts on individual aquatic resources.

Table 3.8-15 Anticipated Work in Aquatic Resources

Alternative A		Alternative B[1]	
Without Stream Diversion and Dewatering	With Stream Diversion and Dewatering	Without Stream Diversion and Dewatering	With Stream Diversion and Dewatering
San Francisco to South San Francisco Subsection			
Wetland 1 Visitacion Creek Constructed Basin 4	Visitacion Creek Visitacion Creek Wetlands Guadalupe Valley Creek Guadalupe Valley Creek Saline Wetland	Wetland 1 Visitacion Creek Tributary and Wetland	Brisbane Wetlands Visitacion Creek Wetlands Guadalupe Valley Creek Guadalupe Valley Creek Saline Wetland
San Bruno to San Mateo Subsection			
Highline Creek Tributary and Wetlands Drainage Ditch 8	Highline Creek El Portal Canal Mills Creek Tributary Wetland Sanchez Creek	Same as Alternative A	Same as Alternative A
San Mateo to Palo Alto Subsection			
None	None	Drainage Ditch 9 Drainage Ditch 11 Laurel Creek Tributary Laurel Creek Tributary Wetland	Leslie Creek Borel Creek Wetland 5 Laurel Creek Belmont Creek Brittan (Arroyo) Creek Pulgas Creek Cordilleras Creek
Mountain View to Santa Clara Subsection			
None	None	Same as Alternative A	Same as Alternative A
San Jose Diridon Station Approach Subsection			
None	Guadalupe River	None	None
Total			
4	**9**	**8**	**16**

Sources: Authority 2019a, 2019b, 2020a, 2020b, 2020c, 2020d

[1] Impacts are the same for Alternative B (Viaduct to I-880) and Alternative B (Viaduct to Scott Boulevard).

Prior to construction, the contractor will develop a SWPPP compliant with the CGP (HYD-IAMF#3). The construction contractor's Qualified SWPPP Developer (QSD) will prepare the SWPPP, which will identify stormwater BMPs that minimize erosion and sedimentation that may result from temporary changes in drainage patterns, including BMPs for temporary drainage systems and temporary stream diversion and dewatering. All QSDs must be trained to ensure that SWPPPs are prepared according to the requirements of the permit. The construction contractor's Qualified SWPPP Practitioner (QSP) will be responsible for the SWPPP. As part of that responsibility, the effectiveness of construction BMPs will be monitored before, during, and after storm events. Records of these inspections and monitoring results will be submitted to the RWQCBs as part of the annual report required by the permit. The SWRCB and RWQCBs would have the opportunity to review these documents.

Acronyms:

SWPPP = Stormwater Pollution Prevention Plan

CGP = Construction General Permit

BMP = Best Management Practice

RWQCB = Regional Water Quality Control Board

SWRCB = State Water Resources Control Board

As mentioned above, the SWPPP will include BMPs for temporary stream diversions and dewatering in accordance with the Caltrans *Field Guide to Construction Dewatering* (Caltrans 2014) (GEO-IAMF#10). The BMPs for dewatering operations, erosion control, and soil stabilization will avoid discharging water in a manner and at rates that cause substantial changes in stream hydrology. This will be achieved by controlling pumping rates and using velocity dissipation devices or similar methods that minimize impacts on the flow rates of streams. Additionally, temporary drainage systems will be used in areas with major earthmoving activities to maintain existing drainage patterns while preventing erosion and sedimentation from runoff flowing over the disturbed soil. These temporary drainage systems will be documented in a staging plan or drainage report.

CEQA Conclusion

The impact under CEQA would be less than significant for both alternatives because project activities would not result in a substantial alteration of the existing drainage patterns, substantially increase the rate or amount of surface runoff, result in substantial erosion or siltation on- or off-site, or create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems. Temporary impacts on drainage patterns and stormwater runoff would result from the following activities: grading, construction staging areas, temporary roadways, temporary stream diversion, temporary dewatering, and temporary drainage systems. Project features include maintaining existing drainage patterns to the extent feasible and developing a SWPPP that will prescribe the BMPs necessary to effectively control erosion and sedimentation (HYD-IAMF#3). Through effective management and control measures and compliance with the CGP, project features avoid substantial temporary impacts on drainage patterns and stormwater runoff. Therefore, CEQA does not require mitigation.

Impact HYD#2: Permanent Impacts on Drainage Patterns and Stormwater Runoff

Permanent construction impacts on surface water hydrology would result from earthwork, relocating or filling aquatic resources, modifying bridges and culverts, drainage system improvements, and new impervious surfaces. These impacts would occur under both project alternatives; however, permanent construction impacts on surface water hydrology would be greater under Alternative B, as described in the following discussion. The drainage design goal for both project alternatives is to maintain existing drainage patterns to the extent feasible and prevent substantial changes in drainage capacity.

Both project alternatives are along the existing Caltrain corridor, where the existing railbed is either at-grade or an embankment. Because both project alternatives would utilize these existing at-grade sections and embankments, overall drainage patterns in the RSA would be maintained. However, as described in Impact HYD#1, grading and earthwork would be required to build both of the project alternatives. Minor grading and earthwork would consist of horizontal track shifts and superelevation adjustments along the railbed of the blended Caltrain/HSR system to support HSR's higher travel speeds. Additionally, substantial quantities of grading and earthwork would be required for the Tunnel Avenue overpass, modifications of the widened railbed for a 6-mile-long passing track between San Mateo and Redwood City under Alternative B and construction of the new MT3 track in the San Jose Diridon Station Approach Subsection under Alternative A, as well as the creation of flat areas for structures, such as the East and West Brisbane LMF. Modifying or creating topographical features within the project footprint, including both minor and major grading, would result in permanent, direct, localized impacts on existing drainage patterns. Table 3.8-16 shows the estimated earthwork volumes for the major construction elements of the project alternatives. These estimates demonstrate the difference each alternative would have on drainage patterns: larger quantities of grading would result in larger changes in topography, which would translate into a larger impact on drainage patterns.

Table 3.8-16 Earthwork Volumes for Major Construction Elements

Major Construction Element	Alternative A	Alternative B[1]
San Bruno to San Mateo Subsection		
Tunnel Avenue overpass	540,100 cubic yards	Same as Alternative A
Light maintenance facility	2,833,100 cubic yards	4,031,100 cubic yards
San Mateo to Palo Alto Subsection		
Passing track	Not within Alternative A	2,062,300 cubic yards
San Jose Diridon Station Approach Subsection		
Embankment for new MT3 track	245,600 cubic yards	Not within Alternative B
Total	**3,618,800 cubic yards**	**6,633,500 cubic yards**

Sources: Authority 2019a, 2019b
[1] Values are the same for Alternative B (Viaduct to I-880) and Alternative B (Viaduct to Scott Boulevard).

As shown in Table 3.8-16, most of the earthwork for Alternative A would be associated with the East Brisbane LMF, whereas most earthwork for Alternative B would be associated with the West Brisbane LMF and the passing track. Both LMFs would require creating a level surface for the workshop, yard, tracks, and supporting systems and utilities. To do this, cuts and fills would be required. Therefore, construction of either LMF would have permanent impacts on local drainage patterns. Additional earthwork would be required for the Tunnel Avenue overpass under both alternatives and the new MT3 track in the San Jose Diridon Station Approach Subsection under Alternative A. Although a large amount of earthwork would be required for the passing track and modifications to road crossings, the changes in topography would be minor at any one location because the proposed earthwork would be spread out over approximately 12 miles. Either viaduct option under Alternative B would require minimal earthwork compared to the blended at-graded system under Alternative A. Alternative B is anticipated to result in more local changes in drainage patterns from earthwork and grading because the West Brisbane LMF and the passing track would require more earthwork than the East Brisbane LMF and MT3 track under Alternative A. However, overall drainage patterns in the RSA would be maintained under both alternatives.

A portion of the earthwork associated with construction of the LMF and the nearby Tunnel Avenue overpass includes the placement of fill in aquatic resources. Construction of the East Brisbane LMF under Alternative A would require filling a portion of the Visitacion Creek wetlands and culverting the portion of the Visitacion Creek channel within the project footprint to flow under the East Brisbane LMF along the existing creek alignment (Figure 3.8-7). Placing Visitacion Creek, a tidal aquatic resource, into a culvert below the proposed East Brisbane LMF would not affect the tidal hydrology of Visitacion Creek or San Francisco Bay. There would be no impacts on the tidal hydrology of the creek or bay as a result of constructing the East Brisbane LMF because the culvert would be designed to convey existing flows, drainage system discharges, and tidal influence. Furthermore, flows would not be detained, impounded, rerouted, or otherwise affected in a manner that would preclude tidal influence of Visitacion Creek or result in substantial impacts on the hydrology of San Francisco Bay. Construction of the West Brisbane LMF under Alternative B would require filling most of the Brisbane wetlands, filling a portion of the Visitacion Creek wetlands and placing Visitacion Creek Tributary and Wetland into a culvert (Figure 3.8-8). Construction of the East Brisbane LMF under Alternative A would permanently affect Wetland 6, Visitacion Creek Constructed Basins 1 and 2, Visitacion Creek wetlands, and Visitacion Creek saline wetlands. The Tunnel Avenue realignment would permanently affect Visitacion Creek, Visitacion Creek Constructed Basin 3 and the Visitacion Creek saline wetlands under Alternative A, and the Lagoon Road realignment would permanently affect Brisbane Lagoon constructed basins under both alternatives. Wetlands provide natural flow attenuation to downstream aquatic resources, so both LMF options and the Tunnel Avenue overpass would result in direct impacts from grading and relocating existing creeks and channels and indirect impacts due to a decrease in flow attenuation provided by wetlands. Figures 3.8-7 and 3.8-8 illustrate the areas of permanent impacts associated with the East and West Brisbane LMF, as well as the realigned Tunnel Avenue overpass between the LMF and Brisbane Lagoon in relation to existing aquatic resources.

Permanent impacts on aquatic resources would also occur outside the proposed East and West Brisbane LMF sites. Construction of the passing track under Alternative B would result in permanent impacts on 12 aquatic resources that would not occur under Alternative A. These permanent impacts include modifying existing bridges and culverts in Drainage Ditches 9 and 11, Leslie Creek, Borel Creek, Belmont Creek, Brittan (Arroyo) Creek, Pulgas Creek, and Cordilleras Creek. The passing track would also require filling or relocating portions of four aquatic resources, including Drainage Ditch 11, Borel Creek, and Wetland 5; modifying or relocating Laurel Creek tributary and Laurel Creek tributary wetland; and covering a daylighted portion of Laurel Creek with a concrete slab. Both alternatives would require new culverts in Highline Creek tributary and modifications to existing culverts in Highline Creek, El Portal Canal, Mills Creek tributary wetland, and Sanchez Creek. Lastly, a new Guadalupe River bridge would be built under Alternative A and there would be two new viaduct crossings for Los Gatos Creek and Guadalupe River under Alternative B in the San Jose Diridon Station Approach Subsection. Modifying existing bridges and culverts would maintain overall drainage patterns because the overall course of the aquatic resources would not be altered. Filling and relocating aquatic resources would only be done where absolutely necessary to build the alternatives. Relocated aquatic resources would be situated as close to the original location as allowed by safety and operational constraints to maintain overall drainage patterns.

Source: Authority 2019a, 2020a, 2020b

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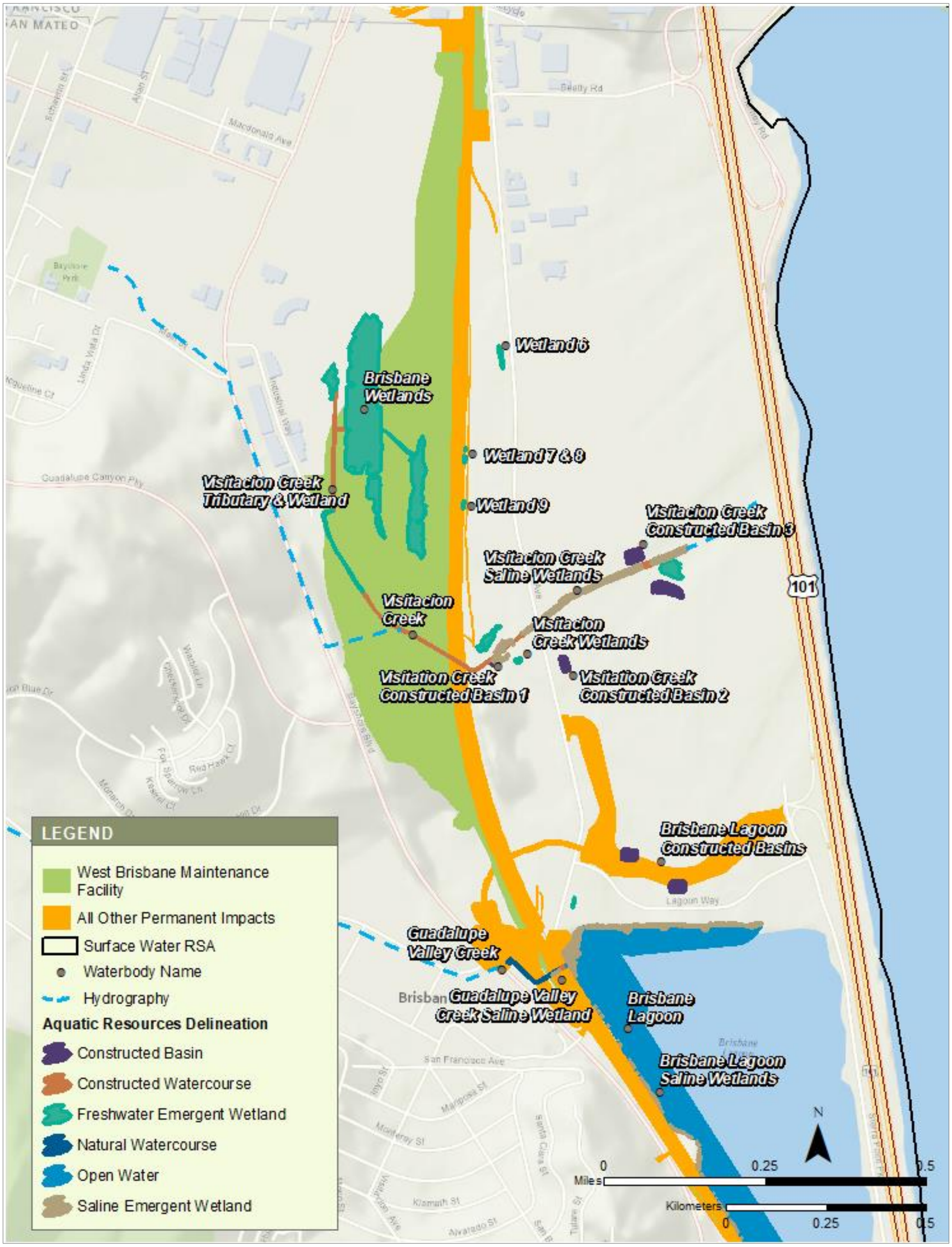
Figure 3.8-7 Permanent Impacts of East Brisbane Light Maintenance Facility (Alternative A) on Existing Aquatic Resources



Source: Authority 2019a, 2020a, 2020b

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Figure 3.8-8 Permanent Impacts of West Brisbane Light Maintenance Facility (Alternative B) on Existing Aquatic Resources

Table 3.8-17 summarizes all proposed modifications to bridges and culverts, as well as locations where aquatic resources would be filled or realigned under both alternatives by subsection. Refer to Volume 2, Appendix 3.8-C for a detailed description of impacts on individual aquatic resources.

Table 3.8-17 Aquatic Resources Anticipated to Experience Permanent Impacts

Aquatic Resource	Alternative A	Alternative B[1]
San Francisco to South San Francisco Subsection		
Wetland 1	Add culvert in wetland or fill wetland for proposed radio communication tower	Same as Alternative A
Brisbane Wetlands	No permanent impacts	Most of these wetlands would be filled for the West Brisbane LMF
Visitacion Creek	Add culvert in portion under East Brisbane LMF	No permanent impacts
Wetland 6	Fill wetland for East Brisbane LMF	No permanent impacts
Wetland 7	Fill portion for the track	Same as Alternative A
Wetland 8	Fill portion for the track	Same as Alternative A
Wetland 9	Fill portion for the track	Same as Alternative A
Visitacion Creek Tributary and Wetland	No permanent impacts	Place into culvert and relocate for West Brisbane LMF
Visitacion Creek Wetlands	Fill a portion of the wetlands for East Brisbane LMF	No permanent impacts
Visitacion Creek Constructed Basin 1	Fill a portion of the basin for East Brisbane LMF access road	No permanent impacts
Visitacion Creek Constructed Basin 2	Fill basin for East Brisbane LMF	No permanent impacts
Visitacion Creek Constructed Basin 3	Fill a portion of the basin for East Brisbane LMF and Tunnel Avenue realignment	No permanent impacts
Visitacion Creek Saline Wetlands	Fill a portion of the wetlands for East Brisbane LMF and access road for LMF	No permanent impacts
Guadalupe Valley Creek	Widen existing bridge in the upstream direction	Same as Alternative A
Guadalupe Valley Creek Saline Wetland	Widen existing Guadalupe Valley Creek bridge in the upstream direction	Same as Alternative A
Brisbane Lagoon Constructed Basins	Fill a portion of the two basins to realign Lagoon Road	Same as Alternative A

Aquatic Resource	Alternative A	Alternative B[1]
San Bruno to San Mateo Subsection		
Highline Creek Tributary and Wetlands	Build new culverts for radio communication towers	Same as Alternative A
Highline Creek	Cover open section of channel upstream of railbed, extend eight 54-inch-diameter reinforced concrete pipes in the upstream direction, and relocate a portion of the channel upstream of the railbed for Millbrae Station improvements	Same as Alternative A
El Portal Canal	Extend two existing 54-inch corrugated metal pipe culverts in the upstream direction	Same as Alternative A
Mills Creek Tributary Wetland	Extend existing culvert in the upstream direction to support a track shift	Same as Alternative A
Sanchez Creek	Widen existing bridge to support a track shift	Same as Alternative A
San Mateo to Palo Alto Subsection		
Drainage Ditch 9	No permanent impacts	Extend existing 18-inch reinforced concrete pipe culvert to support the passing track
Leslie Creek	No permanent impacts	Extend existing 4.4-foot by 10.6-foot box culvert to support the passing track
Drainage Ditch 11	No permanent impacts	Extend existing 30-inch reinforced concrete pipe culvert to support the passing track. The longitudinal portion of this ditch may also require relocation farther away from the widened railbed.
Borel Creek	No permanent impacts	Relocate 10-foot-wide concrete-lined channel immediately north of existing alignment, extend existing culvert, and widen existing bridge to support the passing track.
Wetland 5	No permanent impacts	Fill wetland to support the passing track
Laurel Creek	No permanent impacts	Cover daylighted portion of the creek with a concrete slab to support the passing track
Laurel Creek Tributary	No permanent impacts	Permanent modification of banks and bed or relocation away from railbed to support the passing track

Aquatic Resource	Alternative A	Alternative B[1]
Laurel Creek Tributary Wetland	No permanent impacts	Permanent modification of banks and bed or relocation away from railbed to support the passing track
Belmont Creek	No permanent impacts	Extend existing culvert in the downstream direction to support the passing track
Brittan (Arroyo) Creek	No permanent impacts	Extend existing twin 5-foot by 12-foot box culvert to support the passing track
Pulgas Creek	No permanent impacts	Extend existing twin 6-foot by 12-foot box culvert to support the passing track
Cordilleras Creek	No permanent impacts	Extend existing drainage arch structure to support the passing track
Mountain View to Santa Clara Subsection		
None	N/A	N/A
San Jose Diridon Station Approach Subsection		
Los Gatos Creek	No permanent impacts	New viaduct crossing with no piers in the channel
Guadalupe River	New railroad bridge adjacent to the south side of the existing bridge	New viaduct crossing with no piers in the channel
Total		
	20	**28**

Sources: Authority 2019a, 2019b, 2020a, 2020b, 2020c, 2020d
HSR = high-speed rail
I- = Interstate
LMF = light maintenance facility
N/A = not applicable
[1] Impacts are the same for Alternative B (Viaduct to I-880) and Alternative B (Viaduct to Scott Boulevard).

Both project alternatives would require building new impervious surfaces, as well as replacing existing impervious surfaces. While net additions of impervious surfaces have the potential to affect hydrology, rebuilding existing impervious surfaces would not affect hydrology. The largest source of impervious surfaces in the RSA would be associated with improvements in the San Jose Diridon Station Approach Subsection under Alternative B, which is anticipated to be 103.1 acres of new impervious surfaces from viaducts, parking lots, roadways, platforms, and structures. The next largest source of new impervious surfaces would be the East or West Brisbane LMF, which is anticipated to result in more than 70 acres of new impervious surfaces. Some of the impervious surfaces at the LMF sites would be placed on filled wetlands, which provide natural flow attenuation. Improvements at the Millbrae Station are anticipated to be the third-largest source of new impervious surfaces under both alternatives, due to the proposed parking lots, roadways, platforms, and structures. Aside from the LMF sites, San Jose Diridon Station, and Millbrae Station, additions of impervious surfaces to the RSA would be primarily associated with platform reconstruction and they would be relatively small in area.

