3.8 Hydrology and Water Resources

3.8.1 Introduction

This section describes the regulatory setting associated with hydrology and water resources, the affected environment for hydrology and water resources, the impacts on hydrology and water resources that would result from the project, and the mitigation measures that would reduce these impacts. This section includes a range of topics related to water resources, including surface water hydrology, water quality, groundwater, and floodplains. Surface water resources are important for fish and wildlife habitat, urban and agricultural water supply, and conveying floodwaters. Groundwater also is an important source of urban and agricultural water supply. Additional information about issues related to hydrology and water resources, such as stream crossings, irrigation, drainage canals, stormwater systems for the Downtown Merced and Downtown Fresno station areas, erosion, and wetlands is included in Sections 3.6, Public Utilities and Energy; 3.7, Biological Resources and Wetlands; 3.9, Geology, Soils, and Seismicity; 3.10, Hazardous Materials and Wastes; and 3.14, Agricultural Lands. Information about water availability is presented in Section 3.6, Public Utilities and Energy.

The *Final Program Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Proposed California High-Speed Train System* (Statewide Program EIR/EIS) (Authority and FRA 2005) concluded that the HST project would have low potential to result in impacts on water resources. The HST alternatives would use existing transportation corridors and rail lines to reduce new crossings, changes to drainage, and encroachments on water resources. To reduce project impacts on water resources, the HST alternatives incorporate, to the extent practical, design solutions such as elevated track that avoid construction and project effects on streams.

3.8.2 Laws, Regulations, and Orders

A number of federal, state, and local laws, regulations, and agency jurisdiction and management guidance exist regarding this resource. Brief descriptions of these follow.

3.8.2.1 Federal

<u>Clean Water Act (33 U.S.C. 1251 et seq.)</u>

The Clean Water Act (CWA) is the primary federal law protecting the quality of the nation's surface waters, including lakes, rivers, and coastal wetlands. The primary principle is that any pollutant discharge into the nation's waters is prohibited unless specifically authorized by a permit; permit review is the CWA's primary regulatory tool. The applicable sections of the CWA are discussed further below.

Permit for Fill Material in Waters and Wetlands (Section 404)

Section 404 establishes a permit program administered by the U.S. Army Corps of Engineers (USACE). Section 404 regulates the discharge of dredged or fill material into waters of the United States (including wetlands).

National Pollutant Discharge Elimination System Program (Section 402)

Section 402 establishes a permitting system for the discharge of any pollutant (except dredge or fill material) into waters of the United States. It requires a National Pollutant Discharge Elimination System (NPDES) permit for discharges. The Regional Water Quality Control Boards (RWQCBs) administer the NPDES program in California.

Clean Water Quality Certification (Section 401)

Section 401 requires that an applicant for a federal license or permit to allow activities that would result in a discharge to waters of the United States obtain a state certification that the discharge complies with other provisions of the CWA. The RWQCBs administer the certification program in California.

Water Quality Impairments (Section 303[d])

Section 303(d) requires each state to provide a list of impaired waters that do not meet or are expected not to meet state water quality standards as defined by that section. It also requires the state to develop total maximum daily loads (TMDLs) from the pollution sources for such impaired water bodies.

Section 10 of Rivers and Harbors Act (33 U.S.C. 401 et seq.)

Section 10 of the Rivers and Harbors Act requires a permit for creating obstructions (including excavation and fill activities) to the navigable waters of the United States. Navigable waters are defined as those water bodies subject to the ebb and flow of the tide and/or that are utilized, in their natural condition or by reasonable improvements, as means to transport interstate or foreign commerce.

Section 14 of Rivers and Harbors Act (33 U.S.C. Section 408)

Section 14 of the Rivers and Harbors Act requires permission for the use, including modifications or alterations, of any flood control facility work built by the United States to ensure that the usefulness of the federal facility is not impaired. The permission for occupation or use is to be granted by “appropriate real estate instrument in accordance with existing real estate regulations.” For the USACE facilities, the Section 408 approval, known as a Section 408 permit, is required.

Floodplain Management (Executive Order 11988)

Executive Order 11988 requires that federal agency construction, permitting, or funding of a project must avoid incompatible floodplain development, be consistent with the standards and criteria of the National Flood Insurance Program (NFIP), and restore and preserve natural and beneficial floodplain values.

National Flood Insurance Act (42 U.S.C. 4001 et seq.)

The purpose of the National Flood Insurance Act is 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 flood-hazard areas.

Floodplain Management and Protection (U.S. Department of Transportation Order 5650.2) and Flood Disaster Protection Act (42 U.S.C. Section 4001–4128)

The purpose of these acts is to identify flood-prone areas and to provide insurance. The act requires purchase of insurance for buildings in special flood-hazard areas.

3.8.2.2 State

Porter-Cologne Water Quality Act (Water Code Section 13000 et seq.)

The Porter-Cologne Water Quality Act requires projects that are discharging, or proposing to discharge, wastes that could affect the quality of the state’s water to file a Report of Waste Discharge with the appropriate RWQCB. The RWQCBs are responsible for implementing CWA Sections 401,402, and 303(d). The act also provides for the development and periodic review of basin plans that designate beneficial uses of California’s major rivers and groundwater basins and establish water quality objectives for those waters. Projects primarily implement basin plans using the NPDES permitting system to regulate waste discharges so that water quality objectives are met.

Streambed Alteration Agreement (Section 1601 through 1603)

The California Fish and Game Code requires agencies to notify the California Department of Fish and Game (CDFG) prior to implementing any project that would divert, obstruct, or change the natural flow or bed, channel, or bank of any river, stream, or lake.

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

This act documents the state's intent to support local governments in their use of land use regulations to accomplish floodplain management and to provide assistance and guidance as appropriate.

Central Valley Flood Protection Board (California Code of Regulations Title 23, Division 1)

The Central Valley Flood Protection Board (CVFPB) exercises regulatory authority to maintain the integrity of the existing flood-control system and designated floodways by issuing permits for encroachments. The CVFPB has mapped designated floodways along more than 60 streams and rivers in the Central Valley and has identified designated floodways. In addition, Table 8.1 of Title 23 of the California Code of Regulations (CCR) contains several hundred stream reaches and waterways that are regulated streams. Projects that encroach within a designated floodway or regulated stream, or within 10 feet of the toe of a state-federal flood control structure (levee), require an encroachment permit and the submission of an associated application, including an environmental assessment questionnaire. A project must demonstrate that it will not reduce the channel flow capacity and that it will comply with channel and levee safety requirements.

Central Valley Flood Protection Act

The Central Valley Flood Protection Act of 2008 establishes the 200-year flood event as the minimum level of flood protection for urban and urbanizing areas. As part of the state's FloodSafe program, those urban areas protected by flood-control project levees must receive protection from the 200-year flood event level by 2025.The California Department of Water Resources (DWR) and the CVFPB are collaborating with local governments and planning agencies to prepare and adopt the Central Valley Flood Protection Plan (CVFPP) by mid-2012. The objective of the CVFPP is to create a system-wide approach to flood management and protection improvements for the Central Valley (Sacramento Valley and San Joaquin Valley).

3.8.2.3 Regional and Local

This section discusses local and regional regulations and permitting requirements. Cities and counties within the study area, as well as regional agencies, have developed ordinances, policies, and other regulatory mechanisms to minimize negative effects during a project's construction and operation.

Regional Water Quality Control Boards

The Regional Water Quality Control Board (RWQCB) was established by the Porter-Cologne Act. The HST project lies within the boundary of the Central Valley RWQCB, which makes water quality decisions for the region. Its responsibilities include setting standards, issuing waste discharge requirements, determining compliance with those requirements, and taking appropriate enforcement actions.

Basin Plans and Water Quality Objectives

The RWQCB adopts water quality control plans, or basin plans, that establish water quality objectives to provide reasonable protection of beneficial uses and a program of implementation for achieving water quality objectives within the basin plans. Section 303(d) of the CWA requires that the states list waters that are not attaining water quality standards. For these, the RWQCB establishes TMDLs and a program of implementation to meet the TMDL. A TMDL must account for the pollution sources causing the water to be listed.

Construction Activities, National Pollutant Discharge Elimination System General Construction Permit

Under the federal CWA, discharge of stormwater from construction sites must comply with the conditions of an NPDES permit. The State Water Resources Control Board (SWRCB) is the permitting authority in California and has adopted a statewide General Permit for Stormwater Discharges Associated with Construction Activity (SWRCB Water Quality Order No. 99-08-DWQ) that applies to projects resulting in 1 or more acres of soil disturbance. For projects disturbing more than 1 acre of soil, a construction stormwater pollution prevention plan (SWPPP) is required that specifies site management activities to be implemented during site development. These management activities include construction stormwater best management practices (BMPs), erosion and sedimentation controls, dewatering (nuisance water removal), runoff controls, and construction equipment maintenance.

The Central Valley RWQCB requires a Notice of Intent to be filed prior to any stormwater discharge from construction activities, and that the SWPPP be implemented and maintained onsite. On July 1, 2010, the statewide General Permit for Stormwater Discharges Associated with Construction and Land Disturbance Activities (SWRCB Water Quality Order No. 2009-0009-DWQ) superseded the statewide General Permit for Stormwater Discharges Associated with Construction Activity (SWRCB Water Quality Order No. 99-08-DWQ). The new statewide permit implements a risk-based permitting approach, specifies minimum BMP requirements, and requires stormwater monitoring and reporting.

Dewatering Activities

Care is required for the removal of nuisance water from a construction site (known as dewatering), because of the high turbidity and other pollutants potentially associated with this activity. Central Valley RWQCB's Order No. R5-2008-0081, Waste Discharge Requirements General Order for Dewatering and Other Low Threat Discharges to Surface Water cover discharges to surface water from dewatering activities. Discharges to land from dewatering activities are covered under Resolution No. R5-2008-0182, Approving Waiver of Reports of Waste Discharge and Waste Discharge Requirements for Specific Types of Discharge within the Central Valley Region.

Stormwater Management Programs

Section 402(p) of the CWA requires that stormwater management programs be developed and implemented to meet the requirements for stormwater discharges from municipal separate storm sewer systems (MS4s). Stormwater management programs limit to the maximum extent practicable (MEP) 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 BMPs intended to reduce the quantity and improve the quality of stormwater discharged to the stormwater system. Discharges to storm sewer systems must comply with the stormwater management program requirements.

Stormwater management programs applicable to the project include the following:

- Merced Storm Water Group (cities of Atwater and Merced, Merced County, and the Merced Irrigation District Storm Water Management Program (Merced Storm Water Group 2007)
- City of Madera Storm Water Quality Management Program (City of Madera 2004)
- Fresno Metropolitan Flood Control District, City of Fresno, City of Clovis, County of Fresno, and California State University Fresno Storm Water Management Plan (Central Valley RWQCB 2001)

City and County Policies and Regulations

Table 3.8-1 identifies water resources policies and regulations from cities and counties in the study area that were identified and considered in the preparation of this analysis. The policies pertain to water quality, floodplain and groundwater protection, and grading.