Table 3.8-18 quantifies the estimated area of new or rebuilt impervious surfaces in the project footprint by source, subsection, alternative, and watershed. Table 3.8-18 also quantifies the proportion of the watershed that new or rebuilt impervious surfaces would occupy. As shown in the table, the amount of new impervious surfaces in each Planning Watershed that comprises the RSA would be minimal when compared to the total acreage of the watershed and the amount of existing impervious surfaces in those watersheds. These estimates will continue to change as the design of the project advances. Detailed delineations of these impervious surfaces will occur in the final design phase and be incorporated into the stormwater management and treatment plan (HYD-IAMF#1).

Both project alternatives would require the construction of new drainage systems and the modification of existing drainage systems to prevent standing water on the impervious surfaces described in Table 3.8-18 and along the railbed. New drainage systems would be required for parking lots, such as those proposed at the East or West Brisbane LMF, Millbrae Station, and San Jose Diridon Station; viaducts in the San Jose Diridon Station Approach Subsection under Alternative B; and other impervious surfaces, such as the Tunnel Avenue overpass under both alternatives and the Lagoon Road realignment under Alternative A. These drainage systems would be connected to existing local drainage systems, requiring the Authority to coordinate with owners of these drainage systems during the design phase. Drainage systems at radio communication towers and modified station platforms are not proposed under either alternative; instead, runoff would sheet flow into nearby pervious areas. The existing Caltrain corridor contains longitudinal earthen drainage ditches that convey water away from the railbed and into piped drainage systems. Although Drainage Ditch 11 may require relocation as a result of the passing track under Alternative B, existing longitudinal drainage ditches in the Caltrain corridor would not be affected by track shifts and curve straightening. The underground pipes would connect with existing drainage systems or discharge directly into a nearby aquatic resource. Although new drainage systems would be installed and existing drainage systems would be modified, these changes would be similar to the existing conditions described in Aquatic Resources and Drainage Systems in Section 3.8.5.2.

Prior to construction, the contractor will develop a stormwater management and treatment plan to control stormwater runoff from impervious surfaces in accordance with the Phase II MS4 permit (HYD-IAMF#1). As part of developing the stormwater management and treatment plan, engineers will analyze the runoff that would be generated by the project alternatives and incorporate stormwater management measures (BMPs) to manage the anticipated flows, such as bioretention facilities, where appropriate. All stormwater features built in the Authority's right-of-way will comply with the requirements of the Phase II MS4 permit. Both the East and West Brisbane LMF will ultimately drain into Visitacion Creek, and treatment BMPs, such as detention basins, bioretention facilities, and pervious pavement, will be incorporated into the design of the LMF to prevent substantial increases in the rate of runoff from the LMF and avoid potential erosion and sedimentation in Visitacion Creek. BMPs in local rights-of-way, such as in TCEs that will be relinquished back to the local agency after the construction phase, will comply with the applicable MS4 permit, such as the MRP, Caltrans NPDES permit, and Phase II MS4 permit. Alternatively, engineers may identify upgrades to the receiving drainage system in order to maintain adequate drainage system capacity.

As illustrated on Figure 3.8-3 and described in Hydromodification Susceptibility in Section 3.8.5.2, most of the project footprint is not susceptible to impacts related to hydromodification. The relatively flat terrain of the project footprint and the fact that most of the railbed and associated infrastructure drain to channels that have been hardened or are tidally influenced would prevent substantial changes in surface water hydrology even with construction of new impervious surfaces.

Table 3.8-18 Estimated Areas and Sources of New and Rebuilt Impervious Surfaces

Planning Watershed (Size)	Alternative A		Alternative B[1]		Source of Impervious Surfaces
	New Impervious Surface	Proportion of Watershed	New Impervious Surface	Proportion of Watershed	
San Francisco to South San Francisco Subsection					
Bernal Heights (12,356 acres)	3.3 acres	<0.1%	Same as Alternative A	Same as Alternative A	HSR station platforms at 4th and King Street Station
Candlestick Point (6,019 acres)	106.3 acres	1.8%	112.1 acres	1.9%	Lagoon Road realignment, East or West Brisbane LMF, and realignment of Tunnel Avenue overpass (both alternatives)
Oyster Point (11,826 acres)	0.4 acres	<0.1%	Same as Alternative A	Same as Alternative A	Platform reconstruction at South San Francisco Station
San Bruno to San Mateo Subsection					
Oyster Point (11,826 acres)	0 acres	0%	Same as Alternative A	Same as Alternative A	N/A
Coyote Point (10,754 acres)	14.8 acres	0.1%	Same as Alternative A	Same as Alternative A	Platform extension at San Bruno Station; access roads for radio communication towers; buildings, roadways, and parking lots at the Millbrae Station; platform upgrades at Broadway Station
San Mateo to Palo Alto Subsection					
Coyote Point (10,754 acres)	0 acres	0%	Same as Alternative A	Same as Alternative A	N/A
Undefined, Steinberger Slough Super Planning Watershed (29,625 acres)	<0.1 acres	<0.1%	4.2 acres	<0.1%	Track shifts at Hayward Park Station (Alternative A only) Platform reconstruction at Hayward Park, Hillsdale, Belmont, and San Carlos Stations to support the passing track (Alternative B only)
Polhemus Creek (8,364 acres)	0 acres	0%	Same as Alternative A	Same as Alternative A	N/A
Undefined, Sunnyvale Super Planning Watershed (84,155 acres)	0 acres	0%	Same as Alternative A	Same as Alternative A	N/A

Planning Watershed (Size)	Alternative A		Alternative B[1]		Source of Impervious Surfaces
	New Impervious Surface	Proportion of Watershed	New Impervious Surface	Proportion of Watershed	
Mountain View to Santa Clara Subsection					
Undefined, Sunnyvale Super Planning Watershed (84,155 acres)	0.1 acres	<0.1%	Same as Alternative A	Same as Alternative A	Proposed HSR access road
San Jose Diridon Station Approach Subsection					
Undefined, Sunnyvale Super Planning Watershed (84,155 acres)	9.2 acres	<0.1%	18.8/44.2 acres	<0.1%/0.1%	Modification of public roads; proposed HSR access roads; proposed traction power substation (both alternatives) Proposed automatic train control site; new pedestrian bridge; platform reconstruction at the existing Caltrain maintenance facility (Alternative A only)
Undefined, San Jose West Super Planning Watershed (35,036 acres)	25.0 acres	0.1%	84.3/79.5 acres	0.2%/0.2%	Modification of public roads; platform reconstruction, buildings, and parking lots at San Jose Diridon Station (both alternatives) Proposed automatic train control sites (Alternative A only) Proposed bike path, proposed traction power substation, proposed HSR access roads, proposed viaducts over Los Gatos Creek and Guadalupe River (Alternative B only)
Total	**159.2 acres**	**0.1%**	**238.0/258.6 acres**	**0.1%/0.1%**	

Sources: Authority 2019a, 2019b, 2020a, 2020b, 2020c, 2020d
HSR = high-speed rail
I- = Interstate
LMF = light maintenance facility
N/A = not applicable
[1] Where there are differences, values are presented for Alternative B (Viaduct to I-880) first, followed by Alternative B (Viaduct to Scott Boulevard).

Drainage systems to drain the impervious surfaces from the East and West Brisbane LMF, passing track under Alternative B, viaducts in the San Jose Diridon Station Approach Subsection under Alternative B, traction power stations, and other facilities in the Authority's dedicated right-of-way, some of which are quantified in Table 3.8-18, must be designed according to the Authority's *Hydraulic and Hydrology Design Guidelines* (Authority 2011). The goal of these guidelines is to protect the track and associated infrastructure and facilities from stormwater damage, eliminate nuisance stormwater run-on and runoff, expedite drainage flow, maintain drainage capacity, and provide maintenance and pedestrian access. The designs of all bridges, culverts, and drainage systems would be documented in a drainage report.

Project features also include design goals for bridges, culverts, and channels (HYD-IAMF#2). These design goals include provisions to design site crossings to be as nearly perpendicular to the channel as feasible to minimize bridge length and orient piers parallel to the flow direction to minimize flow disturbances. Additionally, these design goals require the provision of adequate clearance for floating debris; analysis of potential scour depths to evaluate the depth for burying the bridge piers and abutments; scour-control measures to reduce erosion potential; use of natural materials stabilized with riparian plantings for erosion control; and placement of bedding materials under riprap at locations where the underlying soils require stabilization as a result of streamflow velocity. These design goals will be applied, as necessary, to minimize potential impacts on surface water hydrology resulting from new or modified bridges and culverts and relocated channels.

CEQA Conclusion

The impact under CEQA would be less than significant for both alternatives because project activities would not result in a substantial alteration of the existing drainage patterns, substantially increase the rate or amount of surface runoff, result in substantial erosion or siltation on- or off-site, or create or contribute runoff water which would exceed the capacity of existing or planned stormwater drainage systems. The project design will maintain existing drainage patterns by providing culverts and bridges for concentrated flows to pass through the project or realigning aquatic resources to flow around the project. Realigned channels would be near the original aquatic resource, and changes in drainage patterns and hydrology would be similar to existing conditions. New or rebuilt impervious surfaces would not substantially affect the imperviousness of watersheds within the RSA. Furthermore, the stormwater management and treatment plan (HYD-IAMF#1) will manage runoff from new impervious surfaces, evaluate the capacity of receiving stormwater drainage systems, determine improvements and/or upgrades required to maintain or improve existing drainage capacity, and specify BMPs for infiltration, retention, or detention from new and reconstructed impervious surfaces. Through effective management and control measures, substantial permanent impacts on water quality will be avoided. Therefore, CEQA does not require mitigation.

Operations Impacts

Operations of the project would include activities conducted at either the East or West Brisbane LMF, as well as maintenance activities on bridges and culverts and vegetation management to maintain track clearance. Chapter 2 provides a more detailed description of operations and maintenance (O&M) activities.

Impact HYD#3: Intermittent Impacts on Drainage Patterns and Stormwater Runoff from Maintenance Activities during Operations

Intermittent impacts on surface water hydrology would result from maintenance activities on bridges and culverts and vegetation management. These impacts would occur under both project alternatives. However, intermittent operations impacts on surface water hydrology would be greater under Alternative B.

Although the project would include the construction of either the East or West Brisbane LMF, intermittent maintenance activities at the LMF are not anticipated to affect drainage patterns or flow rates in receiving waters. Therefore, intermittent impacts on surface water hydrology resulting from activities performed at the LMF would not occur. However, intermittent maintenance activities on bridges and culverts, as well as vegetation trimming and clearing to maintain adequate horizontal clearance from the tracks, are performed in the Caltrain corridor in the existing condition. These intermittent maintenance activities would continue to be conducted by Caltrain along the entire project corridor under both alternatives where the railbed crosses over aquatic resources on bridges or culverts and passes close to aquatic resources.

During intermittent maintenance on bridges and culverts and vegetation trimming, maintenance personnel would include standard BMPs in an O&M plan prepared under the Phase II MS4 permit. The O&M plan requires the use of standard BMPs during bridge and culvert maintenance activities, which may include painting, channel/vegetation maintenance, and other right-of-way maintenance activities that would contribute sediment to receiving waters. Some of the temporary BMPs used during these activities could include, as applicable, sediment control BMPs, such as silt fences and fiber rolls, that retain destabilized sediment, as well as soil stabilization BMPs, like hydroseed and temporary covers, that would assist with the stabilization of disturbed soils. These BMPs would minimize impacts on surface water hydrology by minimizing sediment and siltation in receiving waters during intermittent bridge, culvert, or channel-maintenance activities. Maintenance activities that disturb soil may trigger the need to develop an erosion control or similar plan pursuant to the Phase II MS4 permit to minimize surface water impacts.

Considering these project features, Table 3.8-19 shows the aquatic resources in which intermittent impacts from bridge and culvert maintenance and vegetation management during operations would occur. Intermittent operations impacts on water quality would occur in the same aquatic resources in all but the San Francisco to South San Francisco Subsection, San Mateo to Palo Alto Subsection, and San Jose Diridon Station Approach Subsection. The difference in the San Francisco to South San Francisco Subsection is related to the LMF options under Alternatives A and B: the East Brisbane LMF would not affect Visitacion Creek tributary during operations, whereas operations of Alternative B may require intermittent maintenance on the culvert proposed for Visitacion Creek tributary. In the San Mateo to Palo Alto Subsection, the passing track under Alternative B would require permanently filling Wetland 5 during construction; consequently, this aquatic resource would not be affected by operations. In the San Jose Diridon Station Approach Subsection, Alternative B would build a new crossing over Los Gatos Creek that would require intermittent maintenance during operations, while Alternative A would use the existing Los Gatos Creek bridge. Refer to Section 3.7 of this Final EIR/EIS and Volume 2, Appendix 3.8-C for more information regarding intermittent operation impacts on individual aquatic resources.

Table 3.8-19 Aquatic Resources with Intermittent Bridge/Culvert Maintenance and Vegetation Management

Alternative A	Alternative B[1]
San Francisco to South San Francisco Subsection	
Drainage Ditch 1 Wetland 1 Drainage Ditch 2 and Wetlands Visitacion Creek Guadalupe Valley Creek Guadalupe Valley Creek Saline Wetland Oyster Point Channel Saline Wetland 1 Drainage Ditch 13 Wetland 3 Colma Creek	Drainage Ditch 1 Wetland 1 Drainage Ditch 2 and Wetlands Visitacion Creek Visitacion Creek Tributary and Wetland Guadalupe Valley Creek Guadalupe Valley Creek Saline Wetland Oyster Point Channel Saline Wetland 1 Drainage Ditch 13 Wetland 3 Colma Creek

Alternative A	Alternative B[1]
San Bruno to San Mateo Subsection	
Drainage Ditch 3 Wetland 4 Drainage Ditch 4 Drainage Ditch 5 Drainage Ditch 6 Drainage Ditch 7 Highline Creek Tributary and Wetlands Highline Creek El Portal Canal Mills Creek Tributary Wetland Mills Creek Easton Creek Sanchez Creek Sanchez Creek Tributary and Wetland Burlingame Creek San Mateo Creek	Same as Alternative A
San Mateo to Palo Alto Subsection	
Drainage Ditch 9 Leslie Creek Drainage Ditch 11 Borel Creek Wetland 5 Drainage Ditch 12 Fiesta Creek Laurel Creek Laurel Creek Tributary Laurel Creek Tributary Wetland Belmont Creek Brittan (Arroyo) Creek Pulgas Creek Cordilleras Creek Arroyo Ojo de Aqua Redwood Creek Atherton Channel San Francisquito Creek Constructed Watercourse 1 Matadero Creek Barron Creek Adobe Creek	Drainage Ditch 9 Leslie Creek Drainage Ditch 11 Borel Creek Drainage Ditch 12 Fiesta Creek Laurel Creek Laurel Creek Tributary Laurel Creek Tributary Wetland Belmont Creek Brittan (Arroyo) Creek Pulgas Creek Cordilleras Creek Arroyo Ojo de Aqua Redwood Creek Atherton Channel San Francisquito Creek Constructed Watercourse 1 Matadero Creek Barron Creek Adobe Creek

Alternative A	Alternative B[1]
Mountain View to Santa Clara Subsection	
Permanente Creek Stevens Creek Sunnyvale East Channel Calabazas Creek El Camino Storm Drain San Tomas Aquino Creek	Same as Alternative A
San Jose Diridon Station Approach Subsection	
Guadalupe River	Los Gatos Creek Guadalupe River
Total	
56	**57**

Sources: Authority 2019a, 2019b, 2020a, 2020b, 2020c, 2020d

[1] Impacts are the same for Alternative B (Viaduct to I-880) and Alternative B (Viaduct to Scott Boulevard).

CEQA Conclusion

The impact under CEQA would be less than significant for both project alternatives because O&M activities at the LMF and within the blended Caltrain corridor would not substantially alter the drainage pattern of the area, cause erosion or siltation on-site or off-site, substantially increase the rate or amount of surface runoff in a manner which would result in flooding on- or off-site, or create or contribute runoff water that would exceed the capacity of existing or planned stormwater drainage systems. The Authority will develop an O&M plan in compliance with the Phase II MS4 permit to minimize impacts on surface water hydrology from intermittent maintenance activities on bridges and culverts, as well as vegetation management to maintain track clearance conducted in or near aquatic resources. With project features, including development of an O&M plan in compliance with the Phase II MS4 permit, substantial intermittent operations impacts on surface water hydrology from bridge and culvert maintenance and vegetation management will be avoided. Therefore, CEQA does not require any mitigation.

3.8.6.3 Surface Water Quality

Project construction and operations would result in temporary and permanent impacts on surface water quality, including increased sediment concentrations in aquatic resources. Construction impacts would result from physical disturbance of aquatic resources, as well as the filling and relocation of aquatic resources. Operations would avoid substantial water quality impacts associated with bridge or culvert maintenance activities or other activities conducted in or near aquatic resources, as well as the release of contaminants from trains and the use of potentially toxic materials.

No Project Impacts

The conditions describing the No Project Alternative are the same as those described in Section 3.8.6.2, Surface Water Hydrology. The same planned development and transportation projects would generally result in the construction of new impervious surfaces, grading, and work in aquatic resources, which would affect surface water quality.

Many of the planned development projects are anticipated to increase the imperviousness of the RSA. The impervious surfaces associated with these developments would encourage hydromodification in susceptible areas, resulting in increased sediment transport that negatively affects surface water quality. Highway projects that propose to widen existing roadways or modify existing roadway interchanges have the potential to result in multiple acres of contiguous new impervious surfaces. See Section 3.8.6.2 for information about specific projects that are anticipated to create impervious surfaces in the RSA.

Further, vehicle miles traveled (VMT) in the RSA are projected to increase by 2040 (Caltrans 2016). This projection is supported by a number of highway widening and other highway improvement projects that would increase the capacity of the highway systems in the RSA. An increase in the amount of vehicular travel on roadways would lead to increased concentrations of particulate matter, petroleum hydrocarbons, heavy metals, and other contaminants in roadway runoff and aquatic resources in the RSA.

Therefore, pollutant loading in surface waters would also continue under the No Project Alternative in association with the construction of new impervious surfaces and increase in VMT. New impervious surfaces associated with transportation corridors, including highways and airports, would collect pollutants associated with vehicles and the combustion of fuels, whereas new impervious surfaces built by residential developments would collect pollutants associated with households, such as pesticides and fertilizers. Overall, there is anticipated to be a shift in the economy of the Bay Area toward professional rather than industry and manufacturing (Association of Bay Area Governments [ABAG] 2016). Because land use influences surface water quality, there would be a reduction in pollutants associated with industry and manufacturing in the RSA.

Linear transit projects have the potential to cross over one or more aquatic resources. Where these linear projects require widening of an existing facility, there is a potential need for the project to widen or reconstruct bridges and culverts, which could require construction activities in several aquatic resources. Moreover, some planned development may have permanent impacts on aquatic resources, like the Inner Harbor Specific Plan and ferry terminal in Redwood City. See No Project Impacts in Section 3.8.6.2 for a list of linear transit projects that are anticipated to require construction activities in aquatic resources.

Under the No Project Alternative, new impervious surfaces would be built, VMT would increase, and work in aquatic resources could occur. These developments would result in impacts on surface water quality in the RSA. These developments would likely comply with existing laws and regulations that protect surface water quality, including various CWA Section 402 NPDES permits, such as the MRP and Caltrans NPDES permit that require the use of temporary and permanent BMPs to minimize pollutant loading in surface waters, and could require various forms of mitigation to address impacts on water quality, jurisdictional aquatic resources, and riparian habitat.

Project Impacts

Construction Impacts

Construction of the project would involve areas of disturbed soil; construction materials and waste; work in aquatic resources, which would include temporary stream diversion and dewatering; new impervious surfaces; and the realignment or filling of aquatic resources. Chapter 2 further describes construction activities.

Impact HYD#4: Temporary Impacts on Surface Water Quality during Construction

Temporary construction impacts on surface water quality would result from disturbed soil, construction materials and waste, and work in aquatic resources, which would include temporary stream diversion and dewatering. These impacts would occur under both project alternatives. However, temporary construction impacts on surface water quality would be greater under Alternative B.

Construction of the project alternatives would require grading, excavation, vegetation clearing, operation of heavy equipment, and other activities that would disturb, destabilize, and stockpile soil. These construction activities are sources of sediment that would need to be controlled to prevent sediment-laden runoff from entering aquatic resources. When discharged into an aquatic resource, sediment increases the concentrations of suspended solids, dissolved solids, and organic pollutants in stormwater runoff, leading to elevated concentrations of these pollutants and the creation of nuisance sediment deposits in the receiving water. These activities would occur throughout the entire corridor to construct the station modifications, Tunnel Avenue overpass, Millbrae Station and San Jose Diridon Station improvements, and passing track under Alternative B. However, these activities would be performed nearly continuously for 2 to 3 years at the East or West Brisbane LMF site. At the East and West Brisbane LMF sites, unstabilized cut-and-fill slopes, staging areas, materials storage areas, stockpiles of hazardous and nonhazardous materials, and other temporarily disturbed, unstabilized soil areas are potential sources of sediment that would need to be controlled to avoid or minimize impacts on nearby aquatic resources, including Visitacion Creek and nearby wetlands.

The primary water quality pollutant that would need to be controlled throughout the entire project corridor would be sediment. Thus, the area of soil that is anticipated to be disturbed by construction activities can be used to estimate the relative magnitude of temporary water quality impacts of a construction project. Table 3.8-20 shows the maximum estimated amount of soil disturbance that is anticipated to result from construction of each alternative. Because both project alternatives share the same footprint except near the East and West Brisbane LMF, the passing track under Alternative B, and the San Jose Diridon Station Approach Subsection, the area of soil disturbance from the project alternatives is similar, with 989 acres for Alternative A and 1,108 to 1,137 acres for Alternative B. The East or West Brisbane LMF is anticipated to result in approximately 100 acres of soil disturbance in the vicinity of Visitacion Creek, Brisbane wetlands, Visitacion Creek wetlands, and the Visitacion Creek constructed basins; therefore, these aquatic resources have the highest potential for temporary sediment-related impacts during construction. In addition to soil disturbances at the LMF sites, the passing track under Alternative B would generate additional soil disturbances that would not occur under Alternative A. Soil disturbance associated with building the passing track could affect Drainage Ditches 9 and 11, Leslie Creek, Borel Creek, Wetland 5, Laurel Creek, Laurel Creek tributary, Laurel Creek tributary wetland, Belmont Creek, Brittan (Arroyo) Creek, Pulgas Creek, and Cordilleras Creek. The amount of construction effort for Alternative A with the DDV would be approximately the same as Alternative A without the DDV; therefore, the construction-period potential for erosion/sedimentation/construction material spills would be approximately the same.

Table 3.8-20 Maximum Estimated Amount of Disturbed Soil Areas

Alternative	Disturbed Soil Area (acres)
Alternative A	989
Alternative B[1]	1,108/1,137

Sources: Authority 2019a, 2019b
[1] Values are presented for Alternative B (Viaduct to I-880) first, followed by Alternative B (Viaduct to Scott Boulevard).

Aside from sediment, construction of the East or West Brisbane LMF would have the potential to encounter other pollutants of concern, including hazardous and nonhazardous wastes. The East Brisbane LMF under Alternative A would be located on the site of a former Class II landfill, and the West Brisbane LMF (Alternative B) would be located on the former Bayshore freight yard. Excavations required to construct the East Brisbane LMF may encounter heavy metals, volatile organic compounds (VOC), semi-VOCs, petroleum hydrocarbons, PCBs, pesticides, and asbestos products. The excavations required to construct the West Brisbane LMF may encounter metals (chromium, copper, zinc, lead, and arsenic), petroleum hydrocarbons, and VOCs. These pollutants may be encountered in soil and/or groundwater. When discharged into an aquatic resource, VOCs, semi-VOCs, heavy metals, PCBs, pesticides, and asbestos material may become bound to sediment particles and increase sediment toxicity or remain suspended in the water column. When discharged into an aquatic resource in sufficient quantities, these pollutants would have adverse effects on beneficial uses, including wildlife habitat and recreation. The management, transport, and disposal of hazardous and nonhazardous waste material would be controlled to minimize exposure to stormwater runoff and subsequent discharge into Visitacion

Creek and nearby wetlands during construction. Refer to Section 3.10 for more information on the history and hazardous materials at the sites of the East or West Brisbane LMF.

As shown in Table 3.8-20, both project alternatives would disturb more than 1 acre of soil and would need to comply with the CGP. Potential temporary impacts on water quality from soil disturbance, in-water and over-water construction activities, as well as the use, storage, and disposal of construction materials and wastes, will be avoided or minimized by a SWPPP and standard BMPs recommended for a particular construction activity (HYD-IAMF#3). The construction contractor will develop a SWPPP compliant with the conditions of the CGP. The QSD will prepare the SWPPP and identify stormwater BMPs to minimize potential water quality impacts. The latest edition of Caltrans' Project Planning and Design Guide (Caltrans 2017b) and Construction Site BMP Manual (Caltrans 2017a) will be used to evaluate, select, and design temporary construction site BMPs for the project. The temporary BMPs selected by the QSD will be consistent with the practices required under the CGP and achieve compliance with its requirements. Compliance with the requirements of the CGP will reduce or avoid substantial construction-related impacts on water quality. Further evaluation of the BMPs necessary to comply with the CGP and minimize potential water quality impacts during construction will be detailed during the design phase. Refer to Appendix A, Temporary and Permanent Stormwater Best Management Practices, of the San Francisco to San Jose Hydrology and Water Resources Technical Report (Authority 2020a) for an inventory of the construction site BMPs that will be considered during the construction phase by the QSD.

The construction contractor's QSP will be responsible for the SWPPP, including sediment and erosion control BMPs, as well as nonstormwater and waste management BMPs. As part of that responsibility, the QSP will monitor the effectiveness of temporary construction site BMPs before, during, and after storm events. The construction site water quality monitoring program will be used to identify areas subject to poor runoff water quality during storm events to identify additional BMPs to improve runoff water quality. Under the CGP, a construction site water quality monitoring program is required for projects with risk levels greater than 1 (i.e., risk levels 2 and 3). As part of the water quality monitoring process, the QSP will compare the quality of runoff from the construction site to numeric action levels (NAL) for turbidity and pH in the CGP. If NALs for turbidity or pH are triggered, the QSP will oversee necessary BMP corrective actions and, where necessary, the QSD will prescribe additional BMPs until NALs are no longer exceeded. Thus, the monitoring program will be used to evaluate compliance with and prevent violations of water quality standards during construction, including construction activities in or near aquatic resources. Records of these inspections and monitoring results will be submitted to the SWRCB as part of the annual report required by the CGP.

Definition:

Numeric Action Levels (NAL) refer to a specific concentration or level of a pollutant in runoff. When an NAL is exceeded, it is an indication that the current configuration of BMPs may not be effective at reducing pollutants in runoff.

Construction of the project, including the East or West Brisbane LMF, passing track and viaducts under Alternative B, Millbrae Station, and San Jose Diridon Station, is anticipated to occur over the course of multiple construction seasons. Therefore, careful scheduling and phasing will be critical to minimizing potential surface-water quality impacts during construction. Scheduling will be considered during the development of the grading plan. Minimizing areas of disturbed soil, especially with erosive soil types and geological deposits, only disturbing areas that may be stabilized before the onset of winter rains, not performing grading or earthwork during the wet months or storm events, and protecting disturbed soil areas with temporary erosion and sediment control BMPs will minimize the potential for water quality impacts during construction (GEO-IAMF#1, GEO-IAMF#10). Additionally, soil-disturbing work proposed in wetlands or waters of the U.S. or waters of the state (Table 3.8-15) will need to be scheduled according to the appropriate regulatory agency requirements to minimize impacts on water quality, species, and habitat.

Temporary erosion and sediment control measures will be applied to all inactive disturbed soil areas during construction, including the detention of sediment in the construction area with linear sediment barriers, such as silt fences, or the construction of temporary detention basins. Other methods of minimizing erosion include preserving existing vegetation and avoiding sensitive wetland and riparian habitats to the extent feasible, which will be documented in a biological resources management plan (BIO-IAMF#5). Additionally, the SWPPP will specify the installation of replacement plantings or application of a seed mix to assist in permanently stabilizing exposed soils. Wind erosion, resulting in fugitive dust emissions, will be avoided or minimized through standard construction site BMPs, such as construction roadway speed limits, halting activities during windy conditions, and dust suppression by wetting disturbed soil areas (AQ-IAMF#1).

In accordance with the CGP, nonstormwater and waste management BMPs will also be included in the construction phase. These types of BMPs are used to minimize the potential for water quality impacts from construction materials and wastes, including hazardous materials encountered during construction of the LMF. These BMPs provide for the management of liquids not related to rainfall or stormwater (i.e., nonstormwater) and wastes, all of which may include equipment and vehicle washwater, accidental spills of petroleum hydrocarbons (such as fuels and lubricating oils), concrete wastewater, sanitary wastes from construction worksite wash facilities, contaminated soil, and hazardous materials and waste. For contaminated soil and hazardous materials, waste management BMPs include procedures and methods to minimize water quality impacts from stockpiling, transport, disposal, and exposure to stormwater and groundwater. These BMPs will control and manage hazardous materials and contaminated soil to avoid discharges of hazardous materials into receiving waters, including VOCs, semi-VOCs, PCBs, heavy metals, petroleum hydrocarbons, asbestos products, and other waste materials encountered during construction of the LMF. The CGP will also require procedures to effectively contain and clean any spills of hazardous and nonhazardous materials. Nonstormwater and waste management BMPs, good housekeeping practices, and adhering to CGP conditions for the storage of hazardous materials will avoid or minimize the potential for discharging construction materials and wastes into receiving waters (HMW-IAMF#8).

Construction activities for the East or West Brisbane LMF will also comply with regulations that control the transport, use, and storage of hazardous materials and minimize the potential for an accidental release of hazardous materials (HMW-IAMF#7 and HMW-IAMF#8). Transport of hazardous materials and wastes is regulated by federal agencies through the Hazardous Materials Transportation Act of 1975. Transport of hazardous materials and wastes is also regulated by state agencies through the Hazardous Waste Control Act. Together, these IAMFs and regulations minimize the potential for accidental releases during the transport of hazardous materials and wastes within the construction site and on off-site public roadways by establishing procedures and policies for the proper handling, labeling, packaging, and transportation of these materials. These requirements will apply to haul trucks transporting hazardous materials from the site of the East or West Brisbane LMF to an off-site disposal facility on public roadways.

Additionally, the Authority will minimize the types of hazardous substances required for construction by using an environmental management system to replace hazardous materials with nonhazardous alternatives to the extent possible (HMW-IAMF#9). Alternative materials will be evaluated annually to minimize the use of hazardous materials during construction. If required for construction, hazardous materials will be stored according to state and federal regulations (HMW-IAMF#10). BMPs to minimize the potential for accidental spills and procedures to mitigate spills will be documented in the spill prevention, control, and countermeasure plans (HMW-IAMF#6) for all project facilities. The construction contractor will prepare a hazardous materials and waste plan for Authority review and approval that describes responsible parties and procedures for hazardous waste and the transport of hazardous materials on public roadways (HMW-IAMF#7).

As described in Section 3.8.5.4, groundwater within the existing Caltrain corridor is reported to contain petroleum hydrocarbons, and groundwater underlying the proposed East and West Brisbane LMF sites also contains various chemical contaminants. When contaminated groundwater is brought to the surface in excavations or through pumping, it must be handled and managed to avoid substantial impacts on surface water quality. Therefore, nonstormwater and waste management BMPs will be critical for avoiding substantial surface-water quality impacts during construction activities that may encounter groundwater in these areas. These BMPs could include containing contaminated groundwater in tanks prior to disposal at a publicly owned treatment works. Alternatively, if large quantities of contaminated groundwater are expected to be encountered, the contractor may elect to use an active treatment system in accordance with the CGP (HYD-IAMF#3). Active treatment systems utilize conventional water treatment technologies to improve the quality of stormwater and/or nonstormwater runoff to comply with CWA Section 402 NPDES permits. The active treatment system will potentially include the use of coagulants and a sedimentation basin to reduce turbidity, added acids and bases to control alkalinity and pH, granular activated carbon to reduce hydrocarbons and petroleum products, ion exchange resins to remove metals, and any other treatment systems as applicable to comply with water quality standards prior to discharge into receiving waters.

The contractor will also prepare demolition plans for the safe dismantling and removal of waste materials (HMW-IAMF#5). For bridges and other structures near water, the demolition plans will include temporary structures and systems to collect and contain falling debris, including lead-based paint and asbestos-containing materials, and prevent them from entering receiving waters as needed. This project feature provide measures to collect and contain construction materials, debris, and other toxic substances and prevent them from entering aquatic resources.

In-water and over-water construction activities would be required under both project alternatives. In addition to potentially exposing receiving waters to construction equipment, materials, and debris, these activities may require dewatering for excavations or temporary stream diversion, or both. Temporary stream diversions and dewatering would be required to modify a portion of the existing aquatic resource crossing structures. These activities would be required for construction activities in perennial aquatic resources, including creeks, wetlands, and ditches. Other various construction activities required for the implementation of the project may also be conducted in aquatic resources. With project features, temporary stream diversions and dewatering would create minimal increases in turbidity and suspended sediment concentrations in receiving waters. Locations where construction activity would be required in aquatic resources and result in temporary impacts on surface water quality are listed in Table 3.8-15.

Construction of the project alternatives would require work in aquatic resources to construct new bridges and culverts, as well as realign and relocate aquatic resources (Tables 3.8-15 and 3.8-17). Work in aquatic resources would result in temporary disturbance of the beds and banks of aquatic resources leading to increased erosion and sedimentation and the exposure of construction materials, equipment, and wastes to receiving waters. Work in perennial aquatic resources would require temporary stream diversion and channel dewatering to allow work on a dry ground surface. Intermittent or ephemeral aquatic resources are not likely to contain flowing or standing water during summer when construction in aquatic resources is anticipated to occur, and would not require temporary stream diversion and dewatering. However, erosion and sedimentation would occur in all aquatic resources directly disturbed by construction activities when flows occur during winter.

Additionally, work in aquatic resources may require the removal of riparian vegetation, if present. Removal of riparian vegetation increases the exposure of water to sunlight, causing water temperatures to increase. Because warm water cannot hold as much oxygen as cold water, the removal of riparian vegetation, especially when this occurs in multiple locations within the same watershed, would result in temporary increases in water temperature and decreases in dissolved oxygen levels. However, it is not expected that the removal of riparian vegetation required for project construction would violate water quality standards for temperature or dissolved oxygen.

CEQA Conclusion

The impact under CEQA would be significant for both alternatives, because the project would require construction activities to be performed within aquatic resources, which is expected to substantially degrade existing water quality from elevated sediment concentrations and turbidity. While actions before and during construction minimize such impacts, including the SWPPP developed under the CGP and associated actions to manage, transport, and dispose of hazardous and nonhazardous materials (HYD-IAMF#3), the project would result in the temporary degradation of water quality from construction within aquatic resources. Mitigation measures to address this impact are identified in Section 3.8.9. Section 3.8.7 describes these measures in detail.

Impact HYD#5: Permanent Impacts on Surface Water Quality

Permanent impacts on surface water quality would result from new impervious surfaces and the realignment or filling of aquatic resources. These impacts would occur under both project alternatives. However, permanent impacts on surface water quality would be greater under Alternative B.

Prior to construction, the contractor will prepare a stormwater management and treatment plan for Authority review and approval prior to construction (HYD-IAMF#1). With permanent stormwater treatment and hydromodification management BMPs specified in a stormwater treatment and management plan, stormwater runoff will be collected, treated, and discharged in a manner that will not produce excessive erosion or come into contact with pollutant-generating activities. Additionally, potential sources of pollutants will be controlled and managed to prevent exposure to stormwater, as well as reduce the risk of pollutant discharges during flood events. On-site stormwater treatment BMPs, such as bioretention, permeable pavers, and on-site storage devices, will capture runoff or improve the quality of runoff prior to discharge, or both. These permanent BMPs minimize the discharge of sediment and sediment-bound pollutants into surface waters and minimize the exposure of toxic materials (e.g., metals, petroleum hydrocarbons) to aquatic life.

As described and quantified in Impact HYD#2 and Table 3.8-18, construction of the project would result in the addition of impervious surfaces in the RSA. Impervious surfaces collect pollutants, including sediment, oil and grease, hydrocarbons (e.g., fuels, solvents), heavy metals, organic fertilizers and pesticides, pathogens, nutrients, and debris. These pollutants would be mobilized by runoff during storm events and conveyed into surface water either directly or through drainage systems. As shown in Table 3.8-18, Alternative A is expected to result in the creation of less additional impervious surface than Alternative B. A large portion of new impervious surface under both project alternatives is associated with the East or West Brisbane LMF, including the associated roadways, structures, and parking lots, as well as the San Jose Diridon Station. Refer to Impact HYD#2 for more information on impervious surfaces built by the project alternatives.

The stormwater treatment and management plan will include permanent stormwater BMPs to reduce the quantity and improve the quality of stormwater runoff (treatment and low-impact development [LID] measures), as well as retain flows to prevent increases in flow rates and durations above pre-project conditions (hydromodification management). BMPs will be sized to manage the expected runoff from new and reconstructed impervious surfaces. Within the Authority's right-of-way, the primary CWA Section 402 NPDES permit is the Phase II MS4 permit. Potential LID measures will include built wetland systems, biofiltration and bioretention systems, wet ponds, organic mulch layers, planting soil beds, and vegetated biofilters. The design of stormwater BMPs within drainage areas connected with local drainage systems will comply with the local agency's MS4 permit and associated technical guidance (Table 3.8-1). The Authority has identified Caltrans' *Project Planning and Design Guide* (2017b) for the selection, evaluation, and design of permanent stormwater BMPs.

The Caltrans *Project Planning and Design Guide* (2017b) was developed with the intention to reduce, to the maximum extent practicable, pollutant loadings from a project site after construction, and comply with the Caltrans NPDES permit and CGP. Permanent stormwater BMPs reduce suspended particulate loads in runoff, and thus pollutants associated with sediment particles (e.g., certain metals, such as lead and mercury, PCBs, and PAHs) from entering waterways. The Caltrans *Project Planning and Design Guide* contains guidance on the selection and implementation of many of the Phase II MS4 permit requirements, such as site design measures, stormwater treatment, and hydromodification management BMPs. Where guidelines for the selection and design of BMPs are not provided in the *Project Planning and Design Guide*, the San Francisco Bay RWQCB would be contacted or referenced for guidance, as needed.

In areas served by the San Francisco combined sewer system, which extends from San Francisco to northern Brisbane, permanent surface-water quality impacts would be completely avoided. All runoff in this area would be routed to storage basins along the San Francisco waterfront by San Francisco's combined sewer system, where runoff is retained prior to treatment. All runoff is eventually conveyed to a wastewater treatment facility for treatment prior to discharge into San Francisco Bay. Discharges from the treatment plant are regulated under a NPDES permit and effluent must meet water quality standards prior to discharge. In all other areas in the surface water RSA, stormwater runoff enters MS4s, which drain directly into an aquatic resource without systematic treatment at a wastewater facility.

The International Stormwater BMP Database contains the results of over 450 performance studies of permanent stormwater treatment BMPs in urban areas in the United States and abroad. While site-specific conditions, such as land use and the pollutant concentrations of influent, may vary in each of the performance study locales, the data provide a high-level overview of the efficiency of these BMPs at removing pollutants in situ. A selection of this dataset is shown in Table 3.8-21, and these data demonstrate that permanent stormwater BMPs reduce concentrations of pollutants in stormwater.

Table 3.8-21 Pre- and Post-Project Median Pollutant Concentrations[1]

LID Feature	Analyte	Median Concentration in Influent	Median Concentration in Treated Effluent	Change
Bioretention planters	Total suspended solids	50 mg/L	10 mg/L	-80%
	Total Kjeldahl nitrogen	1.38 mg/L	1.09 mg/L	-21%
	Total zinc	74 µg/L	20 µg/L	-73%
Detention basin	Total suspended solids	68.2 mg/L	23.3 mg/L	-66%
	Total Kjeldahl nitrogen	1.37 mg/L	1.49 mg/L	+9%
	Total zinc	13.1 µg/L	7.83 µg/L	-40%
Permeable pavers and pervious pavements	Total suspended solids	22 mg/L	14 mg/L	-36%
	Total Kjeldahl nitrogen	1.5 mg/L	1.15 mg/L	-23%
	Total zinc	62 µg/L	18 µg/L	-71%

Source: International Stormwater BMP Database 2014
µg/L = micrograms per liter
LID = low-impact development
mg/L = milligrams per liter
[1] It is not anticipated that infiltration best management practices would be feasible for this project due to soil types in the resource study area.

Stormwater treatment BMPs are the standard method for permanently minimizing the concentrations of contaminants in runoff from impervious surfaces along transportation corridors. The primary contaminant associated with construction is sediment. After construction of the project, disturbed soil would continue stabilizing for several years. During this time and for the duration that they are maintained, stormwater treatment BMPs would prevent most sediment, and any sediment-bound pollutants, from entering the receiving water. Other constituents, such as pesticides, particulate metals, dissolved metals, pathogens, bacteria, temperature, mercury and other parameters, would also be effectively treated by many standard treatment BMPs listed in Appendix A of the San Francisco to San Jose Hydrology and Water Resources Technical Report (Authority 2020a).