Table 3.8-1
Local Policies and Plans

Water Quality/ Stormwater Management	Floodplain Protection	Groundwater Protection	Grading Permits
Merced County			
Merced County General Plan (Merced County 1990) Open Space/Conservation, Goal 2, Objectives 2.A and 2.B Agricultural, Goal 4, Objectives 4.A and 4.B	Merced County General Plan (Merced County 1990) Safety, Goal 4, Objective 4.A	Merced County General Plan (Merced County 1990) Open Space/Conservation, Goal 2, Objectives 2.A and 2.B Agricultural, Goal 4, Objectives 4.A and 4.B	Merced County Code Title 16 (Environmental Impact), Section 16.16.010 Title 18 (Zoning), Section 18.41.030
City of Atwater			
City of Atwater General Plan (City of Atwater 2000) Land Use, Goal LU-24	City of Atwater General Plan (City of Atwater 2000) Safety, Goal SF-4, Policy SF-4.1	City of Atwater General Plan (City of Atwater 2000) Open Space and Conservation, Goal CO-2, Policy CO-2.1	City of Atwater Municipal Code Title 15 (Buildings and Construction), Section 15.08.010
City of Merced			
City of Merced General Plan (City of Merced 1997) Safety, Policies S-7.1 and 7.2 Open Space, Policies OS-1.2, 1.5, 5.1, and 5.2 Public Facilities, Policies P-4.2 and P-5.2	City of Merced General Plan (City of Merced 1997) Public Facilities, Policy 5.1 Safety, Policy S 3.1	City of Merced General Plan (City of Merced 1997) Safety, Policies S-7.1 and 7.2 Open Space, Policy OS-1.5 Public Facilities, Policy 5.2	City of Merced Municipal Code Title 17 (Buildings and Construction), Section 17.48.135
Madera County			
Madera County General Plan (Madera County 1995) Land Use, Goal 1.H, Policy 1.H.2 Public Facilities and Services, Goal 3.C, Policies 3.C.3 and 3.C.5, and Goal 3.E, Policies 3.E.2 and 3.E.5-3.E.7 Agricultural and Natural Resources, Goal 5.C, Policies 5.C.1-5.C.4, 5.C.6, and 5.C.8, and Goal 5.H, Policies 5.H.1 and 5.H.2	Madera County General Plan (Madera County 1995) Health and Safety, Goal 6.B, Policies 6.B.1 and 6.B.3-6.B.4 Fairmead Specific Plan (Madera County n.d.) Chapter 6, Drainage Plan policies	Madera County General Plan (Madera County 1995) Public Facilities and Services, Goal 3.C, Policies 3.C.3 and 3.C.5 Agricultural and Natural Resources, Goal 5.C, Policies 5.C.1-5.C.4, 5.C.6, and 5.C.8	Madera County Code Title 14 (Buildings and Construction), Section 14.50.030; Section 14.50.050; and Section 14.50.080

Water Quality/ Stormwater Management	Floodplain Protection	Groundwater Protection	Grading Permits
City of Chowchilla			
City of Chowchilla General Plan (City of Chowchilla 2009) Public Facilities, Policies PF 6.1, PF 7.1-7.3, PF 7.4	City of Chowchilla General Plan (City of Chowchilla 2009) Public Safety, Policies PS 2.2-2.4	None	City of Chowchilla Municipal Code Title 17 (Subdivisions), Section 17.32.060
City of Madera			
None	City of Madera General Plan (City of Madera 1992) Safety, Goal 1	None	City of Madera Municipal Code Title 9 (Building Regulations), Section 9-1.01
Fresno County			
Fresno County General Plan (Fresno County 2000) Public Facilities and Services, Goal PF-E, Policies PF-E.5-E.6, E.9, E.11-E.16, and E.19-E.21 Open Space and Conservation, Goal OS-A, Policies OS-A.4, A.13, A.19-A.20, A.23-A.26, and A.29	Fresno County General Plan (Fresno County 2000) Health and Safety, Goal HS-C, Policies HS-C.3-C.8 and C.10	Fresno County General Plan (Fresno County 2000) Public Facilities and Services, Goal PF-E, Policies PF-E.5-E.6, E.9, E.11-E.16, and E.19-E.21 Open Space and Conservation, Goal OS-A, Policies OS-A.4, A.13, A.19-A.20, A.23-A.26, and A.29	Fresno County Code Title 15 (Building and Construction), Section 15.28.010
City of Fresno			
City of Fresno General Plan (City of Fresno 2002) Resource Conservation, Objective G-3 Goal 11 Goal 14 Public Facilities, Objective E-23, Policies E-23-f and E-23-i	None	City of Fresno General Plan (City of Fresno 2002) Policy G-3-I	City of Fresno Municipal Code Chapter 12, Section 12-314

3.8.3 Methods for Evaluating Impacts

The following information sources (and associated GIS data) describe the project's affected environment:

- **Climate, precipitation, and topography** – Sources of information for these elements included the Program EIR/EIS, California Data Exchange Center, Western Regional Climate Center, California Irrigation Management Information System (CIMIS), California Climate Data Archive, U.S. Geological Survey (USGS) Topographic Maps and Digital Elevation Model (DEM), project description and conceptual design, and project plans and profiles.
- **Regional and Local Hydrology and Water Quality** – The following hydrology and water quality features exist in the regional and local project vicinity: major surface water features, including lakes, reservoirs, rivers, streams, canals, and floodplains; major water quality impairments; major groundwater aquifers; and highly erodible soils. Information regarding these features and their

conditions originates in the following sources: the Program EIR/EIS, USGS Topographic Maps, Hydro 24 blueline and Layer 610; Federal Emergency Management Agency (FEMA) maps, Flood Insurance Rate Map (FIRM), CWA Section 303(d) lists of water quality-impaired reaches; California DWR Bulletin 118; USGS Ground Water Atlas of the United States; and STATSGO GIS database (erodible soils).

The following sections summarize the methods used to analyze likely study area impacts on surface water hydrology, surface water quality, groundwater, and floodplains using the data gathered (and the GIS databases) from the sources listed above. Water availability is discussed in Section 3.6, Public Utilities and Energy.

Surface Water Hydrology

- Analysts overlaid GIS layers for the proposed HST alternatives on the GIS layers for surface waters and flood-prone areas, and on the GIS layers for the irrigation districts to identify the potential impacts on surface waters. Analysts then used these GIS layers to identify project crossings of streams and irrigation canals.

Surface Water Quality

- Analysts evaluated construction activities for the potential to affect surface water quality due to uncontrolled runoff and discharges. These included accidental releases of construction-related hazardous materials, ground disturbance and associated erosion and sedimentation, stormwater discharges, and dewatering discharges, particularly in locations within or close to a surface water body.
- Analysts reviewed project operation and maintenance activities for the potential to introduce pollutants into the environment, with a particular focus on stormwater runoff from major facilities such as the HMF.

Groundwater

- Analysts overlaid the GIS database layers for the proposed HST alternatives and groundwater to evaluate the potential for groundwater impacts during construction where there is a potential for site runoff to percolate to the groundwater aquifer. Analysts reviewed major project facilities, particularly the HMF alternative sites, for the potential to reduce groundwater recharge.
- Analysts evaluated whether water use by the facility had the potential to cause groundwater depletion of the local aquifer. To evaluate any potential groundwater use effects associated with the HMF alternatives, analysts used a multilayer unsteady state model. Analysts used data from input files for the USGS Central Valley Groundwater Model (USGS 2009) to estimate the groundwater aquifer properties over a 15-square-mile area centered on the City of Chowchilla (most of the HMF sites are located in the vicinity of Chowchilla).

Floodplains

- Analysts overlaid GIS layers for the proposed HST alternatives on the GIS floodplain layers to identify how much of the project lies within the 100-year floodplain.
- Analysts evaluated the potential for the proposed HST alternatives to increase flood height and/or to divert flood flows using flood information from the FEMA county flood insurance studies.

3.8.3.1 Methods for Evaluating Effects Under NEPA

Pursuant to NEPA regulations (40 CFR 1500-1508), project effects are evaluated based on the criteria of context and intensity. Context means the affected environment in which a proposed project occurs. Intensity refers to the severity of the effect, which is examined in terms of the type, quality, and sensitivity of the resource involved, location and extent of the effect, duration of the effect (short- or long-term), and other consideration of context. Beneficial effects are identified and described. When there is no measurable effect, impact is found not to occur. Intensity of adverse effects are summarized as the degree or magnitude of a potential adverse effect where the adverse effect is thus determined to be negligible, moderate, or substantial. It is possible that a significant adverse effect may still exist when on balance the impact is negligible or even beneficial.

For hydrology and water resources, the terms are defined as follows:

- *Negligible* impacts are those impacts that would have no measurable change in surface water and groundwater hydrology, water quality, and drainage and floodplains.
- *Moderate* impacts are those impacts with a measurable change in these resources, but do not contribute to a violation of regulatory standards or exceed the capacity of existing facilities.
- *Substantial* impacts are those impacts that contribute to a violation of regulatory standards or exceed the capacity of existing facilities.

3.8.3.2 CEQA Significance Criteria

According to CEQA Guidelines Appendix G, a project would result in a significant impact on hydrology and water resources if it would:

- Violate any water quality standards or waste discharge requirements.
- Substantially deplete groundwater supplies or interfere substantially with groundwater recharge such that there would be a net deficit in aquifer volume or a lowering of the local groundwater table level (e.g., the production rate of pre-existing nearby wells would drop to a level that would not support existing land uses or planned uses for which permits have been granted).
- Substantially alter the existing drainage pattern of an area, including through the alteration of the stream or river, in a manner which would result in substantial erosion or siltation onsite or offsite.
- Substantially alter the existing drainage pattern of the site or area, including through the alteration of the course of a stream or river, or substantially increase the rate or amount of surface runoff in a manner which would result in flooding onsite or offsite.
- 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.
- Otherwise substantially degrade water quality.
- Place housing within a 100-year flood hazard area as mapped on a federal Flood Hazard Boundary or FIRM or other flood hazard delineation map.
- Place structures within a 100-year flood hazard area which would impede or redirect flood flows.
- Expose people or structures to loss, injury, or death involving flooding, including flooding as a result of the failure of a levee or dam.

3.8.3.3 Study Area for Analysis

The study area for hydrology and water resources is in the southern portion of the San Joaquin River Basin, which extends from the Delta in the north to the northerly boundary of the Tulare Lake Basin in the south, and from the crest of the Sierra Nevada Mountains in the east to the crest of the coast ranges in the west. The study area covers the area generally defined by Merced to the north, Fresno to the south, the lower San Joaquin River to the west (downstream to a point upstream of its junction with the Merced River), and the Sierra Nevada foothills and reservoirs to the east (Figure 3.8-1).