In addition, the Authority will be required to inspect and maintain these permanent stormwater treatment BMPs as a condition of the Phase II MS4 permit. Inspections will include field observations of the BMPs to evaluate whether they are effective in removing pollutants from stormwater runoff, reducing hydromodification impacts, or both. Additionally, the Authority will develop a long-term plan for conducting regular maintenance of permanent stormwater treatment BMPs within dedicated HSR right-of-way; this plan will specify the frequency of maintenance activities to ensure ongoing effectiveness.

The project would require the permanent relocation, filling, or modification of aquatic resources. Filling and relocating aquatic resources would only be done where absolutely necessary to build the project alternatives and provide safe, blended HSR and Caltrain services. Modifying aquatic resources would include adjusting the existing banks and bed of the aquatic resource, relocating the aquatic resource nearby, or converting the aquatic resource to a transportation land use by placing fill material, such as rock and soil, in the aquatic resource to construct project improvements. Realigning, modifying, and partially or completely filling an aquatic resource would permanently impact beneficial uses. Although some aquatic resources would be realigned, they may not support the same quantity or quality of beneficial uses as the original alignments. Section 3.7 assesses impacts on the biological resources related to aquatic resources.

Table 3.8-17 lists the aquatic resources that would be permanently filled or relocated by construction of the project alternatives. Permanent impacts associated with filling or realigning aquatic resources include: placing Visitacion Creek into a culvert below the East Brisbane LMF under Alternative A; filling Wetland 6 and Visitacion Creek Constructed Basin 2 and a portion of Visitacion Creek Constructed Basin 1, Visitacion Creek wetlands, and Visitacion Creek saline wetlands from the East Brisbane LMF under Alternative A; filling most of the Brisbane wetlands, and a portion of the Visitacion Creek wetlands under Alternative B; filling or relocating Drainage Ditch 11, Borel Creek, and Wetland 5 to support the passing track under Alternative B. Relocated aquatic resources would be situated as close to the original location as allowed by safety and operational constraints to maintain overall drainage patterns. There is potential for placing Visitacion Creek into a culvert under Alternative A to result in beneficial impacts, which would occur by preventing the discharge of shallow groundwater contaminated with leachate from the former Brisbane Class II landfill into the creek (City of Brisbane 2013). However, because contaminated shallow groundwater in the area has not contributed to substantial alterations of water quality within Visitacion Creek, it is expected that the beneficial impact would be minimal or negligible when compared with existing conditions. Refer to Volume 2, Appendix 3.8-C, and Section 3.7 for more information regarding permanent impacts on jurisdictional aquatic resources in the RSA.

CEQA Conclusion

The impact under CEQA would be significant for both alternatives because the project would substantially degrade water quality through direct removal, filling, hydrological interruption, and other indirect impacts on aquatic resources, as well as the permanent conversion or removal of riparian vegetation. Although actions taken before and during construction will minimize such impacts, the project would result in the permanent loss of aquatic resources and associated degradations of water quality. Mitigation measures to address this impact are identified in Section 3.8.9, and Section 3.8.7 describes these measures in detail.

Operations Impacts

Operations of the project would include daily cleaning, inspection, and train and vehicle storage at the East or West Brisbane LMF; bridge and culvert maintenance and vegetation management conducted in or near aquatic resources; and the release of contaminants, such as brake dust, from the operation of trains. Chapter 2 more fully describes O&M activities.

Impact HYD#6: Intermittent Impacts on Surface Water Quality from Maintenance Activities during Operations

During operations, maintenance activities at stations, LMFs, and traction power facilities (TPF) would require the use and storage of materials and chemicals. Additionally, bridges and culverts would require intermittent maintenance, and vegetation would need to be managed to maintain adequate track clearance. The Authority will prepare a SWPPP under the IGP for applicable station and maintenance facilities (HYD-IAMF#4), an O&M plan identifying BMPs, and an environmental management system to identify nonhazardous alternative materials. The Authority will conduct worker environmental awareness program training sessions for all maintenance employees.

Activities at the East or West Brisbane LMF would include routine maintenance and inspections of trains, storing trains and rail-borne equipment on yard and siding tracks, and storing bulk and non-bulk materials in stockpile areas, including thousands of gallons of heavy and light oils, fuels, and hydraulic fluids, as well as metal filings, cleaning products, refuse, landscaping supplies, and other potentially toxic materials. Materials and chemicals used and stored at the LMF, stations, and TPFs would be managed and controlled to prevent discharges of pollutants into storm drain systems and receiving waters, as described below.

Materials storage areas at the East or West Brisbane LMF, TPFs, and stations will designed to avoid the risk of pollutant discharges during floods. To avoid discharging these materials during floods, the ground floor elevation of materials storage areas, including those at the East or West Brisbane LMF, TPFs, and stations, in floodplains will be set above the 100-year water surface elevation or otherwise protected from flooding; these measures will be documented and described in a flood protection plan (HYD-IAMF#2). Therefore, project features avoid the risk of pollutant discharges during flood events.

Prior to operations, an industrial SWPPP will be prepared for the portions of stations and LMF regulated by the IGP (HYD-IAMF#4) that will describe the BMPs incorporated into operations to prevent the exposure of materials and chemicals to stormwater and manage the quality of stormwater runoff. The IGP contains monitoring requirements that determine whether pollutants are being discharged, and whether corrective actions are necessary. The IGP will require the Authority to evaluate BMP options for the East or West Brisbane LMF to prevent stormwater discharges from the facility from exceeding NALs. The Authority may have to implement physical, structural, or mechanical BMPs that are intended to prevent pollutants from contacting stormwater. Examples of such controls include, but are not limited to: enclosing or covering outdoor pollutant sources in a building or under a roofed or tarped outdoor area; physically separating the pollutant sources from contact with run-on of uncontaminated stormwater; devices that direct contaminated stormwater to appropriate treatment BMPs, including sanitary sewers as allowed by local sewer authority; and treatment BMPs, such as detention ponds, oil/water separators, sand filters, sediment removal controls, and constructed wetlands. The Authority will select effective BMPs to control the discharge of pollutants from the East or West Brisbane LMF. Where appropriate, BMPs will be designed and targeted for known pollutant sources.

Accordingly, the LMF would be designed to minimize the potential for surface-water quality impacts during operations. Most of the mechanical maintenance on trains would be performed inside a building designated for mechanical maintenance activities. Tracks would take trains from the main line into the interior of a maintenance building, where lubricants, grease, and other materials would be used and stored on impervious surfaces. Drainage systems for the interior of the maintenance building, if required, would be routed to a sanitary sewer system and not to a storm drain system where they would be discharged into an aquatic resource. However, daily cleaning, inspection, and train and vehicle storage would be carried out on additional tracks outdoors. Leaks from trains and vehicles in the storage area and materials used during cleaning and inspection could be spilled onto the ground surface and mobilized to a storm drain inlet.

Furthermore, the Authority will minimize hazardous substances required for O&M activities by using an environmental management system to replace hazardous materials with nonhazardous alternatives (HMW-IAMF#9). Alternative materials will be evaluated on an annual basis to continually avoid or minimize the use of hazardous materials during operations. If hazardous materials are required for O&M activities, state and federal laws regulate the storage of hazardous materials; regulated materials will be in maintenance areas with secondary containment to prevent potential spills in compliance with good housekeeping practices (HMW-IAMF#10). The Authority will limit the amount of hazardous substances used for HSR operations and have specific cleanup protocols and trained personnel to prevent regular use or accidental spills of hazardous materials from reaching aquatic resources, and the project alternatives would not contribute to a violation of regulatory standards.

Additional intermittent operations impacts on surface water quality may also result from bridge and culvert maintenance activities, as well as vegetation management conducted in or near aquatic resources. Intermittent maintenance activities for bridges and culverts would include painting, graffiti removal, grinding, and saw cutting, while vegetation management would include the use of pesticides, which would negatively affect receiving water quality if applied to vegetation adjacent to or above aquatic resources. These activities would also contribute sediment to receiving waters when soil is exposed following the removal of vegetation. Because the project alternatives are primarily within the existing Caltrain corridor, and Caltrain already performs these maintenance activities, providing blended HSR operations into the Caltrain corridor would not require additional maintenance activities to be performed along the railbed in Alternative A. Additionally, the passing track and a portion in the San Jose Diridon Station Approach Subsection under Alternative B would not be blended with Caltrain and would require the Authority to perform additional maintenance activities at the dedicated HSR aquatic resource crossings.

Refer to Table 3.8-19 for the aquatic resources that are anticipated to experience intermittent impacts during operations under each project alternative. Intermittent operations impacts on water quality would occur in the same aquatic resources under both project alternatives in all but the San Francisco to South San Francisco Subsection, San Mateo to Palo Alto Subsection, and the San Jose Diridon Station Approach Subsection. In the San Francisco to South San Francisco Subsection, the East Brisbane LMF would not affect Visitacion Creek Tributary and Wetland during operations because that aquatic resource is not within the footprint of Alternative A, whereas Alternative B may require intermittent maintenance of a culvert proposed for Visitacion Creek Tributary and Wetland for the West Brisbane LMF. In the San Mateo to Palo Alto Subsection, Wetland 5 would be permanently filled under Alternative B during construction; consequently, that aquatic resource would not be affected by operations. In the San Jose Diridon Station Approach Subsection, Alternative B proposes a bridge over Los Gatos Creek dedicated to HSR service that would require intermittent maintenance during operations.

The Authority will be required to develop an O&M plan to assign BMPs to pollutant-generating activities for the project in accordance with the Phase II MS4 Permit, including bridges and culvert maintenance and vegetation management. The O&M plan will be required to identify all materials that may be discharged into an aquatic resource or storm drain system during the following pollutant-generating activities and implement measures to reduce pollutants in stormwater and nonstormwater runoff: road and parking lot maintenance, bridge maintenance, right-of-way maintenance, green waste deposited in the street, graffiti removal, and hydrant flushing.

Additionally, Attachment G of the Phase II MS4 permit requires all permittees in the jurisdiction of the San Francisco Bay RWQCB, which includes the Authority, to develop integrated pest management (IPM) policies to prevent the impairment of streams in the RSA by pesticide-related toxicity from vegetation management conducted in or near aquatic resources. The IPM policies would regulate the usage of the following pesticides of concern: organophosphorous pesticides (chlorpyrifos, diazinon, and malathion); pyrethroid pesticides (bifenthrin, cyfluthrin, beta-cyfluthrin, cypermethrin, deltamethrin, esfenvalerate, lambda-cyhalothrin, permethrin, and tralomethrin); carbamates (e.g., carbaryl); and fipronil. The IPM policies would require all employees and landscape contractors involved in the application or use of pesticides to be trained in IPM practices, as well as require the Authority to inform County Agricultural Commissioners in the RSA of water quality issues related to pesticides and of violations of pesticide regulations associated with stormwater management. Additionally, the Authority would be required to track the usage of pesticides of concern by employees and contractors and report usage information to the San Francisco Bay RWQCB when requested. Lastly, the Authority would be required to monitor water and sediment quality for compliance with wasteload allocations

Definitions:

Integrated pest management (IPM) is an ecosystem-based strategy of pest control that focuses on long-term prevention of pests through a combination of techniques. Pesticides are used only after monitoring indicates they are needed according to established guidelines. Pest control materials are selected and applied in a manner that minimizes risks to human health, beneficial and nontarget organisms, and the aquatic environment.

established in the Urban Creek Diazinon and Pesticide Toxicity TMDL with an individual or regional monitoring program. With implementation of IPM policies in accordance with the Phase II MS4 permit, pesticide impacts on surface water quality and resulting toxicity to aquatic organisms would be minimized. Refer to Section 3.7 of this Final EIR/EIS and Volume 2, Appendix 3.8-C for more information regarding intermittent impacts on individual aquatic resources.

CEQA Conclusion

The impact under CEQA would be less than significant for both alternatives because project operations would not violate a water quality standard or plan or create a substantial new source of polluted runoff within the RSA. Either Brisbane LMF location would prevent stormwater pollution with source control and stormwater treatment BMPs. Additionally, prior to operations, the Authority will develop a SWPPP under the IGP and an O&M plan under the Phase II MS4 permit. These plans will be developed to comply with applicable CWA Section 402 NPDES permits by specifying BMPs needed to avoid or minimize impacts on water quality. IPM policies would minimize potential intermittent impacts on existing water quality impairments by minimizing the quantity of pesticides applied in the RSA. Through effective management, planning, and policies, substantial intermittent impacts on surface water quality would be avoided. Therefore, CEQA does not require any mitigation.

Impact HYD#7: Continuous Impacts on Surface Water Quality during Operations

Continuous operations impacts on surface water quality under both project alternatives would result from the release of contaminants, such as brake dust and PAHs, during train operation. However, continuous operations impacts on surface water quality would be greater under Alternative B, because it also has the potential to release contaminants, such as brake dust and PAHs, to Visitacion Creek tributary.

During operations, pollutants would be discharged into aquatic resources when trains cross over an aquatic resource on a bridge or culvert or are in close proximity to an aquatic resource. Alternatively, pollutants emitted by trains would also be deposited on nearby impervious surfaces, where runoff may eventually mobilize them to a storm drain inlet and into an aquatic resource. The DDV would slightly change the extent of impervious surfaces compared to Alternative A without the DDV, but this would not materially change the amount of surficial runoff. Because both project alternatives would primarily use the existing Caltrain corridor, where rail service has been operational for over 150 years, introducing blended Caltrain and HSR service would not introduce new pollutants into the RSA. However, the increase in rail service within the RSA would result in incremental increases in the quantity of the pollutants associated with rail operations within the RSA.

The technology proposed for the electric HSR trains would not require large amounts of lubricants or hazardous materials that could incidentally be leaked or spilled into an aquatic resource during operations. The HSR system would be electrically powered and would not emit petroleum hydrocarbons or byproducts of internal combustion engines. In addition, the electric trains would use a regenerative braking technology, resulting in reduced physical braking and associated wear. When using regenerative braking, the train converts some kinetic energy into electrical energy and feeds this energy back into the overhead contact system (OCS).

Nevertheless, it is expected that the trains would generate pollutants that would be discharged into aquatic resources, which could affect water quality. These pollutants may include both inorganic compounds, such as metals, and organic compounds, including PAHs. The dust generated by physical braking processes may contain metals like iron, copper, silicon, calcium, manganese, chromium, and barium (Burkhardt et al. 2008; Moreno et al. 2015) as well as PAHs (Markiewicz et al. 2017). Although brake dust would consist primarily of particulate metals, some of these metals would become dissolved in rainwater. Additionally, brake dust would not be generated in equal amounts throughout the project. The primary locations where brake dust would be generated are areas where the trains must reduce their travel speed, such as approaches to stations, turns, and tunnels, and elevation changes, primarily descents. Along at-grade and embankment profiles, brake dust is generally anticipated to be retained in track ballast.

Additionally, the use of lubricating oils in trains may also contribute to the release of particulate PAHs into receiving waters (Markiewicz et al. 2017). However, studies have shown that only a small fraction of PAHs released along transportation corridors is actually found in stormwater runoff (about 2 to 6 percent), and the primary sources of these PAHs are physical wear of tires, lubricant oil leakage, exhaust from internal combustion engines, road surface wear, and brakes (Markiewicz et al. 2017). Because electric trains do not require the use of tires, internal combustion engines, or road surfaces, the primary sources of PAHs from HSR trains would be leaks and emissions of lubricants as well as brake dust. The electric train technology that would be utilized by the HSR system would not require large amounts of lubricants, and it would use regenerative braking technology that results in reduced physical abrasion of the braking system.

During operations, the permanent stormwater treatment BMPs specified in the stormwater management and treatment plan (HYD-IAMF#1) will reduce the quantity and improve the quality of stormwater runoff before runoff is discharged into an aquatic resource. Potential treatment BMPs as part of the project could include infiltration areas, infiltration devices, bioretention systems, detention devices, media filters, and wet basins. Of these potential treatment BMPs, all are capable of reducing concentrations of particulate materials in runoff, such as metals and PAHs, while only infiltration areas, infiltration devices, biofiltration systems, and media filters can reduce dissolved metals concentrations in runoff (Caltrans 2017b).

Though not quantifiable at this time, the increase in the quantity of brake dust and PAHs that would be discharged into aquatic resources above existing conditions within the existing Caltrain corridor is not anticipated to be sufficient to substantially alter water quality. Even though certain heavy metals have the potential to bioaccumulate within the aquatic environment or stimulate the growth of microbes, resulting in adverse impacts on aquatic life, the discharge of metals into aquatic resources is not likely to cause a violation of the water quality objectives for bioaccumulation and biostimulatory substances. Unlike metals, PAHs do not bioaccumulate or stimulate microbial growth. However, PAHs can have detrimental developmental and toxic effects on aquatic plants, fish, amphibians, and invertebrates, and they can accumulate in sediment within aquatic resources (Perrin n.d.). Regardless, it is not expected that discharges of PAHs from trains would be of sufficient quantity to exceed the water quality objectives for toxicity or population and community ecology. Considering that the project would use treatment BMPs to reduce the quantity of and improve the quality of runoff generated on all new and replaced impervious surfaces, and the electric HSR system would minimize the quantity of brake dust that would be generated compared to conventional rail technology, the project would minimize potential water quality impacts from brake dust to the maximum extent practicable using the best available technology.

Table 3.8-22 shows the aquatic resources in which continuous impacts on water quality are anticipated to occur during operations. Because both alternatives would cross near the same aquatic resources along the same alignment between the 4th and King Street Station in San Francisco and San Jose Diridon Station, the impact would be similar under both alternatives. Differences in the impact are associated with the East or West Brisbane LMF, where Alternative B would affect Visitacion Creek Tributary and Wetland, and the passing track, where Alternative B would require permanently filling Wetland 5 during construction such that this aquatic resource would not be affected by operations.

Table 3.8-22 Aquatic Resources with Continuous Impacts from the Release of Contaminants from Trains

Alternative A	Alternative B[1]
San Francisco to South San Francisco Subsection	
Drainage Ditch 1 Wetland 1 Drainage Ditch 2 and Wetlands Visitacion Creek Guadalupe Valley Creek Guadalupe Valley Creek Saline Wetland Brisbane Lagoon Brisbane Lagoon Saline Wetlands Oyster Point Channel Saline Wetland 1 Wetland 3 Colma Creek	Drainage Ditch 1 Wetland 1 Drainage Ditch 2 and Wetlands Visitacion Creek Visitacion Creek Tributary and Wetland Guadalupe Valley Creek Guadalupe Valley Creek Saline Wetland Brisbane Lagoon Brisbane Lagoon wetlands Oyster Point Channel Saline Wetland 1 Wetland 3 Colma Creek
San Bruno to San Mateo Subsection	
Drainage Ditch 3 Wetland 4 Drainage Ditch 4 Drainage Ditch 5 Drainage Ditch 6 San Bruno Creek El Zanjon Drainage Ditch 7 Highline Creek Tributary and Wetlands Highline Creek Drainage Ditch 8 El Portal Canal Mills Creek Tributary Wetland Mills Creek Easton Creek Sanchez Creek Sanchez Creek Tributary and Wetland Burlingame Creek San Mateo Creek	Same as Alternative A

Alternative A	Alternative B[1]
San Mateo to Palo Alto Subsection	
Drainage Ditch 9 Leslie Creek Drainage Ditch 11 Borel Creek Wetland 5 Drainage Ditch 12 Fiesta Creek Laurel Creek Laurel Creek Tributary Laurel Creek Tributary Wetland Belmont Creek Brittan (Arroyo) Creek Pulgas Creek Cordilleras Creek Arroyo Ojo de Aqua Redwood Creek Atherton Channel San Francisquito Creek Constructed Watercourse 1 Matadero Creek Barron Creek Adobe Creek	Drainage Ditch 9 Leslie Creek Drainage Ditch 11 Borel Creek Drainage Ditch 12 Fiesta Creek Laurel Creek Laurel Creek Tributary Laurel Creek Tributary Wetland Belmont Creek Brittan (Arroyo) Creek Pulgas Creek Cordilleras Creek Arroyo Ojo de Aqua Redwood Creek Atherton Channel San Francisquito Creek Constructed Watercourse 1 Matadero Creek Barron Creek Adobe Creek
Mountain View to Santa Clara Subsection	
Permanente Creek Stevens Creek Sunnyvale East Channel Calabazas Creek El Camino Storm Drain San Tomas Aquino Creek	Same as Alternative A
San Jose Diridon Station Approach Subsection	
Los Gatos Creek Guadalupe River	Same as Alternative A
Total	
61	**61**

Sources: Authority 2019a, 2019b, 2020a, 2020b, 2020c, 2020d

[1] Impacts are the same for Alternative B (Viaduct to I-880) and Alternative B (Viaduct to Scott Boulevard).