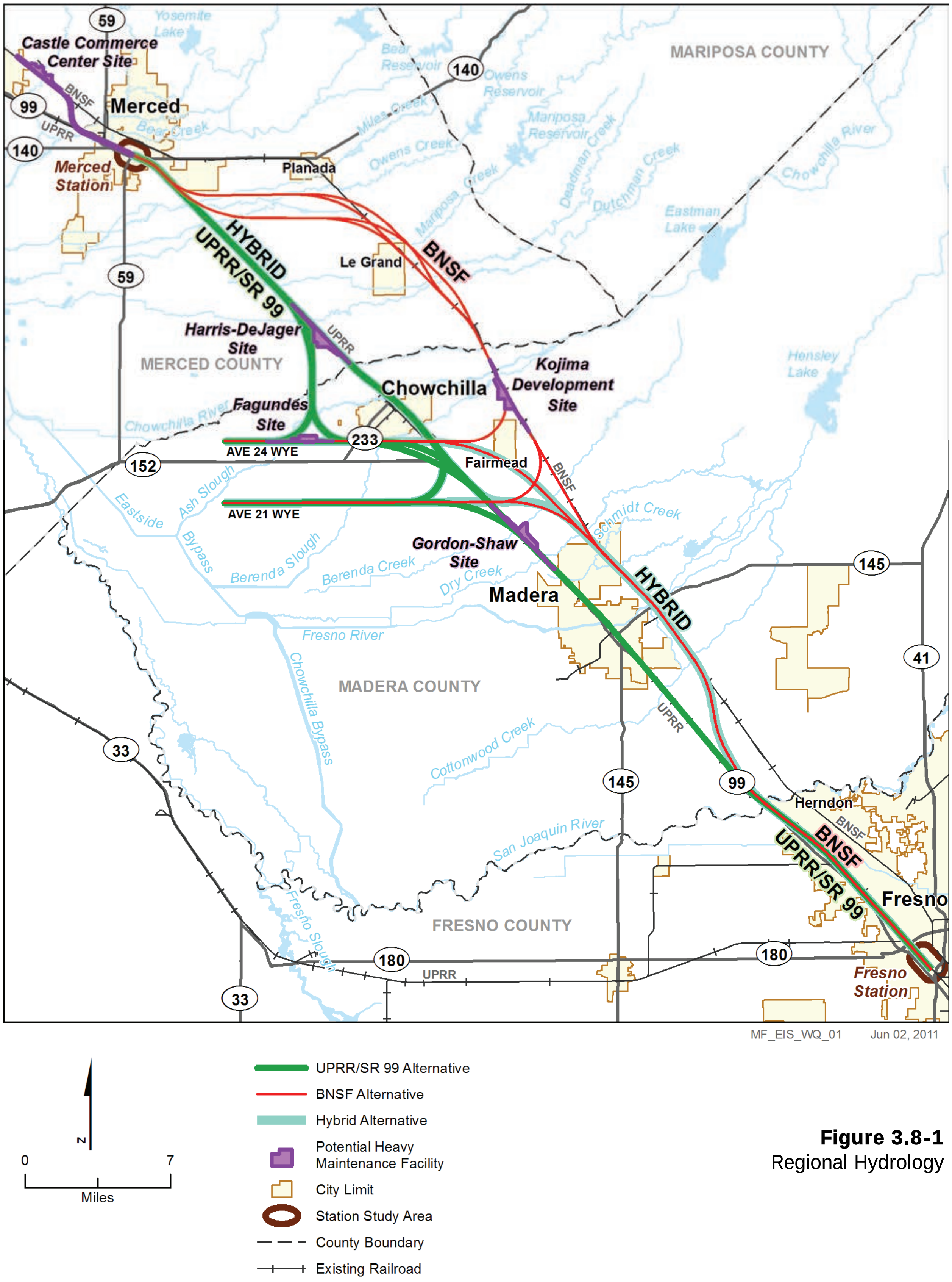


Figure 3.8-1
Regional Hydrology

The study area includes the construction footprint as described in Section 3.1, Introduction, and the following elements:

- Surface Water: Receiving waters of project runoff, including from the Sierra Nevada foothills to the junction of the San Joaquin River and Merced River.
- Groundwater: Aquifer(s) underlying the construction footprint.
- Flooding: FEMA-designated flood hazard areas located within the proposed project's physical ground disturbance footprint, as well as any areas where flood frequency, extent, and duration could be affected by the project.

3.8.4 Affected Environment

3.8.4.1 Climate, Precipitation, and Topography

The climate in the project vicinity is semi-arid, with dry summers of extended hot weather and cool winter temperatures with fog and light to intermediate rain. Temperatures range from average lows of 35 degrees Fahrenheit (˚F) in the winter months to average highs of 95˚F in the summer months. Average annual precipitation is approximately 11 inches, with most precipitation occurring from October through March (Western Regional Climate Center [WRCC] 2009). Topography in the project vicinity is generally flat.

The soils underlying the project alternatives and HMFs consist primarily of alluvial deposits of clay, silt, sand, and gravel with varying grain sizes and content. The soil types and consistencies of these deposits vary by location, depending on how they were deposited. The surface soils in the southern and central portions of the project vicinity generally have low permeability and infiltrate runoff relatively slowly. Soils with somewhat higher infiltration rates are common in the northern portion of the project vicinity. However, highly permeable soils often are located near active stream channels throughout the project vicinity. Section 3.9, Geology, Soils, and Seismicity, provides more information.

3.8.4.2 Regional Hydrology and Water Quality

Surface Waters

The project lies in the San Joaquin River Basin, which drains to the Sacramento-San Joaquin Delta via the San Joaquin River and its major tributaries, the Fresno, Merced, Tuolumne, and Stanislaus rivers (DWR 2004). Most watercourses in the San Joaquin Valley drain from east to west and eventually join the San Joaquin River. They include improved flood control or drainage channels, river and stream channels, and sloughs. Figure 3.8-1 shows the regional hydrology (river and stream system). The Fresno River is controlled upstream by the Bureau of Reclamation's John Franchi Diversion Dam, which is operated by the Madera Irrigation District to support the Madera Canal. The Bureau's Friant Dam, which forms Millerton Lake, controls the San Joaquin River. Millerton Lake provides irrigation of the San Joaquin Valley, distributed by the Madera and Friant-Kern-Canals, as well as power generation, flood control, and recreation.

> **What is Nonpoint- and Point-Source Pollution?**
>
> *Nonpoint-source* pollution is caused by rainfall moving over and through the ground. As the runoff moves, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even underground sources of drinking water (EPA 2005). A *point-source* discharge usually refers to a waste emanating from single, identifiable place (Central Valley RWQCB 1998).

Stream flow consists of natural flows, irrigation runoff, and other point- and nonpoint-source discharges (see text box on page 3.8-9). Natural flows depend on precipitation, snowmelt runoff, and the slow discharge of groundwater through surface seeps and springs. Natural or manmade impoundments, water diversions, levees, and channel straightening or realignment regulate stream flows. Much of the region is in a floodplain, which has a relatively flat gradient that generally slopes slowly to the west or southwest. When the stream channels overflow, shallow, 1- to 3-foot-deep overland flooding occurs that tends to pond against linear obstacles such as canal levees and road and railroad embankments lying perpendicular to the land gradient. If these facilities lack sufficient culverts or other means of cross drainage, the overland flows can be diverted for long distances before finally overflowing the linear obstacles and continuing west.

Natural flow from the headwaters in the Sierra Nevada Mountains starts out generally free of pollutants. As natural flows decrease seasonally, concentrations of pollutants increase. Stormwater and irrigation runoff enters streams directly as overland flow and, therefore, surrounding land uses affect surface water quality. Urban and agricultural runoff can carry the dissolved or suspended residue of both natural and human land uses within the watershed. Pollutant sources in urban areas include parking lots and streets, industrial uses, rooftops, exposed earth at construction sites, and landscaped areas. Pollutant sources in rural and agricultural areas primarily include agricultural fields and operations. Pollutants in runoff can include sediment, oil and grease, hydrocarbons (e.g., fuels, solvents), heavy metals, organic fertilizers and pesticides, pathogens, nutrients, and debris. Construction activities, such as grading that removes vegetation and exposes soil to erosion, can contribute to accelerated erosion rates, which can result in runoff containing sediment that ultimately flows into surface waters. In addition, potentially erosive conditions occur in areas that have a combination of erosive soil types and steep slopes. Section 3.9, Geology, Soils, and Seismicity, provides more details regarding soil erosion.

Table 3.8-2 lists the beneficial uses of water bodies in the project vicinity. The beneficial uses listed for these water bodies generally apply to upstream tributary streams, as well. Most of the study area is within the boundary of the East San Joaquin Water Quality Coalition, which is responsible for monitoring of and compliance with Order No. R5-2006-0053, Coalition Group Conditional Waiver of Waste Discharge Requirements for Discharges from Irrigated Lands. Table 3.8-3 provides the current and proposed 303(d) list of impaired waters in the project vicinity. Currently, two water bodies are impaired—Bear Creek and San Joaquin River (Friant Dam to Mendota Pool), which means these waters do not meet water quality standards for one or more constituents (SWRCB 2006). The impairments are attributed to mercury from resource extraction and to exotic species, respectively. Recent water quality monitoring of runoff from irrigated agriculture in this area has identified additional water quality impairments associated with agriculture and other unknown sources, resulting in proposed additions to the 303(d) list. Proposed 303(d) listings indicate impairments due to herbicides and pesticides from agriculture, bacteria from urban areas and/or agriculture, and toxicity from unknown sources (Central Valley RWQCB 2008).

Table 3.8-2
Beneficial Uses of Surface Water in the Project Vicinity

Surface Water Body	Beneficial Uses[a]
Chowchilla River (Buchanan Dam to San Joaquin River)	Municipal and Domestic Supply (potential); Agricultural Supply; Industrial Service Supply; Water Contact Recreation; Non-contact Water Recreation; Warm Freshwater Habitat; Wildlife Habitat
Fresno River (Hidden Reservoir to San Joaquin River)	Municipal and Domestic Supply (potential); Agricultural Supply; Water Contact Recreation; Non-contact Water Recreation; Warm Freshwater Habitat; Wildlife Habitat
San Joaquin River (Friant Dam to Mendota Pool)	Municipal and Domestic Supply; Agricultural Supply; Industrial Service Supply; Water Contact Recreation; Non-contact Water Recreation; Warm/Cold Freshwater Habitat; Migration; Spawning; Wildlife Habitat

[a] Beneficial use is existing unless noted as “potential.”
Source: Central Valley RWQCB (1998).