Additional pollutants that may be continuously generated during operations, such as trash, would also be minimal and managed with good housekeeping practices, such as trash pick-up and sweeping along the tracks and at stations, as required by the Phase II MS4 permit. The pollution prevention and good housekeeping practices for operations include identifying all materials that contain pollutants, including metals that could be discharged from O&M activities, and developing

BMPs that, when applied during O&M activities, would reduce pollutants in stormwater and nonstormwater discharges. Refer to Volume 2, Appendix 3.8-C for detailed descriptions of potential impacts on individual aquatic resources and CWA Section 303(d) list impairments.

CEQA Conclusion

The impact under CEQA would be less than significant for both alternatives because project operations would not violate water quality standards or plan or create a substantial new source of polluted runoff. The HSR system would use electric locomotive and regenerative braking technologies that minimize the types and quantities of pollutants that would be continuously released during operations. Additionally, stormwater treatment BMPs incorporated into the design of the project would reduce the concentrations of particulate and dissolved metals as well as PAHs in runoff to the maximum extent practicable using the best available technology. Therefore, the electric train technology and stormwater treatment BMPs incorporated into the design of the project alternatives would avoid substantial continuous impacts on surface water quality. Therefore, CEQA does not require any mitigation.

3.8.6.4 Groundwater

Construction and operations of the project would avoid substantial temporary and permanent impacts on groundwater quality and volume, such as increases in pollutant concentrations in aquifers and changes in the groundwater table elevation. Construction impacts on groundwater would result from dewatering excavations; the potential presence of undocumented contamination; leaks and spills from construction materials and equipment; new impervious surfaces and soil compaction; obstruction of shallow groundwater flow; and the abandonment and relocation of existing groundwater wells. Operations impacts on groundwater would result from the release of brake dust from trains, the use of potentially toxic materials, the consumption of water, and dewatering.

No Project Impacts

The conditions for the No Project Alternative are the same as those described in Section 3.8.6.2. The same planned development and transportation projects would result in construction of new impervious surfaces, dewatering, and subsurface construction activities, which would affect both groundwater quantity and quality.

Many of the planned development projects are anticipated to increase the imperviousness of the RSA. New impervious surfaces associated with planned development would result in potential impacts on groundwater recharge by minimizing opportunities for infiltration. Further, many of these planned developments are entirely in areas designated for groundwater recharge in the Santa Clara Subbasin, whereas the project alternatives are not substantially located in groundwater recharge zones. Projects that propose to widen existing roadways and modify existing roadway interchanges and new transit centers in Hunters Point in San Francisco and San Mateo County are anticipated to result in new impervious surfaces. See Section 3.8.6.2 for projects that are anticipated to create impervious surfaces in the RSA.

Planned development in the RSA is also anticipated to require dewatering groundwater resources during construction. Included in the projects that may require dewatering is the Central Subway Project, a new 1.7-mile-long tunnel that passes through aquifers in San Francisco. In addition to dewatering, subsurface construction activities, including those required to build the subway and other planned development, would be exposed to groundwater and provide a direct mechanism for groundwater contamination. Additionally, some land use change is anticipated to occur in the RSA by 2040 under the No Project Alternative, resulting in potential indirect improvements in groundwater quality. Projections indicate a shift in economic and land use activity toward professional services and health and education under the No Project Alternative and less in the direct production of goods (ABAG 2016). This shift in land use and economic activity would result in the reduced potential for groundwater contamination in the RSA associated with industrial activities and manufacturing.

These trends of increased population growth and land use change under the No Project Alternative, as well as impervious surfaces from planned development, would affect groundwater in the RSA. Planned development is expected to comply with existing laws, regulations, and agencies that protect groundwater resources, including the SGMA. Groundwater sustainability plans prepared under or consistent with the SGMA for the Santa Clara subbasin will provide a pathway for sustainable groundwater management by 2040.

Project Impacts

Construction Impacts

Construction of the project would involve dewatering, construction materials and waste, new impervious surfaces, and subsurface activities near existing groundwater contamination. Chapter 2 further describes construction activities.

Impact HYD#8: Temporary Impacts on Groundwater Quality and Volume during Construction

Temporary construction impacts on groundwater would result from dewatering and construction materials and waste. These impacts would occur under both project alternatives. However, temporary construction impacts on groundwater would be greater under Alternative B.

Groundwater elevations within the RSA vary over time and within each groundwater basin and subbasin. However, Table 3.8-9 indicates that groundwater can occur at shallow depths within each subsection, depending upon a number of hydrologic factors, including high rainfall quantities, prolonged drought, and altered extraction rates. Although specific locations requiring groundwater dewatering are not known at this time, cuts and other excavations required to build the East or West Brisbane LMF are anticipated to encounter groundwater, particularly the 15-foot-deep inspection pits at the LMF. Additional excavations that have the potential to require dewatering could be associated with relocating underground utilities and OCS poles; foundations required for the Tunnel Avenue overpass, structures at the Millbrae and San Jose Diridon Stations, TPFs, communication radio towers, and viaduct foundations under Alternative B; and widening the Hillcrest Boulevard underpass and Euclid Avenue pedestrian underpass. In addition, the construction or modification of bridges and culverts (Table 3.8-15), where groundwater levels may be locally higher due to proximity to surface water, would also likely require dewatering. Refer to Section 2.10.3.2, Track Modifications and Overhead Contact System Adjustments, for more information about OCS pole relocation.

Construction dewatering would have minimal impacts on groundwater elevations, because most excavations potentially requiring dewatering are anticipated to be relatively shallow and widely spaced throughout the project corridor. Additionally, the impacts would be temporary, because dewatering would cease once the excavation has been backfilled or the specific task requiring dewatering has been completed. Alternative B is anticipated to result in more dewatering than Alternative A, due to a higher number of temporary stream diversions required for the construction of bridges, culverts, channel relocations, and viaduct pier foundations that are not proposed under Alternative A. Because streams may receive baseflows from the underlying aquifer, pumping surface water from a stream would have indirect impacts on groundwater. Additionally, other excavations that may require dewatering would be shared or similar between the alternatives, including utility and OCS pole relocations, the East or West Brisbane LMF, Tunnel Avenue overpass, Millbrae Station, San Jose Diridon Station, and widening underpasses at Hillcrest Boulevard and Euclid Avenue.

Construction activities and dewatering within the Caltrain corridor would have the potential to encounter contaminated groundwater. As described in Section 3.8.5.4, groundwater below the West Brisbane LMF is contaminated with halogenated organic solvents, VOC, petroleum hydrocarbons, and metals (arsenic and lead), and groundwater below the East Brisbane LMF is contaminated with aviation fuel, diesel, gasoline, benzene, and fuel oxygenates. In addition to contamination associated with existing railroad, petroleum industry, and landfill operations, groundwater within the RSA may be contaminated near airports, airstrips, and heliports, as well as in historical agricultural areas, where petroleum, gas, pesticides, and other pollutants could leak or infiltrate into the groundwater table. Refer to Section 3.10 for more information on the pollutants that are known to be present within the project footprint.

Prior to construction, the Authority will conduct hazardous materials studies to document the locations of known soil and groundwater contamination within its right-of-way (HMW-IAMF#1), including the sites of the East or West Brisbane LMF. The Authority will manage, remove, and dispose of hazardous materials in a safe and controlled manner as required by all federal and state regulatory requirements to construct the project alternatives. These activities could include excavation, pumping, or *in situ* treatment, as applicable and in coordination with appropriate regulatory agencies, such as the California Department of Toxic Substances Control and San Francisco Bay RWQCB, or prevent the exposure of hazardous materials through other interventions, such as encapsulation.

Additionally, when encountered by dewatering activities, groundwater contaminated by historical and current land uses will require proper handling, containment, disposal, and/or treatment to avoid substantial surface water and groundwater quality impacts during construction. Clean groundwater that meets surface water quality standards may be discharged into an aquatic resource in accordance with the SWPPP and CGP (HYD-IAMF#3) and any dewatering permits issued by the San Francisco Bay RWQCB. Contaminated groundwater will need to be contained in tanks prior to disposal at a publicly-owned treatment works. Alternatively, if large quantities of contaminated groundwater are expected to be encountered, the contractor may elect to use an active treatment system in accordance with the CGP (HYD-IAMF#3), as described in Impact HYD#4. If drilling methods are required to build foundations, the drilling contractor will remove and dispose of any groundwater encountered along with the drilling slurry. These activities are consistent with San Francisco Bay RWQCB's dewatering requirements, CGP (HYD-IAMF#3), and the Caltrans *Field Guide to Construction Site Dewatering* (Caltrans 2014) (GEO-IAMF#10).

Nevertheless, there remains a slight risk for directly pumping and disturbing undocumented subsurface contamination during these activities, which could include movement within the groundwater table due to altered hydrogeologic gradients. Should undocumented contamination be detected, construction activities requiring excavations and dewatering will cease, and remedial actions will be coordinated with the jurisdictional groundwater management agency, the San Francisco Bay RWQCB, and other agencies, as needed (HMW-IAMF#4). Resolutions may involve a site investigation, remediation activities, and properly disposing of contaminated materials within the Authority's right-of-way.

The construction contractor will also implement measures specified in the spill prevention, control, and countermeasure plan (HMW-IAMF#6). This plan will establish procedures to minimize the potential for spills, as well as methods to contain and control spills, if any occur. To minimize the potential impact of a spill, the construction contractor will minimize the number and volume of hazardous substances at the construction site by using an environmental management system to identify and promote the use of nonhazardous alternatives (HMW-IAMF#9). If hazardous materials are required for construction, the construction contractor will prepare a hazardous materials and waste plan for Authority review and approval that describes responsible parties and procedures for hazardous waste and the transport of hazardous materials on public roadways (HMW-IAMF#7). These project features minimize the potential for spills, as well as the resulting toxic impact of a spill, minimizing potential impacts on groundwater quality.

CEQA Conclusion

The impact under CEQA would be less than significant for both project alternatives because project activities would not violate groundwater quality standards or conflict with the groundwater sustainability plan for the Santa Clara Subbasin, as designated under the SGMA. Project features include performing hazardous material studies to identify locations of groundwater contamination, address groundwater contamination prior to construction, properly handle, manage, and dispose of contaminated groundwater, minimize the potential for leaks and spills, reduce the quantity of hazardous materials used during construction, and provide contingency protocols in the event that undocumented contamination is discovered. Through compliance with regulatory permits, guidance manuals, and state and federal regulations for hazardous waste, the project would avoid substantial impacts on groundwater quality and volume during construction. Therefore, CEQA does not require any mitigation.

Refer to Section 3.10 for more information and CEQA conclusions related to hazardous wastes and groundwater contamination.

Impact HYD#9: Permanent Impacts on Groundwater Quality and Volume

Permanent impacts on groundwater would result from new impervious surfaces and groundwater contamination near the project that would occur under both project alternatives. Permanent impacts on groundwater would be the same under both project alternatives.

Construction of both project alternatives would result in new impervious surfaces, including new and modified roadways, widened bridge and culvert structures, parking lots, an LMF, the at-grade railbed for LMF tracks and passing tracks (Alternative B), and viaducts in the San Jose Diridon Station Approach Subsection under Alternative B. Some of these impervious surfaces would be placed on existing pervious surfaces that allow stormwater to infiltrate into the groundwater table, reducing the capacity for groundwater recharge. However, some impervious surface improvements under both project alternatives would rebuild existing impervious surfaces in the same footprint, which would not affect groundwater recharge because there would be no change from the existing condition. Impacts on groundwater recharge from new impervious surfaces would occur under both project alternatives, but their impacts would vary according to the area of new impervious surfaces.

Table 3.8-23 shows the area of new and replaced impervious surfaces associated with access roads, reconstructed and widened bridges and roadway overpasses, emergency services, pedestrian bridges, stations, and the East or West Brisbane LMF that would be built in designated groundwater recharge zones. As shown in the table, no impervious surfaces would be built in recharge zones within the Santa Clara Valley Groundwater Basin. Additionally, the acreage of impervious surfaces that would be built in the Westside Groundwater Basin would be small compared to the total area of the recharge zone, indicating that potential impacts on groundwater recharge would be minimal under both alternatives. Refer to Table 3.8-18 for estimates of all impervious surfaces that would be built for the project alternatives.

Table 3.8-23 Estimates of Impervious Surfaces Built in Designated Groundwater Recharge Zones

Groundwater Basin	Subbasin	Area of Recharge Zone	Alternative A	Alternative B[1]
Westside	N/A	4,510 acres	0.2 acre	Same as Alternative A
Santa Clara Valley	Santa Clara	101,687 acres	0 acres	Same as Alternative A
Estimate of impervious surfaces built in recharge zone			**0.2 acre**	**Same as Alternative A**

Sources: Authority 2019a, 2019b
N/A = not applicable
[1] Values are the same for Alternative B (Viaduct to I-880) and Alternative B (Viaduct to Scott Boulevard).

In addition to the small area of impervious surface improvements that would be built in the Westside Groundwater Basin's groundwater recharge zone, groundwater recharge rates within the project footprint are relatively low. This area is a diked, reclaimed former marshland that is underlain by relatively impermeable soils that provide minimal infiltration compared to other areas in the subbasin that naturally have a greater capacity for groundwater recharge (City of San Bruno et al. 2012). Impacts on groundwater recharge in the Westside Groundwater Basin would therefore be minimal under both project alternatives, because a small area of impervious surface would be built in an area that has a low ability to recharge the aquifer.

Although the at-grade railbed is not considered to be an impervious surface, it does reduce the ability of the underlying soils to provide groundwater recharge. The central part of the at-grade track consists of ballast and tie or slab railbed over a dense subballast and sub-grade. This portion of the railbed consists of pervious materials, but would be compacted to a degree that would diminish the recharge value of the area. However, the area peripheral to the railbed would be more permeable than the central embankment, due to reduced compaction, and would continue to provide infiltration. While the existing Caltrain railbed currently reduces infiltration within the project footprint, widening the at-grade railbed in Alternative B in the area of the passing tracks would further diminish the capacity for groundwater recharge.

In addition to affecting groundwater recharge, new impervious surfaces would collect pollutants, such as sediment, oil and grease, hydrocarbons (e.g., fuels, solvents), heavy metals, organic fertilizers and pesticides, pathogens, nutrients, and debris. These pollutants would flow from impervious surfaces and percolate into the groundwater table. Impacts on groundwater quality would be more severe in designated groundwater recharge zones than other portions of the subbasin; however, the total area of impervious surfaces that would be built in recharge zones is minimal. Impacts on groundwater quality from new impervious surfaces would occur under both project alternatives.

The stormwater management and treatment plan will include permanent stormwater BMPs that manage runoff from new and reconstructed impervious surfaces (HYD-IAMF#1). BMPs will include LID measures that promote the use of pervious surfaces and treatment facilities to improve runoff quality. Within the Authority's right-of-way, impervious surfaces will be minimized to the extent feasible, and BMPs will be designed to maximize on-site infiltration. BMPs constructed outside of the Authority's right-of-way will be built according to the MRP. A stormwater management and treatment plan that complies with the applicable MS4 permits will avoid potential impacts of new impervious surfaces on groundwater quality by constructing BMPs that capture runoff from frequent small storm events before it has an opportunity to infiltrate into the groundwater table.

The project would build subsurface structures, including underground utilities; foundations required for the Tunnel Avenue overpass; foundations for viaduct piers under Alternative B; structures at the Millbrae and San Jose Diridon Stations, TPFs, communication radio towers, and relocated OCS poles; and widening the Hillcrest Boulevard underpass and Euclid Avenue pedestrian underpass. Subsurface structures would be waterproofed to prevent the intrusion of groundwater, thereby minimizing the potential need for permanent dewatering operations. If required, permanent subsurface installations that could require dewatering are anticipated to be relatively shallow, such that if any groundwater were to leak into the structure, dewatering would not substantially lower groundwater levels. Subsurface structures in the vicinity of groundwater cleanups, such as *in situ* or pump-and-treat operations, could affect the cleanup operation. These impacts would occur by altering hydrogeologic gradients and flow rates in the vicinity of the subsurface structure, which would have the potential to affect groundwater levels and the duration or effectiveness of existing remedial activities.

Groundwater cleanups are regulated by the RWQCB with local oversight from groundwater management agencies. Prior to construction, the Authority would be required to consult with local groundwater management agencies to obtain a well permit for excavations that would affect groundwater and the San Francisco Bay RWQCB to obtain a groundwater dewatering permit. Local groundwater management agencies and the San Francisco Bay RWQCB would review the project design plans to determine whether the project would affect the groundwater basin or existing groundwater management operations. If required, these agencies would include conditions in the permits that the Authority must comply with during construction, such as remedial activities or BMPs, to avoid or minimize adverse impacts on groundwater cleanups, as well as groundwater quality and quantity in general.

CEQA Conclusion

The impact under CEQA would be less than significant for both project alternatives because construction of the project would not violate groundwater quality standards, substantially deplete groundwater supplies, substantially interfere with groundwater recharge, or conflict with the groundwater sustainability plan for the Santa Clara Subbasin as designated under the SGMA. Prior to construction, the Authority will develop a stormwater treatment and management plan (HYD-IAMF#1) that will require the project to maximize pervious surfaces, minimize impervious surfaces, and construct permanent stormwater BMPs, some of which will infiltrate stormwater runoff into the groundwater table. In addition, the project footprint traverses an area within the Westside Groundwater Basin that naturally provides little groundwater recharge compared to other parts of the basin, minimizing the impact of new impervious surfaces on groundwater recharge in that area. Compliance with applicable CWA Section 402 NPDES permits, such as the Phase II MS4 permit and MRP, and well permits from local groundwater management agencies avoid substantial permanent impacts on groundwater quality and volume. Therefore, CEQA does not require any mitigation.

Operations Impacts

Operation of the project would include daily cleaning, inspection, and train and vehicle storage at the East or West Brisbane LMF, bridge and culvert maintenance and vegetation management conducted in or near aquatic resources, and the release of contaminants, such as brake dust, from the operation of trains. Chapter 2 more fully describes O&M activities.

Impact HYD#10: Intermittent Impacts on Groundwater Quality and Volume from Maintenance Activities during Operations

Intermittent operations impacts on groundwater would result from daily cleaning, inspection, and train and vehicle storage at the East or West Brisbane LMF. These impacts would occur under both project alternatives. The magnitude of the impact would be the same for both project alternatives, but the impact would occur in different locations within the Visitacion Valley Groundwater Basin. Maintenance activities would not require dewatering, pumping, or other activities that would affect the elevation of the groundwater table or groundwater volume.

As described in Impact HYD#6, activities at stations and the LMF, such as mechanical maintenance and servicing of trains, would use materials and chemicals during operations. If intermittently leaked or spilled during operations, these materials and chemicals would affect groundwater quality if they percolate into the groundwater table through a pervious soil surface. These materials and chemicals include lubricants, fuels, metal filings, hydraulic fluids, cleaning products, refuse, landscaping supplies, and other potentially toxic materials. These materials and chemicals could result in elevated levels of petroleum hydrocarbons, dissolved and particulate metals, ammonia, nutrients in fertilizers, such as nitrate and phosphorus, and pesticides in groundwater aquifers underlying stations and the LMF.

Intermittent operations impacts on groundwater quality from leaks and spills at stations and the LMF would be similar under Alternatives A and B because the East and West Brisbane LMF sites are directly adjacent to each other in the Visitacion Valley Groundwater Basin. Additionally, the types and volumes of materials and chemicals that would need to be stored at the LMF would be the same for both project alternatives. Therefore, chemical leaks and spills at the East Brisbane LMF would have a similar impact on groundwater quality as a spill at the West Brisbane LMF.

The LMF would be designed to minimize the potential for groundwater quality impacts during operations. The project features described in Impact HYD#6 also minimize intermittent operations impacts on groundwater quality. The project features that minimize groundwater quality impacts include performing mechanical maintenance inside a building that is drained by a sanitary sewer system, incorporating source control and treatment BMPs into the design of the LMF in accordance with the Phase II MS4 permit (HYD-IAMF#1), managing regulated portions of the LMF with a SWPPP prepared under the IGP (HYD-IAMF#4), using an environmental management system to reduce the toxicity resulting from a potential leak or spill, and storing all hazardous materials according to state and federal regulations.

CEQA Conclusion

The impact under CEQA would be less than significant for both project alternatives because project operations would not violate groundwater quality standards, including those for substantially deplete groundwater supplies, or conflict with the groundwater sustainability plan for the Santa Clara Subbasin as designated under the SGMA. These activities would not require dewatering, pumping, or other activities that would affect the groundwater table or volume. The project would minimize pollutants generated at stations and the LMF and reduce the number of hazardous materials required for operations that could leak or spill and affect groundwater quality.

In addition, an industrial SWPPP, source control BMPs, and an O&M plan that complies with the Phase II MS4 permit would avoid violations of groundwater quality standards. Through effective management, planning, and policies, substantial intermittent impacts on groundwater would be avoided. Therefore, CEQA does not require any mitigation.

Impact HYD#11: Continuous Impacts on Groundwater Quality and Volume during Operations

Continuous operations impacts on groundwater would result from the release of contaminants, such as brake dust and PAHs, from the operation of trains. This impact would occur under both project alternatives and be the same for both project alternatives.

Continuous operations impacts on groundwater would be similar to the continuous operations impacts on surface water quality described in Impact HYD#7. Contaminants continuously released by trains have the potential to percolate into a groundwater aquifer and negatively affect groundwater quality. Both project alternatives would utilize the existing Caltrain corridor, so introducing blended Caltrain and HSR service would not introduce new sources or types of pollutants to the RSA. However, operating HSR service in the Project Section may incrementally increase the total quantity of these pollutants generated due to increased rail service.

Once released by a train, the pathway that brake dust and PAHs follow in the environment and resulting impacts on groundwater quality would be determined, in part, by the profile of the rail. Brake dust and PAHs emitted from trains traveling on an at-grade or embankment profile are anticipated to be retained in the ballast material beneath the tracks. However, rain would mobilize a portion of brake dust and PAHs in track ballast into the ground or earthen drainage ditches that parallel the track alignment. Brake dust and PAHs deposited on impervious surfaces, such as viaducts, bridges, or roadways, would eventually be mobilized to a drain inlet by rain, where they would enter a storm drain system and be discharged into an aquatic resource. Particulate metals and PAHs would remain in the sediment along the bed of the aquatic resource, whereas dissolved metals may percolate through the sediment and enter the groundwater table.

The contractor will prepare a stormwater management and treatment plan for the project prior to construction (HYD-IAMF#1). The plan will include stormwater treatment BMPs that reduce the quantity and improve the quality of stormwater runoff before it is discharged into an aquatic resource, where it will percolate into the groundwater table. Potential treatment BMPs installed within the project may include infiltration areas, infiltration devices, biofiltration systems, and media filters, all of which can reduce concentrations of particulate and dissolved pollutants in runoff (Caltrans 2017b). Furthermore, because pervious areas (i.e., soil) can filter both particulate and dissolved metals as well as PAHs from runoff (Caltrans 2017b), earthen drainage ditches along at-grade and embankment profiles will provide filtration of runoff that infiltrates into the subsurface in these ditches.

Though not quantifiable at this time, the amount of brake dust and PAHs that would enter the groundwater table is not anticipated to be sufficient to substantially alter groundwater quality or violate the groundwater quality objectives for organic or inorganic chemicals. The project alternatives would be within an existing railroad corridor and therefore result in incremental increases in the quantity of pollutants released from trains that may infiltrate into the groundwater table. Considering that earthen drainage ditches would provide filtration of runoff along at-grade and embankment profiles and that the project would incorporate stormwater treatment BMPs to filter runoff from new and replaced impervious surfaces before it percolates into the groundwater table, the project would minimize potential groundwater quality impacts from brake dust and PAHs to the maximum extent practicable using the best available technology.

Operations would not require continuous dewatering of infrastructure below the naturally occurring groundwater table. All underpasses would be designed to be resistant to groundwater inflows. Thus, continuous dewatering and impacts on existing groundwater cleanup operations are not anticipated during operations. However, as design advances, if it becomes apparent that continuous dewatering would be required, alternative foundation designs that minimize the placement of infrastructure in the groundwater table will be evaluated to reduce the need for continuous dewatering (GEO-IAMF#1). Refer to Section 3.10 of this Final EIR/EIS for more information on existing groundwater cleanup operations.

CEQA Conclusion

The impact under CEQA would be less than significant for both project alternatives because operating the project would not violate groundwater quality standards, including those for organic and inorganic chemicals in runoff from the rail corridor, substantially deplete groundwater supplies, or conflict with the groundwater sustainability plan for the Santa Clara Subbasin as designated under the SGMA. The HSR system would use electric locomotive and regenerative braking technologies that minimize the types and quantities of pollutants that would be continuously released during operations. Additionally, the Authority will develop a stormwater management and treatment plan that will specify permanent stormwater treatment BMPs required to maintain compliance with applicable CWA Section 402 NPDES permits, such as the Phase II MS4 permit and MRP (HYD-IAMF#1). The permanent stormwater treatment BMPs will provide opportunities to filter organic and inorganic chemicals in runoff and avoid violating groundwater quality standards. In addition, the project features avoid or minimize continuous dewatering of infrastructure in the groundwater table (GEO-IAMF#1). The technology and design features incorporated into the design of the HSR system avoid substantial potential continuous impacts on groundwater quality. Therefore, CEQA does not require any mitigation.

3.8.6.5 Floodplains

The project alternatives would avoid substantial temporary construction and intermittent operations impacts on floodplains associated with construction and routine maintenance activities performed in floodplains. However, permanent construction impacts on floodplains would result from the placement of fill in floodplains and the realignment or modification of aquatic resources in floodplains.

No Project Impacts

The conditions for the No Project Alternative are the same as those described in Section 3.8.6.2. The same planned development and transportation projects would require development in floodplains.

The No Project Alternative includes numerous residential and transportation projects. Many of these projects are within or directly adjacent to 100-year floodplains delineated by FEMA. These projects could include the construction or modification of existing culverts, bridges, roadways, structures, and other temporary and permanent impacts within existing 100-year floodplains. Such improvements could require the placement of temporary and permanent fill inside of floodplains and floodways, which can alter existing water surface elevations, footprints, and peak flows of 100-year floodplains.

Planned development under the No Project Alternative includes the following project types in or near floodplains: residential development (India Basin Mixed-Use Project and Pier 70 Mixed-Use District Project in San Francisco; and Parkside at Brisbane Village Specific Plan in Brisbane; Downtown Station Area Specific Plan and Mission & McLellan in South San Francisco; San Bruno Transit Corridors Plan in San Bruno; Millbrae Station Area Specific Plan in Millbrae; Downtown Specific Plan in Burlingame; 220 N. Bayshore Townhomes in San Mateo; Belmont Village Specific Plan in Belmont; Inner Harbor Specific Plan, Marina Shores Village Precise Plan, 353 Main Street, 707 Bradford Street, and Watt Communities in Redwood City; 1111 Karlstad Drive, 457-475 E. Evelyn Avenue, 617 E. Evelyn Avenue, 669 Old San Francisco Road, 701-729 E. Evelyn Avenue, 711 E. Evelyn Avenue, and 755 E. Evelyn Avenue in Sunnyvale), port projects (ferry terminal in Redwood City), and intercity rail projects (Dumbarton Bridge Commuter Rail Service in Santa Clara County).

Under the No Project Alternative, planned development would be constructed, which could result in impacts on floodplains. Development under the No Project Alternative is anticipated to comply with floodplain management regulations that minimize impacts on floodplains, or these projects could also include various forms of mitigation to address impacts on floodplains.

Project Impacts

Construction Impacts

Construction of the Project Section would involve temporary fill in floodplains; development within floodplains, including new bridges and culverts, modified bridges and culverts, and earthwork; and relocating floodplains. Chapter 2 further describes construction activities.

Impact HYD#12: Temporary Impacts on Floodplain Hydraulics during Construction

Temporary construction impacts on floodplains from placing temporary fill in floodplains would be avoided under both project alternatives with project features. Construction of the project would require temporary fill in 100-year floodplains regulated by FEMA. Depending upon the specific construction methods selected by the contractor, temporary fill within floodplains during the construction phase could include temporary structures, such as formworks (temporary molds for new concrete structures), falseworks (temporary supports for new structures), trestles (temporary elevated working surfaces), and cofferdams (temporary structures to isolate work from receiving waters); equipment, including excavators and pumps; and construction materials. When floodwaters are present, temporary fill reduces the storage capacity of the floodplain, resulting in localized changes in water surface elevation, flow velocity, flood flow patterns, or extents of the floodplain.

Under Alternative A, temporary fill would be required in at least seven floodplains, including those along Visitacion Creek within the East Brisbane LMF, Guadalupe Valley Creek just north of Brisbane Lagoon, Highline Creek and Highline Creek tributary near San Francisco International Airport (SFO), El Portal Canal, Sanchez Creek, and Guadalupe River. Except for Visitacion Creek, Alternative B would require temporary fill in these floodplains, as well as the floodplains along Borel Creek, Laurel Creek, Belmont Creek, Brittan (Arroyo) Creek, Pulgas Creek, and Cordilleras Creek, to build the passing track and Los Gatos Creek and Guadalupe River to build the viaduct pier foundations. Temporary fill may be required in the floodplains of these aquatic resources in order to modify existing bridges and culverts, construct new viaduct crossings, or relocate the channel. Refer to Impact HYD#13 for descriptions of the permanent improvements proposed in these floodplains by subsection and alternative.

Floodplain impacts from temporary fill in the floodplain will be avoided by monitoring weather forecasts for intense storm events that have the potential to create flood conditions; monitoring weather forecasts is required by HYD-IAMF#3. When there is a possibility for flooding within the project footprint, the contractor will remove temporary structures, equipment, and materials from aquatic resources to avoid substantial increases in the water surface elevations of 100-year floodplains, as required by HYD-IAMF#2. If needed, formworks, falseworks, trestles, and cofferdams will be designed to remain within floodplains during the winter rainy season and withstand the hydraulic forces of flood flows without increasing water surface elevations by 1 foot, in accordance with HYD-IAMF#2. In addition to floodplains along or in proximity to aquatic resources, floodplains in the project footprint occur on local roadways or in isolated areas that are not associated with aquatic resources. In these areas, the contractor may elect to remove temporary structures, equipment, and materials from the floodplain area or use temporary drainage systems to safely reroute flood flows away from active construction areas without exposing nearby structures and residences to new flood hazards, provided that the water surface elevations of 100-year floodplains are not substantially changed from existing conditions (HYD-IAMF#2). Further, the contractor will be required to coordinate with water districts regarding scheduled releases from upstream dams. The contractor will remove equipment and materials from the floodplain when a release is scheduled.

There would also be temporary impacts on the ecological values of floodplains. Temporary floodplain impacts during the construction of new bridges and culverts, modification of existing bridges and culverts, and any other construction activity performed in a floodplain include the loss of vegetation during construction activity that provides habitat for wildlife. Project features, such as preserving existing vegetation to the extent feasible in compliance with the CGP and Phase II

MS4 permit, minimize these impacts on the ecological values of floodplains. Refer to Section 3.7 for more information on ecological impacts resulting from construction of the project alternatives.

CEQA Conclusion

The impact under CEQA would be less than significant for both project alternatives because project activities would not result in flooding on- or off-site or impede or redirect flood flows. Additionally, a flood protection plan (HYD-IAMF#2) will ensure conformance of project improvements with FEMA and local agency standards for floodplain development. The construction contractor will monitor weather forecasts for potential flood conditions (HYD-IAMF#3). When floods are forecasted, the contractor will remove temporary structures, equipment, and materials from floodplains or safely route flood flows away from the construction site with temporary drainage systems to avoid substantial increases in water surface elevations in accordance with HYD-IAMF#2. Additionally, the contractor will coordinate with water districts regarding scheduled releases from dams and relocate equipment and materials temporarily stored in floodplains when releases from dams are scheduled. With these project features, construction of the project alternatives avoids substantial temporary impacts on floodplains. Therefore, CEQA does not require any mitigation.

Impact HYD#13: Permanent Impacts on Floodplain Hydraulics

Permanent impacts on floodplains would result from development within floodplains, including new bridges and culverts, modified bridges and culverts, earthwork, and relocated floodplains. These impacts would occur under both project alternatives. However, permanent impacts on floodplains would be greater under Alternative B. The DDV is not in a floodplain or regulated floodway and thus there would be no difference in flooding effects compared to Alternative A without the DDV.

The project would install new bridges and culvert structures and widen existing bridges and culvert structures in 100-year floodplains. Additionally, permanent improvements, such as the East Brisbane LMF, passing track under Alternative B, and several radio communication towers, would be placed in existing 100-year floodplains. Where bridge approaches and abutments, widened railbed, structures, and other infrastructure are within floodplains, the engineered features would be considered fill in floodplains. Permanent fill in floodplains would result in localized changes to channel geometry and flood flow characteristics. In addition, widening hydraulic structures, such as bridges and culverts, could change the water surface elevation of the floodplain. Flow passing by the widened structure would increase in velocity, causing turbulence and scour at the abutments or embankments. Therefore, modifications to existing hydraulic structures or channel geometry would potentially result in permanent impacts on floodplain hydraulics. Table 3.8-24 shows proposed new and modified bridges and culverts in FEMA flood zones.

In addition to the construction of new or widened bridges and culverts, several creek channels within floodplains regulated by FEMA would be relocated or modified (Table 3.8-24). Creeks and channels that are oriented longitudinally and in conflict with the proposed improvements would be realigned to flow around the project or to cross below proposed roadways or tracks. Relocating channels, including those within 100-year floodplains, would only occur where necessary to provide safe blended HSR and Caltrain services. These channels would be designed to convey the 100-year flood without creating substantial flood risks on- or off-site in coordination with local floodplain managers. For Alternative A, permanent impacts on floodplains from channel relocation have the potential to occur in Highline Creek. For Alternative B, permanent impacts on floodplains from channel relocation have the potential to occur in Highline Creek and Borel Creek. Table 3.8-17 summarizes all aquatic resources that would be permanently realigned or modified by both project alternatives.

Table 3.8-24 Proposed New or Modified Hydraulic Structures in 100-Year Floodplains

Aquatic Resource (Affected Flood Zones)	Alternative A	Alternative B[1]
San Francisco to South San Francisco Subsection		
Visitacion Creek (Zone A)	Relocate the channel and floodplain to the south of the East Brisbane LMF workshop; place a long reach of the channel and floodplain into a culvert to pass below tracks in the LMF yard	Alternative B has no impact
Guadalupe Valley Creek (Zone A)	Extend existing culvert	Same as Alternative A
San Bruno to San Mateo Subsection		
Highline Creek tributary (Zones AE, AH)	Add two new culverts and build two new radio communication towers	Same as Alternative A
Highline Creek (Zone AE)	Extend eight existing 54-inch reinforced concrete pipe culverts in the upstream direction; relocate a portion of the channel upstream of the railbed; cover daylighted portion of creek with a concrete slab	Same as Alternative A
El Portal Canal (Zone A)	Extend two existing 54-inch corrugated metal pipe culverts in the upstream direction	Same as Alternative A
Sanchez Creek (Zone AH)	Extend existing 4-foot by 10-foot box culvert	Same as Alternative A
San Mateo to Palo Alto Subsection		
Borel Creek (Zone AH)	Alternative A has no impact	Relocate a portion of the 10-foot-wide, concrete-lined channel upstream of the existing tracks immediately north and modify culvert to pass below passing track; widen existing bridge to accommodate the passing track; widen railbed to support the passing track
Laurel Creek (Zones AE, AH, AO)	Alternative A has no impact	Cover small daylighted portion of the creek with a concrete slab to accommodate the passing track; widen railbed to support the passing track
Belmont Creek (Zone A)	Alternative A has no impact	Extend existing concrete channel in the downstream direction to accommodate the passing track; widen railbed to support the passing track
Brittan (Arroyo) Creek (Zone AO)	Alternative A has no impact	Extend existing twin 5-foot by 12-foot box culvert to accommodate the passing track; widen railbed to support the passing track

Aquatic Resource (Affected Flood Zones)	Alternative A	Alternative B[1]
Pulgas Creek (Zones AE, AO)	Alternative A has no impact	Extend existing twin 6-foot by 12-foot box culvert to accommodate the passing track; widen railbed to support the passing track
Cordilleras Creek (Zone A, AE, AO)	Alternative A has no impact	Extend existing drainage arch structure to accommodate passing the track; widen railbed to support the passing track
Mountain View to Santa Clara Subsection		
None	N/A	N/A
San Jose Diridon Station Approach Subsection		
Los Gatos Creek (Zone A)	Alternative A has no impact	New viaduct crossing with no piers in the channel
Guadalupe River (Zones A, AH, AO)	New railroad bridge adjacent to the south side of the existing bridge	New viaduct crossing with no piers in the channel
Total	**7**	**13**

Sources: Authority 2019a, 2019b
HSR = high-speed rail
I- = Interstate
LMF = light maintenance facility
N/A = not applicable
[1] Impacts are the same for Alternative B (Viaduct to I-880) and Alternative B (Viaduct to Scott Boulevard).

As shown in Table 3.8-24, there are a number of proposed new or modified hydraulic structures, for both alternatives that the Authority would need to design to minimize permanent floodplain impacts. To do this, the contractor will prepare a flood protection plan for Authority review and approval prior to construction (HYD-IAMF#2). The flood protection plan will describe how the project will avoid or minimize development in floodplains and changes in the water surface elevations of 100-year floodplains. Design goals incorporated into both project alternatives will require, where feasible, setting the underside of new bridges or soffits above the estimated 100-year flood level and designing and placing bridge piers to minimize backwater impacts and local scouring. Materials storage areas at the East or West Brisbane LMF and traction power stations will be designed to be above the 100-year water surface elevation to avoid substantial pollutant discharges during floods. Additionally, the Authority will design the shape and alignment of the piers to minimize adverse hydraulic impacts. Where bridge replacement or modification occurs within a floodplain regulated by FEMA, additional hydraulic studies must occur during the design phase to document the hydraulic performance of the bridge, reduce scour and erosion, identify scour and erosion countermeasures to protect the structure and channel during high flows, and identify and reduce potential impacts on floodplain hydraulics. Minimization measures consistent with HYD-IAMF#2 that will avoid substantial floodplain impacts may include, but are not limited to, balancing cut and fill quantities within floodplains, providing underground storage facilities for flood waters, and designing relocated creek channels to convey the 100-year flood as described below.

Relocated channels would be designed according to the Authority's *Hydraulic and Hydrology Design Guidelines* (Authority 2011) and any other applicable design criteria from FEMA and local agencies. The goal of the Authority's *Hydraulic and Hydrology Design Guidelines* is to protect the track and associated infrastructure and facilities from damage as a result of flooding. Creeks, streams, and drainage channels would be designed to provide capacity for anticipated flows while maintaining adequate freeboard, as necessary, as well as channel protection measures to prevent erosion. Within 100-year floodplains identified by FEMA, channels would need to be designed to convey the 100-year flood without overtopping. Specific design factors that would be considered in open channel design include channel slope and cross-section, surface roughness, size, and shape. These factors would be adjusted where possible to meet anticipated velocity and flow dynamics in the channel and minimize permanent impacts on floodplains. Considering these project features, neither project alternative would have substantial impacts on floodplains.

The project would pass through a federal flood control project along Guadalupe River under both alternatives. Under Section 14 of the RHA (33 U.S.C. § 408), a project proponent proposing to modify a federal flood control project must obtain permission from USACE. In 2010, the Authority entered into an MOU with the FRA, USEPA, and USACE (FRA et al. 2010). Part of the MOU describes the steps the Authority would take to engage USACE in the design process to facilitate timely and informed decision making with respect to compliance with Section 14 of the RHA. Therefore, the Authority and USACE (San Francisco District) would continue to coordinate on the design for the crossings at Guadalupe River. At this location, a new bridge would be constructed under Alternative A adjacent to the south side of the existing bridge, while under Alternative B (under either viaduct option) a viaduct would be built across the river. The preliminary hydraulic model for both alternatives show a water surface elevation increase of less than 0.1 foot. With optimization of the hydraulic model and design of the proposed pier columns, it is likely that there would be no increase in the 100-year water surface elevation of Guadalupe River under both alternatives.

The project would result in an increase of impervious surfaces, which would increase the total volume of runoff that contribute flows to 100-year floodplains. Table 3.8-18 quantifies the estimated area of new or rebuilt impervious surfaces in the project footprint by source, subsection, alternative, and watershed. Table 3.8-18 also quantifies the proportion of the watershed that new or rebuilt impervious surfaces would occupy. As shown in this table, the amount of new impervious surfaces in each watershed that comprises the RSA would be minimal when compared to the total acreage of the watershed and the amount of existing impervious surfaces in those watersheds. Accordingly, this change in impervious surfaces would have minimal impacts on floodplain hydrology and hydraulics. Additionally, the Authority will manage stormwater runoff from impervious surfaces to maintain pre-project hydrology through on-site stormwater management measures, such as infiltration and retention of stormwater runoff, where appropriate (HYD-IAMF#1). Accordingly, construction of the project would not create flooding on- or off-site as a result of new or rebuilt impervious surfaces.