Table 3.8-3
Section 303(d) List of Impaired Waters in the Project Vicinity

Water Body	Impairment	Source of Impairment	TMDL Completion Date
2006 CWA 303(d) Listings			
Bear Creek	Mercury	Resource extraction	2007
San Joaquin River (Friant Dam to Mendota Pool)	Exotic species	Unknown	2019
2008 CWA 303(d) Proposed Listings			
Ash Slough (Madera County)	Chlorpyrifos	Unknown	2021
Bear Creek (from Bear Valley to San Joaquin River, Mariposa and Merced Counties)	*Escherichia coli* Unknown toxicity	Unknown	2021
Berenda Creek (Madera County)	Chlorpyrifos Unknown toxicity	Agriculture Unknown	2021
Berenda Slough (Madera County)	Chlorpyrifos	Agriculture	2021
Cottonwood Creek (S. Madera County)	*Escherichia coli* Unknown toxicity	Unknown	2021
Deadman Creek (Merced County)	Chlorpyrifos *Escherichia coli*	Agriculture Unknown	2021
Duck Slough (Merced County)	Chlorpyrifos *Escherichia coli* Sediment toxicity Unknown toxicity	Agriculture Unknown Unknown Unknown	2021
Miles Creek (Merced County)	Diuron	Agriculture	2021
Source: SWRCB (2006); Central Valley RWQCB (2008).			

To convey water for agricultural purposes, the San Joaquin Valley's many watercourses are highly altered from their natural state and small farm ponds are relatively common. Farmers and other agricultural producers pump groundwater and surface water to and from numerous canals and drains delivering irrigation water to and from agricultural fields. Composed of packed earth or concrete-lined, canals generally lack the meanders, vegetation, biota, and other features of natural streams. Merced Irrigation District, Chowchilla Water District, Madera Irrigation District, and Fresno Irrigation District act as purveyors of irrigation water in the project vicinity. Figures 3.8-2 through 3.8-5 show project vicinity water resources for Merced, Chowchilla, Madera, and Fresno, respectively, including the district service areas.

The HST alternatives are in areas where the majority of the soils have a moderate degree of water erosion potential, but the study area's low gradient reduces the overall erosion risk to low. A 9-mile length of the UPRR/SR 99 Alternative south of Merced between Mission Avenue and Dutchman Creek passes through an area of soils that have a high degree of water erosion potential (refer to Section 3.9, Geology, Soils, and Seismicity).

Groundwater

The project lies within the San Joaquin Valley Groundwater Basin and includes the Merced, Chowchilla, Madera, and Kings subbasins, shown in Figure 3.8-6. Depth to groundwater ranges from a few inches to more than 500 feet, fluctuating with seasonal rainfall, recharge, and pumping (DWR 2004). Recharge occurs naturally (e.g., from rainfall) but also results from importing surface water for irrigation. Extensive clay and hardpan layers generally limit infiltration throughout the basin, but recharge areas exist along active stream channels that contain substantial amounts of sands and gravels.

Beneficial uses of groundwater in these subbasins include municipal, industrial, and agricultural supply. Irrigated agriculture depends heavily on groundwater, especially during dry years or when surface water irrigation supplies are unavailable. The overdraft estimate in the Chowchilla Water District and Madera Irrigation District is approximately 20,000 acre-feet annually (City of Chowchilla 2009). As a result, groundwater levels in the CWD have fallen at a rate of 1.5 feet per year over the last 25-year period (Reclamation 2008).

Groundwater in the San Joaquin Groundwater Basin tends to be of sodium bicarbonate type with low total dissolved solids, hardness, iron, and manganese; however, localized areas of high hardness, iron, nitrate, and chloride exist in the subbasins (DWR 2004, 2006). Septic disposal systems and leach fields, fertilizers, animal manure, geologic sources, and plant residues are potential sources of nitrate contamination in groundwater (Merced County 1990).

Floodplains

Two types of events trigger floods in the San Joaquin Valley: 1) rainfall occurring in the late fall and winter in the foothills and on the valley floor; and 2) snowmelt from the Sierra Nevada Mountains occurring in the late spring and early summer (Merced County 1990). Floodplains provide floodwater storage (which reduces the risk of downstream flooding), provide habitat for native species, improve water quality by allowing sediments and other contaminants to filtrate, and may provide locations for groundwater recharge. Within most urban areas, levees and upstream dams control floods. Many rural areas, however, are subject to shallow flow or ponding, which is typically 1 to 3 feet deep and spreads out over extensive areas. Shallow flooding occurs primarily due to overflows of stream channels when flows exceed the capacity of the channels.

3.8.4.3 Hydrology and Water Quality in the Study Area

Surface Waters

Numerous natural water bodies flow through Merced and Madera counties (see Figures 3.8-2 through 3.8-5). Table 3.8-4 lists the natural water bodies and the HST alternatives that cross them. The Central Valley Flood Protection Board (CVFPB) regulates many of the stream crossings. Stream crossings must meet the provisions of Title 23 of the California Code of Regulations. This regulation requires that crossings maintain stream channel flow capacity through such measures as perpendicular crossings (where practical), adequate streambank freeboard, and measures to protect against streambank and channel scour. Section 208.10 requires that construction of improvements, including crossings, does not reduce the capacity of a channel within a federal flood control project. The CVFPB reviews applications for encroachment permits for approval of a new channel crossing or other channel modification. For a proposed crossing that could affect a federal flood control project, the CVFPB coordinates review of the application with the USACE and with other agencies, as needed.

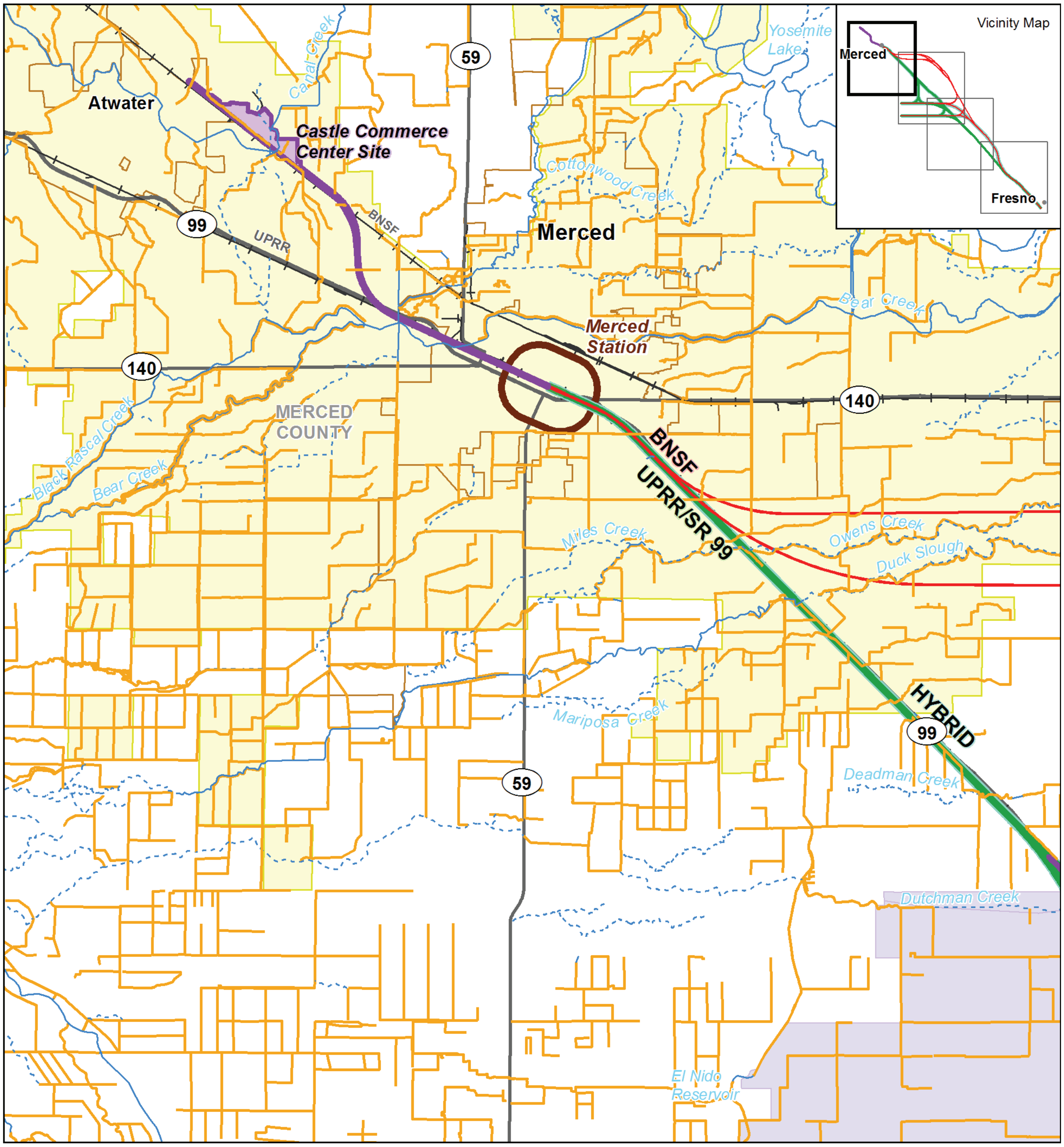
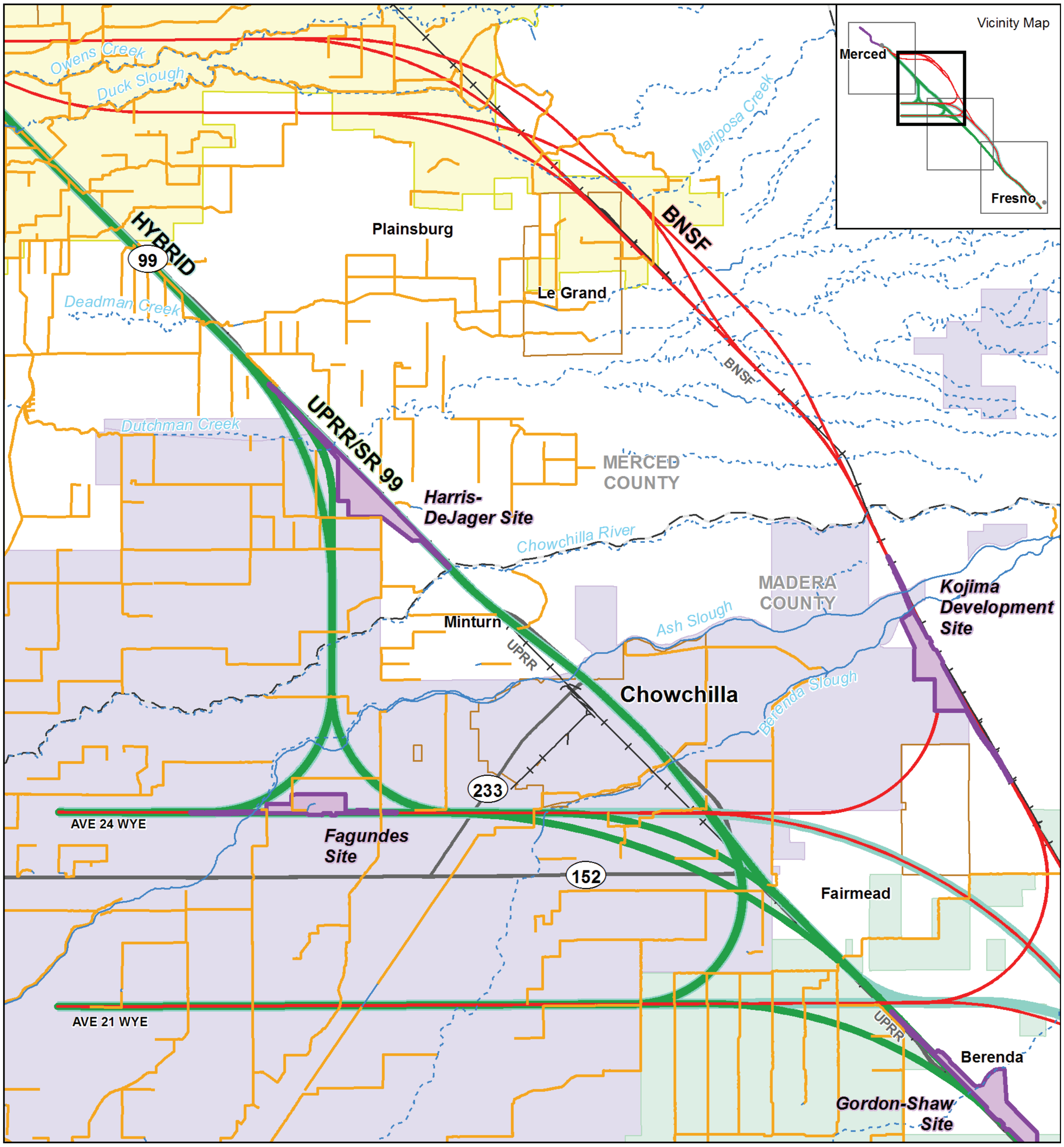


Figure 3.8-2
Water Resources in the Merced Project Vicinity

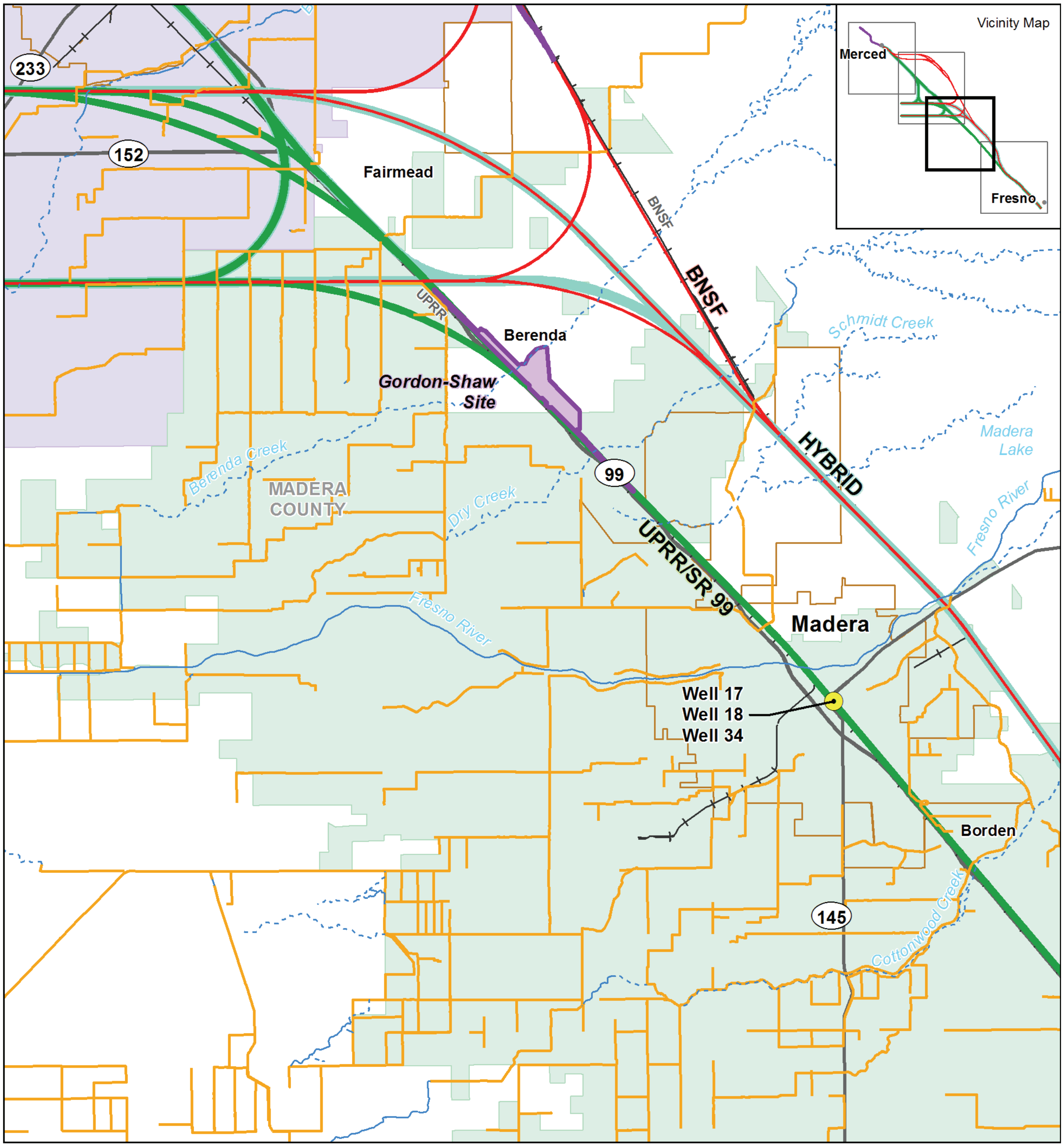


Source: CWD (n.d.), Madera Irrig. Dist. (2000), Fresno Irrig. Dist. (2003), USGS (2010a,b)
MF_EIS_WQ_02-05_b Jun 02, 2011

N
0 2.5
Miles

UPRR/SR 99 Alternative
BNSF Alternative
Hybrid Alternative
Potential Heavy Maintenance Facility
Station Study Area
City Limit
County Boundary
Existing Railroad
Stream/River: Perennial
Stream/River: Intermittent
Canal/Ditch
Merced Irrigation District Service Area
Chowchilla Water District Service Area
Madera Irrigation District Service Area

Figure 3.8-3
Water Resources in the Chowchilla Project Vicinity

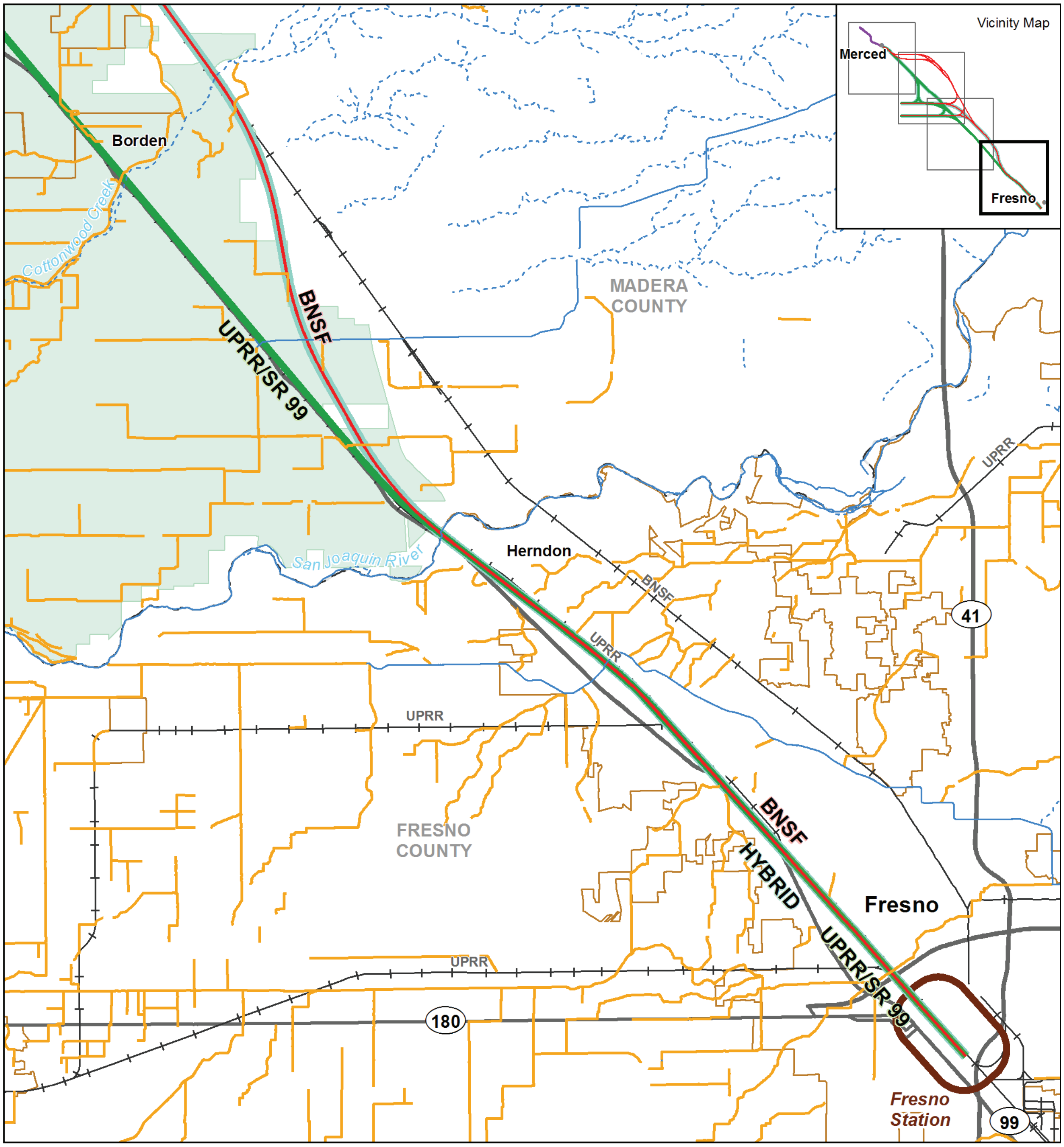


Source: CWD (n.d.), Madera Irrig. Dist. (2000), Fresno Irrig. Dist. (2003), USGS (2010a,b)   MF_EIS_WQ_02-05_c   Jun 02, 2011

N
0 2.5
Miles

- UPRR/SR 99 Alternative
- BNSF Alternative
- Hybrid Alternative
- Potential Heavy Maintenance Facility
- Station Study Area
- City Limit
- County Boundary
- Existing Railroad
- Stream/River: Perennial
- Stream/River: Intermittent
- Canal/Ditch
- Merced Irrigation District Service Area
- Chowchilla Water District Service Area
- Madera Irrigation District Service Area