CEQA Conclusion

The impact under CEQA would be less than significant for both alternatives because project activities would not result in flooding on- or off-site, impede or redirect flood flows, or result in the risk of pollutant discharges due to project inundation. Alternative B would not increase the existing water surface elevations at the West Brisbane LMF and TPFs as a result of project features and conforming to FEMA and local agency standards. The Authority will develop a flood protection plan prior to construction. Using hydraulic analysis, the flood protection plan will include specific measures that minimize development within floodplains and prevent increases in 100-year water surface elevations as required, including balancing cut and fill within floodplains, elevating platforms and structures above the 100-year floodplain water surface elevation and stillwater elevation of San Francisco Bay where feasible, and design goals that minimize backwater, erosion, scour, and other adverse impacts from hydraulic structures. The West Brisbane LMF and TPFs will be designed to be above the 100-year water surface elevation to avoid substantial discharges of pollutants during floods. Through a flood protection plan and coordination with local floodplain managers, the project will avoid substantial permanent impacts on floodplains. Therefore, CEQA does not require any mitigation.

Operations Impacts

Operations of the project would include activities conducted at either the East or West Brisbane LMF, as well as routine maintenance on bridges and culverts, vegetation management, and other activities conducted in or near floodplains. Chapter 2 more fully describes O&M activities.

Impact HYD#14: Intermittent Impacts on Floodplain Hydraulics from Maintenance Activities during Operations

Operating the project would require intermittent maintenance on bridges, viaducts, culverts, and other portions of the right-of-way within floodplains regulated by FEMA. Although some routine maintenance activities would occur within floodplains, these activities would not require the placement of intermittent fill that would impact floodplain hydraulics. Additionally, routine maintenance activities would be scheduled to avoid work in floodplains when there is a potential for flooding, as described in Impact HYD#12. Therefore, intermittent impacts on floodplains would be avoided. The DDV is not in a floodplain or regulated floodway and thus there would be no difference in flooding effects from Alternative A without the DDV.

CEQA Conclusion

The impact would be less than significant under CEQA for both alternatives because operating the project would not impede or redirect flood flows or cause flooding on- or off-site. Routine maintenance activities will not occur when there is a potential for flooding, avoiding substantial intermittent floodplain impacts, such as intermittent increases of 100-year water surface elevations. Therefore, CEQA does not require any mitigation.

3.8.7 Mitigation Measures

Under CEQA, certain impacts on biological and aquatic resources have mitigation measures that will also reduce temporary and permanent impacts on water quality. Mitigation measures for biological and aquatic resources are presented and described in Section 3.7. The following biological and aquatic resources–specific mitigation measures apply to both of the project alternatives:

- BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan
- BIO-MM#3: Establish Environmentally Sensitive Areas and Non-Disturbance Zones
- BIO-MM#4: Conduct Monitoring of Construction Activities
- BIO-MM#13: Restore Temporary Riparian Habitat Impacts
- BIO-MM#14: Prepare Plan for Dewatering and Water Diversions
- BIO-MM#35: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat
- BIO-MM#36: Restore Aquatic Resources Subject to Temporary Impacts
- BIO-MM#37: Prepare and Implement a Compensatory Mitigation Plan for Impacts on Aquatic Resources

3.8.8 Impact Summary for NEPA Comparison of Alternatives

As described in Section 3.1.5.4, the impacts of project actions under NEPA are compared to the No Project condition when evaluating the impact of the project on the resource. The determination of impact is based on the context and intensity of the change that would be generated by construction and operations of the project. Table 3.8-25 shows the hydrology and water resource impacts by alternative.

Table 3.8-25 Comparison of Project Alternative Impacts for Hydrology and Water Resources

Impacts	Alternative A	Alternative B
Surface Water Hydrology		
Impact HYD#1: Temporary Impacts on Drainage Patterns and Stormwater Runoff during Construction	The project would avoid substantial changes in drainage patterns and stormwater runoff. Thirty-six aquatic resources would have minor disturbances, and 9 aquatic resources would be temporarily diverted during construction. Maintaining drainage patterns to the extent feasible, temporary drainage systems in a staging plan or drainage report, SWPPP under the CGP, and adhering to regulatory permits would avoid substantial potential impacts on surface water hydrology.	Impacts under Alternative B would be similar to Alternative A; however, eight fewer aquatic resources would have minor disturbances and seven more aquatic resources would be temporarily diverted.
Impact HYD#2: Permanent Impacts on Drainage Patterns and Stormwater Runoff	Grading, cut-and-fill slopes, impervious surfaces, new bridges and culverts, and realigned or modified aquatic resources would avoid substantial changes in drainage patterns and stormwater runoff. New rail and roadway crossings would be required for nine aquatic resources, seven aquatic resources would be realigned or filled, there would be 3,618,800 cubic yards of cut and fill, and 159.2 acres of impervious surface would be built. Maintaining drainage and pre-construction flow rates, a drainage report, a stormwater management and treatment plan, and the design of realigned or modified aquatic resources would avoid substantial permanent construction impacts on surface water hydrology.	Impacts under Alternative B would be similar to Alternative A; however, nine more aquatic resources would have new railroad and roadway crossings and five more aquatic resources would be realigned or filled. Additionally, there would be 3,014,700 more cubic yards of cut and fill and more new or replaced impervious surface (78.8 more acres for Viaduct to I-880 or 99.4 more acres for Viaduct to Scott Boulevard).
Impact HYD#3: Intermittent Impacts on Drainage Patterns and Stormwater Runoff from Maintenance Activities during Operations	O&M activities would avoid substantial intermittent changes to drainage patterns and stormwater runoff. Approximately 56 aquatic resources would be intermittently affected during operations. BMPs, a SWPPP under the IGP, and an O&M plan under the Phase II MS4 permit will avoid substantial potential impacts.	Impacts under Alternative B would be similar to Alternative A; however, O&M activities would occur in one more aquatic resource.

Impacts	Alternative A	Alternative B
Surface Water Quality		
Impact HYD#4: Temporary Impacts on Surface Water Quality during Construction	Soil disturbances and construction site materials, runoff, and waste would result in minimal impacts on surface water quality. Runoff from 989 acres of disturbed soil would be controlled to avoid substantial increases in turbidity and sedimentation in receiving waters. However, construction activities that take place in aquatic resources would create elevated sediment concentrations and turbidity in 14 aquatic resources, 9 of which would be temporarily diverted and dewatered.	Impacts under Alternative B would be similar to Alternative A; however, construction would disturb a larger area of soil (119 more acres for Viaduct to I-880 and 148 more acres for Viaduct to Scott Boulevard), occur in 12 more aquatic resources, and require temporarily diverting and dewatering of 8 more aquatic resources under Alternative B.
Impact HYD#5: Permanent Impacts on Surface Water Quality	Impervious surfaces and realigned or filled aquatic resources would result in minimal impacts on surface water quality. Alternative A would add 106.9 acres of impervious surfaces. A stormwater management and treatment plan will manage the quality and quantity of runoff generated by impervious surfaces. However, 10 aquatic resources would be realigned or filled, resulting in substantial impacts on water quality from loss of aquatic resources and riparian vegetation.	Impacts under Alternative B would be similar to Alternative A; however, Alternative B would result in more impervious surfaces (61.4 more acres for Viaduct to I-880 or 82.0 more acres for Viaduct to Scott Boulevard) and the realignment or filling of two fewer aquatic resources.
Impact HYD#6: Intermittent Impacts on Surface Water Quality from Maintenance Activities during Operations	Station and LMF activities, including mechanical train maintenance and the storage of chemicals, would avoid substantial changes in surface water quality. Materials storage areas at the LMF and traction power facilities would also be protected from flooding. Bridge and culvert maintenance and vegetation management would result in minimal intermittent impacts on surface water quality during operation. These activities would occur in 56 aquatic resources. The design of stations and the LMF, a SWPPP under the IGP, and an O&M plan under the Phase II MS4 permit would avoid substantial impacts under Alternative A.	Impacts under Alternative B would be similar to Alternative A; however, O&M activities would occur in one more aquatic resource under Alternative B.
Impact HYD#7: Continuous Impacts on Surface Water Quality during Operations	Incremental increases in brake dust and PAHs released by trains during ongoing operation of the rail are anticipated to be deposited in 62 aquatic resources. Permanent stormwater treatment BMPs installed per the Phase II MS4 permit avoid substantial impacts to the maximum extent practicable using the best available technology.	Impacts under Alternative B would be similar to Alternative A; the same number of aquatic resources would be affected by brake dust and PAHs as under Alternative A, but these impacts would occur in different aquatic resources.

Impacts	Alternative A	Alternative B
Groundwater		
Impact HYD#8: Temporary Impacts on Groundwater Quality and Volume during Construction	Dewatering, excavations, and accidental leaks and spills of materials and waste would avoid substantial impacts on groundwater quality and volume. Contaminated groundwater encountered during dewatering operations would be contained and disposed properly. Construction of Alternative A would require dewatering nine aquatic resources, which would avoid substantial impacts on the groundwater table. Substantial impacts would be avoided by adhering to a construction management plan and BMPs and project features regarding the management, transport, and disposal of construction waste and materials.	Impacts under Alternative B would be similar to Alternative A; however, Alternative B is anticipated to require dewatering eight more aquatic resources, which would also avoid substantial impacts on the groundwater table.
Impact HYD#9: Permanent Impacts on Groundwater Quality and Volume	New impervious surfaces built in the Westside Groundwater Basin's recharge zones (0.2 acre) would not substantially affect groundwater quality and volume. Permanent stormwater BMPs and coordination with the RWQCB would substantially avoid impacts on groundwater quality and volume.	Impacts under Alternative B would be the same as Alternative A, because the same area of impervious surface would be built in the Westside Groundwater Basin's recharge zones.
Impact HYD#10: Intermittent Impacts on Groundwater Quality and Volume from Maintenance Activities during Operations	Maintenance activities at the East Brisbane LMF, as well as maintenance activities requiring dewatering, would not substantially affect groundwater quality and volume. An industrial SWPPP, source control BMPs, an O&M plan that complies with the Phase II MS4 permit, and project features regarding the management, transport, and disposal of waste and materials avoid substantial impacts on groundwater quality and volume.	Impacts under Alternative B would be the same as Alternative A, because maintenance activities at the West Brisbane LMF would occur in the same groundwater basins and subbasins.
Impact HYD#11: Continuous Impacts on Groundwater Quality and Volume during Operations	Brake dust and PAHs emitted by trains during operations would minimally affect groundwater quality during operations. Permanent stormwater treatment BMPs installed per the Phase II MS4 permit avoid substantial impacts on groundwater quality and volume.	Impacts under Alternative B would be the same as Alternative A, because brake dust and PAHs would be deposited in the same groundwater basins and subbasins.

Impacts	Alternative A	Alternative B
Floodplains		
Impact HYD#12: Temporary Impacts on Floodplain Hydraulics during Construction	Construction would require temporary fill in seven floodplains. Temporary impacts on 100-year floodplains would be avoided or minimized by not working in streams and creeks when flood conditions are forecast, removing all temporary fill from aquatic resources when flooding may occur or designing temporary fill to withstand flood flows, removing all temporary fill from overland floodplains or installing temporary drainage systems to reroute overland flood flows, and coordinating with water and irrigation districts regarding planned releases from dams.	Impacts under Alternative B would be similar to Alternative A; however, these impacts would occur in six more floodplains.
Impact HYD#13: Permanent Impacts on Floodplain Hydraulics	Construction would require cut and fill in floodplains, including new or modified widened bridges and culverts or realigned and modified aquatic resources. These impacts would occur in seven aquatic resources with 100-year floodplains. A flood protection plan that includes hydraulic analysis of all permanent improvements in regulated 100-year floodplains will minimize permanent impacts on floodplains.	Same as Alternative A
Impact HYD#14: Intermittent Impacts on Floodplain Hydraulics from Maintenance Activities during Operations	O&M activities would require intermittent activities in floodplains delineated by FEMA. However, these activities would not be scheduled when flooding is predicted to occur. Therefore, intermittent impacts on floodplains would be avoided.	Same as Alternative A

BMP = best management practice
CGP = Construction General Permit
FEMA = Federal Emergency Management Agency
IGP = Industrial General Permit
LMF = light maintenance facility
MS4 = municipal separate storm sewer system
O&M = operations and maintenance
PAH = polycyclic aromatic hydrocarbon
RWQCB = Regional Water Quality Control Board
SWPPP = stormwater pollution prevention plan

Project features have been incorporated into the design of the project that reduce impacts on hydrology and water resources. Prior to construction, the contractor will develop a stormwater management and treatment plan to reduce the quantity and improve the quality of runoff discharged into aquatic resources (HYD-IAMF#1), minimizing permanent construction impacts on surface water hydrology, water quality, and groundwater, as well as impacts on surface water quality and groundwater during intermittent and continuous operations. The contractor will prepare a flood protection plan to ensure that the project remains operational during the 100-year flood, provide for a safe method of transportation, and minimize potential permanent construction impacts on floodplains (HYD-IAMF#2). SWPPPs under the CGP and IGP will minimize potential temporary construction impacts on surface water hydrology and surface water quality, as well as impacts on surface water quality and groundwater during intermittent operations (HYD-IAMF#3, HYD-IAMF#4). The project features will avoid substantial changes to drainage patterns and stormwater runoff, groundwater, and floodplains. However, project features are not sufficient to avoid adverse impacts on surface water quality resulting from construction.

Temporary and permanent impacts on water quality would result from work in aquatic resources that has the potential to exceed water quality standards for sediment and turbidity, as well as cause the temporary and permanent loss of riparian vegetation and permanent conversion of aquatic resources to transportation land uses. Mitigation measures will minimize the disturbance of aquatic resources and riparian habitat, dewater creeks and aquatic resources in a manner that minimizes erosion and siltation, restore disturbed aquatic resources, revegetate disturbed riparian habitat, and compensate for permanent losses of water resources and habitat.

3.8.9 CEQA Significance Conclusions

As described in Section 3.1.5.4, the impacts of project actions under CEQA are evaluated against thresholds to determine whether a project action would result in no impact, a less-than-significant impact, or a significant impact. Table 3.8-26 shows the CEQA significance conclusions for each impact discussed in Section 3.8.6. A summary of the significant impact, mitigation measures, and factors supporting the significance conclusion after mitigation follows the table.

Table 3.8-26 CEQA Significance Conclusions and Mitigation Measures for Hydrology and Water Resources

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measures	CEQA Level of Significance after Mitigation
Surface Water Hydrology			
Impact HYD#1: Temporary Impacts on Drainage Patterns and Stormwater Runoff during Construction	Less than significant for both alternatives. Through effective management and control measures, compliance with permits and regulatory plans, and monitoring, project features will avoid substantial temporary impacts on drainage patterns and stormwater runoff.	No mitigation measures are required	Not applicable
Impact HYD#2: Permanent Impacts on Drainage Patterns and Stormwater Runoff	Less than significant for both alternatives. Project features, such as a stormwater management and treatment plan, will avoid substantial permanent impacts on drainage patterns and stormwater runoff.	No mitigation measures are required	Not applicable
Impact HYD#3: Intermittent Impacts on Drainage Patterns and Stormwater Runoff from Maintenance Activities during Operations	Less than significant for both alternatives. The project includes features that will avoid substantial intermittent impacts, such as a SWPPP under the IGP and an O&M plan in compliance with the Phase II MS4 permit.	No mitigation measures are required	Not applicable

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measures	CEQA Level of Significance after Mitigation
Surface Water Quality			
Impact HYD#4: Temporary Impacts on Surface Water Quality during Construction	Significant for both alternatives. Project features include a SWPPP that incorporates BMPs to minimize potential temporary degradation of stormwater runoff quality and avoid discharges of nonstormwater to surface waters. However, there would be significant temporary impacts on receiving water quality and riparian habitat resulting from construction activities performed within aquatic resources and the removal or disturbance of riparian vegetation.	BIO-MM#1: Prepare and Implement a Restoration and Revegetation Plan BIO-MM#3: Establish Environmentally Sensitive Areas and Non-Disturbance Zones BIO-MM#4: Conduct Monitoring of Construction Activities BIO-MM#13: Restore Temporary Riparian Habitat Impacts BIO-MM#14: Prepare Plan for Dewatering and Water Diversions BIO-MM#36: Restore Aquatic Resources Subject to Temporary Impacts BIO-MM#37: Prepare and Implement a Compensatory Mitigation Plan (CMP) for Impacts to Aquatic Resources	Less than Significant
Impact HYD#5: Permanent Impacts on Surface Water Quality	Significant for both alternatives. While project features will minimize potential for permanent degradation of stormwater runoff quality and construction would not result in the violation a water quality standard or creation of a substantial new source of polluted runoff, there would be permanent water quality impacts resulting from the permanent loss or conversion of aquatic resources and riparian habitat.	BIO-MM#35: Provide Compensatory Mitigation for Permanent Impacts on Riparian Habitat BIO-MM#37: Prepare and Implement a Compensatory Mitigation Plan (CMP) for Impacts to Aquatic Resources	Less than Significant
Impact HYD#6: Intermittent Impacts on Surface Water Quality from Maintenance Activities during Operations	Less than significant for both alternatives. Project features will avoid substantial discharges of sediment, pesticides, and other pollutants into receiving waters.	No mitigation measures are required	Not applicable

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measures	CEQA Level of Significance after Mitigation
Impact HYD#7: Continuous Impacts on Surface Water Quality during Operations	Less than significant for both alternatives. Project features include the use of stormwater BMPs to avoid substantial surface-water quality impacts from pollutants released by trains, in accordance with state, regional, and local permits.	No mitigation measures are required	Not applicable
Groundwater			
Impact HYD#8: Temporary Impacts on Groundwater Quality and Volume during Construction	Less than significant for both alternatives. Construction would not violate groundwater quality standards, substantially interfere with groundwater recharge, or impede sustainable groundwater management.	No mitigation measures are required	Not applicable
Impact HYD#9: Permanent Impacts on Groundwater Quality and Volume	Less than significant for both alternatives. Minimal amounts of impervious surfaces would be built in groundwater recharge areas, but construction would not violate groundwater quality standards, substantially interfere with groundwater recharge, or impede sustainable groundwater management.	No mitigation measures are required	Not applicable
Impact HYD#10: Intermittent Impacts on Groundwater Quality and Volume from Maintenance Activities during Operations	Less than significant for both alternatives. Project features include effective measures to avoid substantial intermittent impacts from accidental leaks and spills at stations and the LMF, including designing stations and the LMF to avoid exposing contaminants to runoff and reducing the number of hazardous materials required for operations.	No mitigation measures are required	Not applicable
Impact HYD#11: Continuous Impacts on Groundwater Quality and Volume during Operations	Less than significant for both alternatives. Project features include effective measures to prevent continuously degrading groundwater quality during operations, including measures that avoid the substantial impact of brake dust generated by trains.	No mitigation measures are required	Not applicable

Impacts	Impact Description and CEQA Level of Significance before Mitigation	Mitigation Measures	CEQA Level of Significance after Mitigation
Floodplains			
Impact HYD#12: Temporary Impacts on Floodplain Hydraulics during Construction	Less than significant for both alternatives. Construction of the project would not result in flooding on- or off-site, impede, or redirect flood flows. Project features include measures to avoid construction activities in aquatic resources when the risk of flooding is greatest.	No mitigation measures are required	Not applicable
Impact HYD#13: Permanent Impacts on Floodplain Hydraulics	Less than significant for both alternatives. Project features include a flood protection plan that uses hydraulic modeling to verify that the alterations would not result in flooding on- or off-site, impede or redirect flood flows or result in the risk of pollutant discharges due to project inundation.	No mitigation measures are required	Not applicable
Impact HYD#14: Intermittent Impacts on Floodplain Hydraulics from Maintenance Activities during Operations	Less than significant for both alternatives. Intermittent operations would not result in flooding on- or off-site or impede or redirect flood flows. Intermittent operations in floodplains would not occur when there is a risk of flooding.	No mitigation measures are required	Not applicable

BMP = best management practice
CEQA = California Environmental Quality Act
IGP = Industrial General Permit
LMF = light maintenance facility
MS4 = municipal separate storm sewer system
O&M = operations and maintenance
SWPPP = Stormwater Pollution Prevention Plan

Impact HYD#4: Temporary Impacts on Surface Water Quality during Construction

The Authority would implement mitigation measures to reduce temporary impacts on water quality resulting from erosion and sedimentation in aquatic resources. BIO-MM#1 involves preparation of a restoration and revegetation plan that will identify and describe procedures for restoring temporarily disturbed habitat to its former state. BIO-MM#3 requires the project biologist to establish environmentally sensitive areas and nondisturbance zones that contain aquatic resources to reduce impacts on water quality prior to ground-disturbing activity. BIO-MM#14 requires the Authority to prepare a dewatering plan that incorporates measures to minimize turbidity and siltation of downstream waters. BIO-MM#4 requires the project biologist to monitor construction activities that occur within or adjacent to aquatic resources and document compliance with applicable avoidance and minimization measures, including measures set forth in regulatory authorizations issued under the CWA, Porter-Cologne Act, or both. Under BIO-

MM#32, the restoration and revegetation plan will require contractors to begin revegetation of temporarily affected riparian areas within 90 days of construction completion. BIO-MM#13 will minimize temporary impacts on aquatic resources by requiring contractors to begin restoration of temporarily disturbed features within 90 days of completing construction. BIO-MM#37 requires preparation and implementation of a CMP for impacts on waters of the U.S. regulated under the federal CWA and/or waters of the state under the Porter-Cologne Act. These measures are expected to avoid or minimize temporary impacts and compensate for permanent impacts on receiving water quality resulting from the conversion or loss of aquatic resources and riparian habitat. Therefore, the impact would be less than significant after mitigation for both project alternatives.