Figure 3.8-4
Water Resources in the Madera Project Vicinity



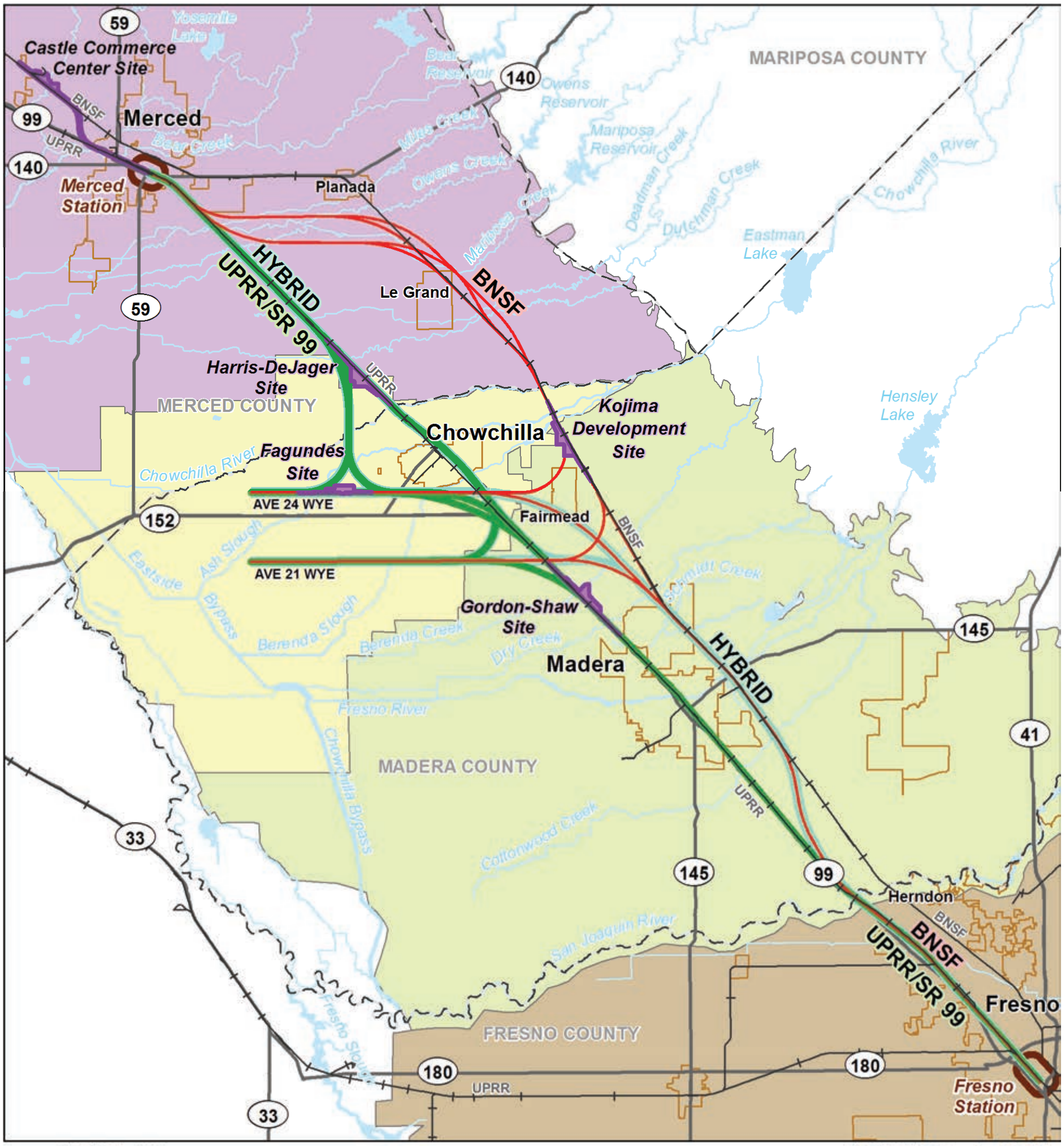
Source: CWD (n.d.), Madera Irrig. Dist. (2000), Fresno Irrig. Dist. (2003), USGS (2010a,b)   MF_EIS_WQ_02-05_d   Jun 02, 2011

N

0   2.5
Miles

- UPRR/SR 99 Alternative
- BNSF Alternative
- Hybrid Alternative
- Potential Heavy Maintenance Facility
- Station Study Area
- City Limit
- County Boundary
- Existing Railroad
- Stream/River: Perennial
- Stream/River: Intermittent
- Canal/Ditch
- Merced Irrigation District Service Area
- Chowchilla Water District Service Area
- Madera Irrigation District Service Area

Figure 3.8-5
Water Resources in the Fresno Project Vicinity



Source: DWR (2004, 2006)
MF_EIS_WQ_07 Jun 02, 2011

N
0 7
Miles

- UPRR/SR 99 Alternative
- BNSF Alternative
- Hybrid Alternative
- Potential Heavy Maintenance Facility
- City Limit
- Station Study Area
- County Boundary
- Existing Railroad

California DWR
San Joaquin Valley Groundwater Basins
- Merced Subbasin
- Chowchilla Subbasin
- Madera Subbasin
- Kings Subbasin

Figure 3.8-6
Groundwater Subbasins in the Project Vicinity

Table 3.8-4
Natural Water Body Crossings

Natural Water Body Name	Alternative/Project Component								
	UPRR/SR 99			BNSF			Hybrid		
	North-South Alignment	Ave 24 Wye	Ave 21 Wye	North-South Alignment	Ave 24 Wye	Ave 21 Wye	North-South Alignment	Ave 24 Wye	Ave 21 Wye
Miles Creek	X			X			X		
Owens Creek	X			X			X		
Duck Slough	X			X[a]			X		
Mariposa Creek				X[b]					
Deadman Creek	X			X			X		
Dutchman Creek	X	X		X			X		
Chowchilla River	X	X		X			X		
Ash Slough	X	X			X		X	X	
Berenda Slough	X	X	X	X	X	X	X	X	X
Berenda Creek	X		X	X	X	X	X		X
Dry Creek	X			X	X	X	X		
Schmidt Creek	X			X			X		
Fresno River	X			X			X		
Cottonwood Creek	X			X			X		
San Joaquin River	X			X			X		

[a] Mariposa Way design option only. At the Mission Ave design option, this water body is called Mariposa Creek.
[b] Mariposa Way and Mariposa Way East of Le Grand design options only.

UPRR/SR 99 Alternative

In Merced County, the UPRR/SR 99 Alternative would have five or six crossings of the following natural water bodies. Depending on the wye connection, some of the listed water bodies would have multiple crossings: Miles Creek, Owens Creek, Duck Slough, Deadman Creek, and Dutchman Creek. In addition, the alignment crosses a number of Merced Irrigation District canals, including but not limited to, Farmdale Lateral, Lingard Lateral, and Russell Lateral. Merced Irrigation District also uses its irrigation distribution system for local flood control by conveying local runoff and stream floodwaters away from population areas (Merced Irrigation District 2008).

In Madera County, the UPRR/SR 99 Alternative would cross eight or nine natural water bodies, depending on the wye alternative. The following water bodies would have crossings (some multiple times): Chowchilla River, Ash Slough, Berenda Slough, Berenda Creek, Dry Creek, Schmidt Creek, Fresno River, and Cottonwood Creek. The UPRR/SR 99 Alternative would travel through Chowchilla and Madera. In Chowchilla, stormwater drainage passes through a system of stormwater collection facilities and eight stormwater basins (Madera County 2008). These basins collect approximately 80% to 90% of stormwater runoff, with the remainder discharged into Ash Slough or other privately owned stormwater basins (Madera County 2008). In Madera, topography is relatively flat with an absence of natural drainage channels except for the Fresno River, which is adjacent to Downtown Madera (City of Madera 1992). The Fresno River is typically dry, with surface flows only in the wettest years. The city uses a storm drain system to collect urban drainage and the principal disposal method is using open retention (infiltration) basins. However, some areas drain directly to the Fresno River or to Madera Irrigation District conveyance facilities. In addition, Madera Irrigation District uses the Fresno River channel to convey irrigation water from the Madera Canal to the Main Canal diversion (Reclamation 2009). In unincorporated Madera County, the alignment crosses a number of Madera Irrigation District irrigation canals.

The UPRR/SR 99 Alternative would cross the San Joaquin River at the Madera-Fresno county line, as well as several irrigation canals in the Fresno Irrigation District. The Fresno Metropolitan Flood Control District operates a regional stormwater conveyance system, which includes several dozen large basins that infiltrate most of the city's runoff. Irrigation canals such as the Herndon Canal convey the city's stormwater.

BNSF Alternative

The surface water hydrology and water quality analysis for the BNSF Alternative is the same as for the UPRR/SR 99 Alternative, with a few exceptions. From Merced to just north of the Chowchilla River are four design options. The BNSF Alternative would cross six streams in Merced County. These water bodies include Miles Creek, Owens Creek, Duck Slough, Mariposa Creek, Deadman Creek, and Dutchman Creek, as well as several unnamed water bodies. Once the design options converge, the alternative would cross an additional seven streams in Madera County. The water bodies in Madera County are the Chowchilla River, Ash Slough, Berenda Slough, Berenda Creek, Dry Creek, Schmidt Creek, and Cottonwood Creek, as well as several unnamed water bodies. The BNSF Alternative would cross the San Joaquin River at the Madera-Fresno county line and would be the same as the UPRR/SR 99 Alternative south to the Downtown Fresno Station.

The BNSF Alternative also would cross the Owens Creek Diversion Channel, a 1.7-mile-long channel that diverts water from Owens Creek to Mariposa Creek. Constructed in 1956, the channel is part of the Merced County Streams Group Flood Control Project located east of Merced; the project provides flood protection for large agricultural land areas, as well as for Planada, Le Grand, and Merced. The diversion channel has a capacity of 400 cubic feet per second (USACE 1962).

The central portion of the BNSF Alternative passes through mostly agricultural areas where conveyance of stormwater runoff would be primarily in drainage ditches or natural streams. Le Grand has a local stormwater system. The stormwater systems in the north and south ends of the BNSF Alternative are as discussed above for the UPRR/SR 99 Alternative.

Hybrid Alternative

The Hybrid Alternative has the same alignment and study area as the UPRR/SR 99 Alternative from Merced to Chowchilla and the same alignment as the BNSF Alternative from south of Chowchilla to Fresno. The Hybrid Alternative, which connects with both the Ave 24 Wye and the Ave 21 Wye, would cross 14 different natural water bodies.

Downtown Merced and Downtown Fresno Stations

There are no water body crossings at either of the HST stations.

Heavy Maintenance Facility Alternatives

A combination of stormwater conveyances, surface drainage facilities, and channels provides stormwater drainage for the Castle Commerce Center HMF site. The collected stormwater discharges into Canal Creek, which the Merced Irrigation District maintains. Both Canal Creek and an intermittent tributary stream lie on the eastern portion of the Castle Commerce Center HMF footprint. The access tracks to the Castle Commerce Center site cross Bear, Black Rascal, and Canal creeks. Soils at this site have low water erosion potential.

Dutchman Creek borders the north side of Harris-DeJager HMF site; soils at this site have moderate to high water erosion potential. Ash Slough lies adjacent on the northwestern boundary of the Fagundes HMF site; two irrigation canals lie within the site boundary. Soils at this site have moderate to high water erosion potential. Berenda Creek lies on the northwest boundary of the Gordon-Shaw HMF footprint; soils at this site have moderate water erosion potential. Berenda Slough lies at the northern tip of the Kojima Development HMF site; soils at this site have moderate water erosion potential.

> **What are intermittent and perennial streams?**
>
> *Intermittent* streams normally stop flowing for periods of time every year. *Perennial* streams flow year round, although they may also cease flowing during dry years, and become intermittent during droughts.

Groundwater

High-Speed Train Alternatives (All)

Most of Merced County lies within the Merced Subbasin (see Figure 3.8-6). The HST alternatives in Merced County are within areas of high groundwater table, with groundwater within 0 to 10 feet of the ground surface in some areas (Merced County 1990). The alternatives are within a groundwater recharge area for the San Joaquin River and its tributaries (Merced County 1990). However, surface water diversions for irrigation, municipal, and industrial water supplies have reduced stream flows, resulting in less than historic recharge percolations in streambed areas (Merced County 1990). Downtown Merced is highly urbanized and the accompanying increase in impervious surfaces, such as parking lots and buildings, has reduced the potential for groundwater recharge. Currently, groundwater withdrawals exceed recharge levels and a notable groundwater depression exists near Merced (DWR 2004).

> **What is recharge?**
>
> *Recharge* is the natural replenishment of groundwater from rain or other surface water. *Overdraft* describes the condition when water pumped from a groundwater basin exceeds the supply flowing into the basin.

In Madera County, groundwater is the main source of both urban and agricultural water (Madera County 2008). Groundwater pumping greatly exceeds natural recharge, a condition known as overdraft. The current average annual overdraft in the valley floor portion of Madera County, which includes the study area for both alternatives, is approximately 100,000 acre-feet per year (Madera County 2008). This area includes both the Madera and Chowchilla subbasins. Approximately 97% of groundwater used in Madera County is for agriculture, and urban use accounts for the remaining 3% (Madera County 2008). Agricultural irrigation recharges groundwater in the vicinity of Chowchilla, as do surface water flows in the Chowchilla River, Ash Slough, and Berenda Slough; however, in general the area does not have high groundwater recharge potential (Madera County 2008). In Madera, favorable recharge areas exist south and southwest of the city where coarse-grained sediments are present (Madera County 2008).

Within Fresno County, the study area is in a groundwater recharge area for the San Joaquin River. Throughout much of Fresno County, the Kings Subbasin is overdrawn (Fresno County 2000), with notable groundwater depressions near the Fresno and Clovis urban areas (DWR 2006). Downtown Fresno is highly urbanized and the accompanying increase in impervious surfaces, such as parking lots and buildings, has reduced the potential for groundwater recharge. However, numerous infiltration basins exist in the Fresno area and the majority of the city's stormwater runoff recharges groundwater.

Downtown Merced and Downtown Fresno Stations

The Downtown Merced Station is located in the Merced Subbasin, as described above. The Downtown Fresno Station is located in the Kings Subbasin, as described above.

Heavy Maintenance Facility Alternatives

The Castle Commerce Center HMF site falls within the Merced Subbasin (see Figure 3.8-6). Past operations at Castle Commerce Center have contaminated groundwater with trichloroethylene (TCE) and other organic solvents (City of Atwater 2000). Groundwater contamination exists underneath the Castle Commerce Center HMF site and remediation activities have been carried out to remove soil contamination and restore groundwater quality. Active remediation of several TCE plumes is still underway. (More information about this is available in Section 3.10, Hazardous Materials and Wastes).

The other HMF sites are located within the Merced, Chowchilla, and Madera subbasins (see Figure 3.8-6). These sites have no identified groundwater contamination or cleanup activities.

Floodplains

High-Speed Train Alternatives (All)

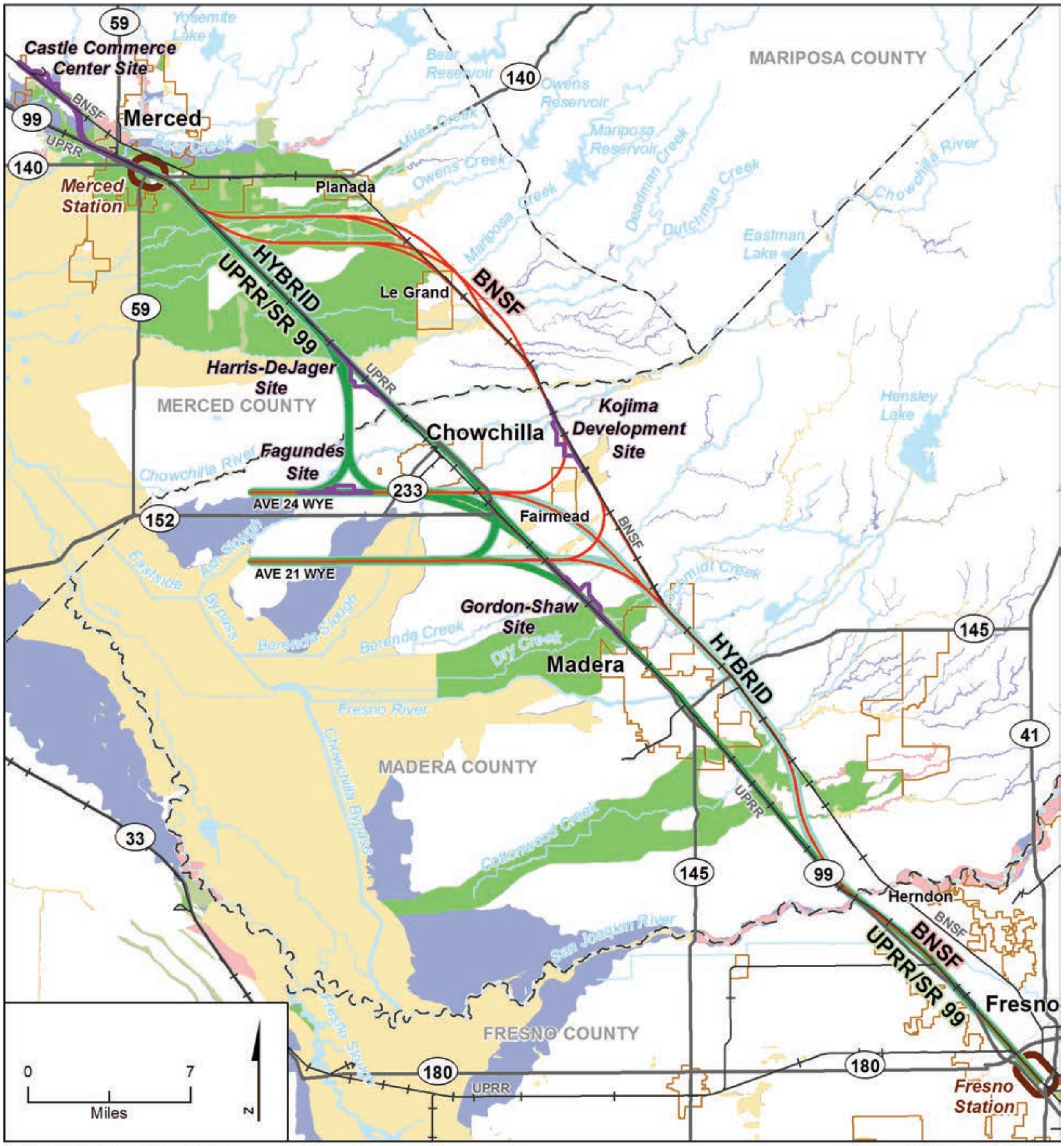
Special flood hazard areas in the study area include flood zones A, AE, AH, and AO, which are defined in Table 3.8-5. The FEMA-delineated 100-year floodplains exist along most of the minor creeks and streams in the study area. The 100-year floodplain, shown in Figure 3.8-7, corresponds to FEMA's special flood hazard area (SFHA). The SFHA is the land area covered by the base flood to which the FEMA floodplain management regulations apply (FEMA 2009).

Table 3.8-5
FEMA Special Flood Hazard Zone Designations in the Study Area

Zone	Zone Description
A	Areas with a 1% annual chance of flooding. Because detailed analyses are not performed for such areas, no depths or base flood elevations are shown within these zones.
AE	Areas with a 1% annual chance of flooding. FEMA flood maps provide base flood elevations.
AH	Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. Base flood elevations derived from detailed analyses are shown at selected intervals within these zones.
AO	River or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. Average flood depths derived from detailed analyses are shown within these zones.
Source: FEMA (2009).	

The northern 16 miles of the north-south alignment of the UPRR/SR 99 Alternative lie almost entirely within floodplain areas. Further south the alignment crosses a 3-mile wide floodplain associated with Dry and Schmidt creeks, north of Madera. The UPRR/SR 99 Alternative also crosses a 4-mile-wide floodplain associated with Cottonwood Creek, south of Madera. As is the case with the BNSF Alternative, most floodplains crossed by the UPRR/SR 99 Alternative involve shallow floodwaters of 1 to 3 feet. Apart from crossing FEMA floodplains, the HST alternatives also cross the five state-designated floodways in the study area: San Joaquin River, Fresno River, Chowchilla River, Ash Slough, and Berenda Slough.

Most of the northern 24 miles of the BNSF Alternative between the Downtown Merced Station and Le Grand lie within floodplains. Much of this area is Zone AO—shallow flowing water, 1 to 3 feet deep. The remaining area is primarily Zone A. This alternative also crosses a 2-mile length of floodplain south of Madera.



Source: DWR (2008), FEMA (2008a,b)

MF_EIS_WQ_06 Jul 20, 2011

- UPRR/SR 99 Alternative
- BNSF Alternative
- Hybrid Alternative
- Potential Heavy Maintenance Facility
- City Limit
- Station Study Area
- County Boundary
- Existing Railroad

SFHA Special Flood Hazard Zone Designation

- A — Areas with a 1% annual chance of flooding. No depths or base flood elevations have been determined for this zone.
- AE — Areas with a 1% annual chance of flooding. Base flood elevations have been determined for this zone.
- AH — Areas with a 1% annual chance of shallow flooding, usually in the form of a pond, with an average depth ranging from 1 to 3 feet. Base flood elevations derived from detailed analyses are shown by FEMA for selected intervals within this zone.
- AO — River or stream flood hazard areas and areas with a 1% or greater chance of shallow flooding each year, usually in the form of sheet flow, with an average depth ranging from 1 to 3 feet. Average flood depths derived from detailed analyses are shown by FEMA within this zone.

California DWR 200-Year Floodplain

Figure 3.8-7
Flood Zones in the Project Vicinity

Downtown Merced and Downtown Fresno Stations

The Downtown Merced Station would be located in a shallow flooding (1 to 3 feet) SFHA that covers much of Downtown Merced. The Downtown Fresno Station would not lie within an SFHA.