Impact HYD#5: Permanent Impacts on Surface Water Quality

The Authority would implement mitigation measures to reduce permanent impacts on water quality resulting from the realignment, filling, or modification of aquatic resources, as well as the removal of riparian vegetation. BIO-MM#35 identifies minimum compensatory mitigation requirements for riparian habitat. BIO-MM#37 requires preparation and implementation of a CMP for both temporary and permanent impacts on aquatic resources. Together, these measures are expected to compensate for permanent impacts on receiving water quality resulting from the conversion or loss aquatic resources. Therefore, the impact would be less than significant after mitigation.

3.8.10 Vulnerability and Adaptation to Sea Level Rise

The impacts of the environment on a project from projected sea level rise are not considered CEQA impacts per recent court rulings. As stated in Sections 3.8.4.4, Method for Evaluating Impacts under NEPA, and 3.8.4.5, impacts of sea level rise are discussed in this section for informational, planning, and regulatory compliance purposes. As such, no CEQA conclusion is provided.

As described in Section 3.8.2.2, all state projects must be planned to reduce and adapt to expected risks from sea level rise. EO S-13-08 directs state agencies planning to build projects in areas vulnerable to future sea level rise to consider a range of sea level projections for the years 2050 and 2100, assess project vulnerability, and, to the extent feasible, reduce expected risks and increase resiliency to sea level rise. CNRA and the California Ocean Protection Council released an updated guidance document in 2018 related to planning, designing, and engineering of state projects, using the best available science (CNRA and California Ocean Protection Council 2018). The 2018 guidance document provides probabilistic projections of sea level rise that are to be used for planning state projects, including the HSR system. The probabilities of sea level rise projects to occur range from 66 percent to 0.5 percent, allowing planners to plan projects with a variety of defined risk tolerances.

The new guidance also acknowledges that there is potential that the probabilistic projections of sea level rise could underestimate the level of extreme sea level rise in the event of rapid melting of the Greenland and Antarctic ice sheets; the guidance document refers to this as the H++ scenario. This scenario in the guidance is based on the plausible change in ice sheets, but is not based on specific prediction of actual change in response to warming temperatures because of uncertainty in ice sheet melting dynamics. Because science cannot currently associate extreme sea level rise projections with a specific probability of occurring, the 2018 guidance projections of extreme sea level rise are not proposed for use in near-term and medium-term design for sea level rise, but would be considered in the long-term adaptation strategy for the project as a contingency.

Table 3.8-27 shows projections of sea level rise for the floodplain RSA, as described in the CNRA and California Ocean Protection Council's guidance document (CNRA and California Ocean Protection Council 2018). The table provides expected levels of sea level rise for each decade between 2030 and 2100 under each emissions scenario and probability. For example, under a high-emissions scenario, there is a 66 percent chance that sea levels will rise by up to 3.4 feet and a 0.5 percent chance that sea levels will rise up to 6.9 feet by the year 2100. For reference, it is possible that sea levels may rise by up to 10.2 feet by 2100 under the H++ scenario, but the probability of sea levels to rise that much is unknown. The Authority has identified the medium-high risk aversion in the years 2050 and 2100 under both low and high emissions scenarios for the use of analyzing potential sea level rise effects for the project. These conservative sea level rise projections are currently estimated to have a 0.5 percent probability of occurring, and they will guide the design of the project to ensure the construction of a resilient HSR system, given the uncertainties of climate change and sea level rise.

Table 3.8-27 Sea Level Rise Projections in the Floodplain Resource Study Area

Decade	Emissions Scenario	Probabilistic Projections (feet) 66% Probability (Low Risk Aversion)	1 in 20 chance, or 5% Probability	1 in 200 chance, or 0.5% probability (Medium to High Risk Aversion)
2030	High	0.5	0.6	0.8
2040	High	0.8	1.0	1.3
2050	High	1.1	1.4	1.9
2060	Low	1.3	1.6	2.4
	High	1.5	1.8	2.6
2070	Low	1.5	1.9	3.1
	High	1.9	2.4	3.5
2080	Low	1.8	2.3	3.9
	High	2.4	3.0	4.5
2090	Low	2.1	2.8	4.7
	High	2.9	3.6	5.6
2100	**Low**	2.4	3.2	**5.7**
	High	3.4	4.4	**6.9**

Source: CNRA and California Ocean Protection Council 2018

Effects from sea level rise would not begin immediately after construction of the project. In the near term, between approximately 2030 and 2050, effects from sea level rise would consist of minor inundation and shallow ponding in low-lying areas with connectivity to San Francisco Bay. As sea levels continue to rise over the long term, between approximately 2050 and 2100, the frequency and magnitude of these effects would increase as rising sea levels continue to encroach upon the blended HSR and Caltrain system. Over the long term, these effects have the potential to become continuous or nearly so in areas that are most vulnerable to sea level rise. In addition to rising sea levels under typical weather patterns, sea level rise would exacerbate coastal flooding during storm events. These effects would be the most extreme during storms with simultaneous high tidal stages, such as king tides.

Using the projections of sea level rise for the floodplain RSA shown in Table 3.8-27, Table 3.8-28 provides the results of a preliminary sea level rise vulnerability assessment performed on the mainline tracks for the project alternatives; the results of the assessment are illustrated on Figure 3.8-9. The vulnerability of the mainline tracks to sea level rise was performed by comparing the proposed top of subballast elevation (2.5 feet below top of rail elevation) to the elevation of San Francisco Bay during a 100-year high tide, storm surge, and anticipated sea level rise, not including wave heights, in the years 2050 and 2100 (CNRA and California Ocean Protection Council 2018). To understand the specific portions of the project alternatives that are vulnerable to sea level rise for design and permitting purposes, the vulnerability assessment used medium-high risk aversion under both low and high emissions scenarios, which has a relatively low probability of occurring (0.5 percent probability, or a 1-in-200 chance). This assessment did not consider the potential presence of downstream obstructions to sea level rise, such as levees or embankments, that may prevent San Francisco Bay from reaching the project.

Table 3.8-28 Sea Level Rise Vulnerability Assessment of the Mainline Tracks using Probabilistic Projections

Location	Top of Subballast Elevation (feet NAVD 88)	100 year High Tide Elevation with Sea Level Rise (feet NAVD 88)	Alternative A		Alternative B	
			Alignment Stationing	Length of Track Inundated (miles)	Alignment Stationing	Length of Track Inundated (miles)
High Emissions with Medium-High Risk Aversion in Year 2050 (0.5% chance of 1.9 feet of sea level rise)						
San Francisco to South San Francisco Subsection						
San Francisco	8.8 to 31.1	11.9	100+00 to 147+20	0.9	Same as Alternative A	
Brisbane	11.1 to 19.9	11.9	402+11 to 411+84	0.2	398+03 to 410+33	11.9
South San Francisco	11.1 to 21.3	11.9	622+63 to 633+80	0.2	Same as Alternative A	
San Bruno to San Mateo Subsection						
Entire subsection	12.0 to 37.7	11.9	–	–	–	–
San Mateo to Palo Alto Subsection						
San Mateo	10.0 to 32.9	11.9	1094+51 to 1116+84	0.4	1107+00 to 1117+63	0.2
Belmont to Mountain View	13.5 to 74.9	11.9 to 12.9	–	–	–	–
Mountain View to Santa Clara Subsection						
Entire subsection	40.6 to 94.3	11.9 to 12.9	–	–	–	–
San Jose Diridon Station Approach Subsection						
Entire subsection	60.1 to 120.0	12.9	–	–	–	–
Total length of track inundated			**1.6 miles**		**1.7 miles**	
Low Emissions with Medium-High Risk Aversion in Year 2100 (0.5% chance of 5.7 feet of sea level rise)						
San Francisco to South San Francisco Subsection						
San Francisco	8.8 to 31.1	15.7	100+00 to 170+58	1.3	Same as Alternative A	
Brisbane	11.1 to 19.9	15.7	383+07 to 513+50	2.5	383+83 to 513+50	15.7
South San Francisco	11.1 to 21.3	15.7	513+50 to 591+40 617+38 to 646+00	2.0	Same as Alternative A	

Location	Top of Subballast Elevation (feet NAVD 88)	100 year High Tide Elevation with Sea Level Rise (feet NAVD 88)	Alternative A		Alternative B	
			Alignment Stationing	Length of Track Inundated (miles)	Alignment Stationing	Length of Track Inundated (miles)
San Bruno to San Mateo Subsection						
South San Francisco	14.5 to 16.1	15.7	646+00 to 647+02	0.1	Same as Alternative A	
San Bruno	13.3 to 37.7	15.7	722+05 to 734+00	0.2	Same as Alternative A	
San Francisco International Airport	12.5 to 13.3	15.7	734+00 to 765+20	0.6	Same as Alternative A	
Millbrae	12.0 to 25.9	15.7	765+20 to 778+91 812+78 to 834+80	0.7	Same as Alternative A	
Burlingame	12.0 to 30.1	15.7	834+80 to 934+61	1.9	Same as Alternative A	
San Mateo	22.2 to 33.1	15.7	–	–	–	15.7
San Mateo to Palo Alto Subsection						
San Mateo	10.0 to 32.9	15.7	1086+44 to 1122+90	0.7	1089+87 to 1123+11	0.6
Belmont to San Carlos	24.8 to 47.2	15.7	–	–	–	–
Redwood City	13.5 to 24.8	15.7	1439+72 to 1469+48	0.6	Same as Alternative A	
Atherton to Mountain View	29.7 to 74.9	15.7 to 16.7	–	–	–	–
Mountain View to Santa Clara Subsection						
Entire subsection	40.6 to 94.3	16.7	–	–	–	–
San Jose Diridon Station Approach Subsection						
Entire subsection	60.1 to 120.0	16.7	–	–	–	–
Total length of track inundated			**10.6 miles**		**10.5 miles**	
High Emissions with Medium-High Risk Aversion in Year 2100 (0.5% chance of 6.9 feet of sea level rise)						
San Francisco to South San Francisco Subsection						
San Francisco	8.8 to 31.1	16.9	100+00 to 175+00	1.4	Same as Alternative A	
Brisbane	11.1 to 19.9	16.9	379+37 to 513+50	2.5	379+93 to 513+50	2.5

Location	Top of Subballast Elevation (feet NAVD 88)	100 year High Tide Elevation with Sea Level Rise (feet NAVD 88)	Alternative A		Alternative B	
			Alignment Stationing	Length of Track Inundated (miles)	Alignment Stationing	Length of Track Inundated (miles)
South San Francisco	11.1 to 21.3	16.9	513+50 to 595+83 615+73 to 646+00	2.1	Same as Alternative A	
San Bruno to San Mateo Subsection						
South San Francisco	14.5 to 16.1	16.9	646+00 to 649+91	0.1	Same as Alternative A	
San Bruno	13.3 to 37.7	16.9	719+92 to 734+00	0.3	Same as Alternative A	
San Francisco International Airport	12.5 to 13.3	16.9	734+00 to 765+20	0.6	Same as Alternative A	
Millbrae	12.0 to 25.9	16.9	765+20 to 780+80 811+82 to 834+80	0.7	Same as Alternative A	
Burlingame	12.0 to 30.1	16.9	834+80 to 936+62	1.9	Same as Alternative A	
San Mateo	22.2 to 33.1	16.9	–	–	–	–
San Mateo to Palo Alto Subsection						
San Mateo	10.0 to 32.9	16.9	1083+27 to 1124+42	0.8	1086+18 to 1124+31	0.8
Belmont to San Carlos	24.8 to 47.2	16.9	–	–	–	–
Redwood City	13.5 to 24.8	16.9	1435+09 to 1486+50	1.0	Same as Alternative A	
Atherton to Mountain View	29.7 to 74.9	16.9 to 17.9	–	–	–	–
Mountain View to Santa Clara Subsection						
Entire subsection	40.6 to 94.3	17.9	–	–	–	–
San Jose Diridon Station Approach Subsection						
Entire subsection	60.1 to 120.0	17.9	–	–	–	–
Total length of track inundated			**11.4 miles**		**11.4 miles**	

Sources: FEMA 2014, 2019a, 2019b; Authority 2019a, 2019b; CNRA and California Ocean Protection Council 2018
NAVD 88 = North American Vertical Datum of 1988
Effects of extreme sea level rise (H++ scenario) were not analyzed because there is no assigned probability of occurrence. However, under the H++ scenario, there would be additional flooding within the project footprint beyond what is shown in the table for both 2050 and 2100.

Source: Authority 2020a

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Figure 3.8-9 Vulnerability of the Mainline Tracks to Sea Level Rise

As summarized in Table 3.8-28, the lowest elevations along the railbed occur in the San Francisco to South San Francisco Subsection and in San Mateo in the San Mateo to Palo Alto Subsection; on Figure 3.8-9, these areas are displayed as a green line. Accordingly, these areas would be prone to inundation from San Francisco Bay by the year 2050 during a 100-year high tide with 1.9 feet of sea level rise. By 2100, substantial portions of the San Francisco to South San Francisco and San Bruno to San Mateo Subsections would be exposed to the effects of sea level rise during a 100-year high tide, as well as areas in San Mateo and Redwood City in the San Mateo to Palo Alto Subsection; on Figure 3.8-9, these areas are displayed as an orange line. In contrast to these areas, the ground elevations in the entire Mountain View to Santa Clara Subsection and portions of all other subsections are above sea level rise projections for both 2050 and 2100; these areas are shown as a blue line on Figure 3.8-9.

The areas of both project alternatives that are most susceptible to sea level rise in both 2050 and 2100 are in the vicinity of the 4th and King Street Station in San Francisco, near Mission Creek, near Islais Creek, near Visitacion Creek and Brisbane Lagoon (including portions of the LMF in both project alternatives), near Oyster Point, near Colma Creek, near El Zanjon Creek, as well as other areas in Millbrae, Burlingame, San Mateo and Redwood City. In these areas, topography is relatively flat and the railbed is in close proximity to San Francisco Bay or other tidally influenced aquatic resources.

The East or West Brisbane LMF would not generally be susceptible to flooding associated with sea level rise. The current design specifies that the ground elevation of the West Brisbane LMF would be at 22.5 feet North American Vertical Datum of 1988 (NAVD 88) and the ground elevation of the East Brisbane LMF at 18.5 feet NAVD 88. With 1.9 feet of sea level rise in 2050, the water surface elevation of San Francisco Bay would be at 11.9 feet NAVD 88 during the 100-year high tide. With 6.9 feet of sea level rise in 2100, the water surface elevation of San Francisco Bay would be at 16.9 feet NAVD 88 during the 100-year high tide. Therefore, based on the current design and projections of sea level rise, the ground surface of the East or West Brisbane LMF would not be susceptible to flooding during the 100-year high tide in either 2050 or 2100.

For these reasons, construction of the LMF would not affect water quality or flooding patterns with projected sea level rise in 2050 and 2100. Because the ground elevation of the LMF would be higher than projected sea level rise in 2050 and 2100, vehicles, equipment, materials, and infrastructure at the LMF located on or above the ground are currently expected to be protected from the effects of sea level rise over the long term. Therefore, vehicles, equipment, materials, and infrastructure at the LMF would not be exposed to Bay waters in such a manner that would create water quality issues. Furthermore, earthwork required to construct the LMF would not expose more of the adjacent community in Brisbane west of the LMF to sea level rise, because the ground surface would be above the water surface elevation of San Francisco Bay in 2050 and 2100. The ground surface within the proposed LMF sites is currently above sea level rise projections for 2050 and 2100, and would remain above these projections after construction of the project.

Both project alternatives would provide a blended corridor with Caltrain, where both HSR and Caltrain locomotives would use the same tracks. The PCJPB owns and operates Caltrain as well as the existing railroad corridor within which Caltrain and HSR services would operate under both project alternatives. Accordingly, the Authority would be a tenant within the railroad corridor on the tracks owned by the PCJPB. As the property owner, the PCJPB has the primary responsibility for ensuring the overall rail corridor adapts to and remains resilient in the face of sea level rise and climate change, including the mainline tracks between San Francisco and San Jose, stations, and associated infrastructure. Where the Authority has a real interest in ensuring a shared facility is resilient, such as the multimodal Millbrae Station that would serve Caltrain, Bay Area Rapid Transit, and HSR, the Authority would consider participating and funding Caltrain's future climate change adaptation efforts. The PCJPB, in the *Peninsula Corridor Electrification Project Final EIR* (PCJPB 2015), has already committed to both short-term and long-term sea level rise and climate change adaptation measures for the existing Caltrain corridor.

However, certain parts of the Project Section would be owned and operated by the Authority. Where these areas are susceptible to the effects of sea level rise or other vulnerabilities posed by a changing climate, the Authority would be the responsible party for climate change adaptation. At this time, the only areas that would be owned and operated by the Authority (i.e., outside of PCJPB/Caltrain's property) that would be vulnerable to the effects of sea level rise are the proposed East Brisbane LMF under Alternative A and West Brisbane LMF under Alternative B and associated storage tracks within the boundaries of the LMF.

During final design, based on the vulnerability assessment described below, the Authority will incorporate features into both project alternatives that will ensure the LMF and areas within BCDC's jurisdiction will be resilient with projected sea level rise in 2050. Proposed near-term adaptation measures and the long-term adaptation strategy will be based on the coordination with BCDC. Adaptation features, such as floodwalls, pump stations, berms, and raising the profile of the rail will address effects from sea level rise over the near term with design modifications that will avoid or minimize potential effects in the year 2050. If development of the Brisbane Baylands project, consistent with the City of Brisbane's 2018 General Plan Amendment, proceeds adjacent to the LMF, then the flood protection improvements will need to be coordinated with that adjacent development.

To address the long-term effects of sea level rise, the Authority will prepare a sea level rise vulnerability assessment and adaptation plan. Because the project proposes an electrified, blended corridor utilized by both Caltrain and HSR along most of its length, a unified approach must be developed with Caltrain to protect shared infrastructure and assets from the threat of sea level rise. The Authority will participate in and provide support to the sea level rise vulnerability assessment and adaptation plan that the PCJPB committed to in the *Peninsula Corridor Electrification Project Final EIR* (PCJPB 2015). Additionally, the Authority will amend the sea level rise vulnerability assessment and adaptation plan with only the dedicated HSR facilities introduced by the project alternatives.

The sea level rise vulnerability assessment and adaptation plan will use the guidance determined to be the best available science by the State of California at the time of preparation. The vulnerability assessment will document the range of sea level rise projections based on best available science. Additionally, the vulnerability assessment will identify specific ground elevations of HSR and blended Caltrain/HSR facilities, the hydraulic connectivity of facilities to San Francisco Bay and tidally influenced aquatic resources, the protectiveness of existing flood control facilities between HSR and San Francisco Bay, areas susceptible to subsidence/soil compression and rising groundwater, and the scenarios, durations, and estimated damage that could result from sea level rise.

Potential sea level rise adaptation measures could include flood levees, seawalls, pumps, elevated tracks, and minor track realignment. Such improvements would optimally be placed closer to San Francisco Bay or along tidal channels, rather than directly along the blended Caltrain and HSR system, given the need to protect other developments that are closer to San Francisco Bay and would also be subject to flooding. In most of the areas of project vulnerability, there is extensive development and infrastructure also subject to such flooding, including mixed-use development adjacent to Mission Creek, industrial development adjacent to Islais Creek, US 101 in Brisbane, commercial and industrial development at Oyster Point and near Colma Creek in South San Francisco, and SFO, US 101, Bay Area Rapid Transit, and residential development near El Zanjon Creek, as well as other development and US 101 in San Bruno, Millbrae, Burlingame, San Mateo, and Redwood City. Where multiple public and private assets are at risk of flooding due to sea level rise, coordinated regional planning for improvements will result in the best outcomes. Where applicable, the Authority will coordinate with these cities on adaptation strategies identified in existing planning programs and documents, such as Sea Change Burlingame, *Coyote Point Sea-Level Rise Vulnerability Assessment* (County of San Mateo 2019), and the Millbrae *Sea Level Rise Adaptation Assessment* (City of Millbrae 2020), as well as other stakeholders in the RSA, such as Caltrans and San Mateo County, as necessary to develop feasible long-term adaptation strategies for sea level rise. Long-term structural adaptation measures will be designed, permitted, and built in compliance with requirements from regulatory agencies. Where blended system facilities are uniquely vulnerable, (e.g., the facilities are directly vulnerable because there are no local or regional assets between the facilities and the source of tidal flooding), the Authority will work with Caltrain on necessary adaptation measures.