Heavy Maintenance Facility Alternatives

The southeastern portion of the Castle Commerce Center HMF site lies within the SFHA associated with Canal Creek, which flows through the southeastern portion of the site. The Fagundes and Kojima Development HMF sites are not located within SFHAs. The western side of the Fagundes site borders Ash Slough, while the northern side of the Kojima Development site borders Berenda Slough. A small portion of the Harris-DeJager HMF site is located within the SFHA associated with Dutchman Creek. The southern portion of the Gordon-Shaw HMF lies within a shallow ponding SFHA and Berenda Creek crosses the northern portion of the site.

3.8.5 Environmental Consequences

3.8.5.1 Overview

Construction of the HST alternatives, the stations, and the HMF would result in temporary impacts on existing drainage, irrigation distribution systems, local groundwater quantity from dewatering, and water quality. Stream channels would be temporarily disturbed at several crossings. The UPRR/SR 99 Alternative would cross 20 to 27 natural water bodies, the BNSF Alternative would cross 30 to 37 natural water bodies, and the Hybrid Alternative would cross 23 to 29 natural water bodies. Most of these crossings would require in-water work for the construction of supporting piers. To the extent construction in the stream channel occurs during wet weather, there could be an increase in sediment in the river during the event. In those streams, the effects on water quality during construction would be moderate under NEPA and impacts would be less than significant under CEQA.

Designing water body crossings to maintain existing hydraulic capacity and connectivity would mitigate operational impacts on hydrology and floodplains, as described in Section 3.8.6. Project stormwater system design would accommodate project runoff and would provide stormwater quality treatment for the new and replaced roads and highways (see Chapter 2, Alternatives), train stations, and HMF facility. In certain locations, track would be elevated above the flood level on sections of elevated guideway supported by piers, thereby avoiding permanent floodplain and stream crossing impacts. Placing at-grade track sections on embankments with culverts adequately sized and placed would avoid intensifying flood or drainage problems in other locations. Impacts on surface water capacity, connectivity, and quality would be negligible under NEPA and less than significant under CEQA.

Project facilities would result in changes to existing drainage, as well as increased runoff from project impervious surfaces. The HST alternatives could redirect shallow flooding and thereby affect SFHAs. Any alignment alternative could result in changes to the hydrology, hydraulics, and connectivity of natural watercourses, including floodways. With design features for stormwater management and flood protection and additional mitigation, impacts on existing drainage patterns would be negligible under NEPA and less than significant under CEQA.

Construction of the HST could result in polluted runoff. Although the trains and tracks are assumed to be less than significant pollutant-generating surfaces, the stations, the new road overpasses, and the HMF facility would create new sources of potentially contaminated runoff during HST operation. The HST project would have the potential benefit of reducing nonpoint-source pollutants because of a decrease in vehicle miles traveled. High-density development opportunities offered from TOD at stations would reduce the amount of new impervious area that otherwise would occur with urban fringe development. With design features for stormwater management and treatment, stormwater runoff would present a negligible impact under NEPA and a less than significant impact under CEQA.

Impacts on groundwater from the construction of the HST would be negligible under NEPA and less than significant under CEQA. The expected decrease in groundwater use—along the alignment particularly—would benefit aquifers, and a worst-case increase in groundwater use at an HMF site would have negligible aquifer effects. Operational project impacts on groundwater would be negligible under NEPA and less than significant under CEQA.

3.8.5.2 No Project Alternative

As discussed in Chapter 1, Project Purpose, Need, and Objectives, and in Section 3.18, Regional Growth, the San Joaquin Valley population has been growing and is projected to continue to grow. Planned and programmed transportation improvements that are constructed and become operational by 2035 under the No Project Alternative would add to the effects under existing conditions. Section 3.19, Cumulative Impacts, provides foreseeable future projects including new shopping centers, large residential developments, quarries, and expansion of SR 99 between Merced and Fresno. Impacts on hydrologic and hydraulic resources, such as increased runoff from added lanes of paved surface, could result from non-project transportation improvements under the No Project Alternative.

Under the No Project Alternative, the effects of the current built environment on hydrology and water resources would continue, including effects from continued operation of existing highways, airports, and railways. Higher vehicle miles traveled also are expected under the No Project Alternative, which could degrade water quality because of increased pollutants in stormwater from roadways without adequate stormwater facilities. The population in the Central Valley is projected to grow, as discussed in Section 3.18, Regional Growth. The land development needed to serve the population would increase, as would traffic, as reflected in the numerous reasonably foreseeable projects listed in Section 3.19, Cumulative Impacts. As documented in Section 3.13, Station Planning, Land Use, and Development, a consequence of the No Project Alternative would be that the project vicinity would not include the higher-density, TOD planned around proposed HST stations, and the continuation of low-density development would be likely. This development is likely to occur on the urban fringe rather than in the urban centers. This development in undeveloped areas would result in an increase in impervious area and an associated increase in stormwater runoff in the urban fringe and potential decrease in groundwater recharge. Stormwater facilities associated with urban fringe development would reduce potential water quality impacts on local streams. Aquifers would continue to experience drawdown effects, with increasing domestic demand for groundwater offset by decreasing agricultural demand from land conversion.

3.8.5.3 High-Speed Train Alternatives

<u>Construction Period Impacts</u>

Chapter 2, Alternatives, discusses project construction. Heavy construction includes grading, excavation, constructing the HST railbed, and laying the trackway. It is estimated that heavy construction would be accomplished within a 5-year period. Potential effects include changes in hydrology, stormwater runoff patterns, and water quality. Section 3.10, Hazardous Materials and Wastes, addresses impacts from release of hazardous materials and disturbance of contaminated groundwater plumes.

Common Surface Water Impacts

Construction activities associated with the proposed project would involve handling, storing, hauling, and placing fill; possible pile driving; stations, parking lots, maintenance facility, aerial structure, and bridge construction; and concrete track bed construction. Likely pollutants that may be contributed by the project during construction include floating material, oil and greases, sediment, settable material, suspended material, chemical constituents (e.g., fuels, solvents), and turbidity. Construction of at-grade sections of the trackway would require excavating or leveling the ground surface, which would potentially result in the need to pump and discharge groundwater, or would expose a groundwater resource to pollutants.

All HST alternatives would result in hydrologic and hydraulic effects due to changes in existing local drainage and stormwater runoff occurring at crossings of natural and artificial water bodies resulting from channel disturbance associated with construction of piers and bridge abutments. As indicated in Table 3.8-6, the UPRR/SR 99, BNSF, and Hybrid alternatives would have similar numbers of natural water body crossings, with 20 to 27 for the UPRR/SR 99 Alternative, 30 to 37 for the BNSF Alternative, and 23 to 29 for the Hybrid Alternative. As described in Chapter 2, Alternatives, the HST alternatives would install bridges or box culverts at natural water body crossings. Potential impacts on biological resources related to HST water body crossings and in-stream supports are evaluated in Section 3.7, Biological Resources and Wetlands.

Table 3.8-6
HST Alternatives Water Body Crossings

Alternative	Natural Water Bodies	Canals and Ditches	Total
UPRR/SR 99 Alternative			
North-South Alignment, Design Options, and Wye Combinations			
West Chowchilla design option with Ave 24 Wye[a]	27	86	113
East Chowchilla design option with Ave 24 Wye	27	71	98
East Chowchilla design option with Ave 21 Wye	20	85	105
Total UPRR/SR 99 Alternative Range of Impact	**20 to 27**	**71 to 86**	**98 to 113**
BNSF Alternative			
North-South Alignment and Wye Combinations[a]			
BNSF Alternative with Ave 24 Wye	17	38	56
BNSF Alternative with Ave 21 Wye	16	43	59
Le Grand Design Options			
Mission Ave	19	30	49
Mission Ave East of Le Grand	14	32	46
Mariposa Way	20	17	37
Mariposa Way East of Le Grand	16	17	33
Impact of Components Combined			
BNSF Alternative with Ave 24 Wye	31 to 37	55 to 70	89 to 105
BNSF Alternative with Ave 21 Wye	30 to 36	60 to 75	92 to 108
Total BNSF Alternative Range of Impact	**30 to 37**	**55 to 75**	**89 to 108**
Hybrid Alternative			
North-South Alignment with Ave 24 Wye	29	85	113
North-South Alignment with Ave 21 Wye	23	78	101
Total Hybrid Alternative Range of Impact	**23 to 29**	**78 to 85**	**101 to 113**
Heavy Maintenance Facility Alternatives			
Castle Commerce Center	4	7	11
Harris-DeJager	0	0	0
Fagundes	0	1	1

Alternative	Natural Water Bodies	Canals and Ditches	Total
Gordon-Shaw	0	0	0
Kojima Development	0	0	0
[a] Does not include the Le Grand design options.			

Temporary Changes to Drainage Patterns and Stormwater Runoff

Construction activities such as grading and establishing construction staging areas could alter existing drainage patterns and redirect stormwater runoff. In addition, the amount of stormwater runoff would increase if construction activities include natural vegetation removal or other barriers to runoff, or if the activities result in an increase in impervious surface. Temporary diversion of stream flow may be necessary during the installation of support piers and bridge abutments in stream channels. This could temporarily reduce channel capacity and cause erosion or sedimentation, degrading water quality. However, the amount of ground disturbance required for each of the HST alternatives is relatively small compared to the overall study area. (See the discussion of Temporary Water Quality Impacts, below.) Based on modeling discussed below in the project impact section, construction of piers in the floodplain would not displace a volume large enough to increase flood risk.

Each alternative requires grading, as well as construction laydown and staging areas. All alternatives would cross the San Joaquin River. All alternatives would disturb areas during construction and result in the potential for changes in stormwater runoff patterns.

A SWPPP would be prepared for construction. No construction would occur in stream or river channels during winter storm season. All temporary changes to stormwater drainage patterns and runoff would be minimal and have a negligible effect under NEPA and a less than significant impact under CEQA because they would be temporary, would not alter drainage enough to displace a large enough volume to increase flood risk, and construction would not occur in stream or river channels during the winter storm season.

UPRR/SR 99 Alternative

The UPRR/SR 99 Alternative would cross a total of 98 to 113 water bodies, of which 20 to 27 are natural water bodies. Although this is more total crossings than with the BNSF Alternative, there would be fewer natural crossings. Both the East and the West Chowchilla design options with the Ave 24 Wye would result in the largest number of natural water body crossings under this alternative.

BNSF Alternative

The BNSF Alternative would have fewer water body crossings than the UPRR/SR 99 Alternative but would have more natural water body crossings (up to 37), depending on the design option. The BNSF Alternative with the Ave 24 Wye and the Mariposa Way design option would result in the greatest number of natural water body crossings.

Hybrid Alternative

The Hybrid Alternative would cross a total of 101 to 113 water bodies, of which 23 to 29 would be natural water bodies. This range is greater than the UPRR/SR 99 Alternative but less than the BNSF Alternative.

Downtown Merced and Downtown Fresno Stations

The station areas would not be adjacent to water bodies and would have little effect on stormwater runoff patterns given the urban nature of the areas. In addition, the sites are currently developed and construction would require limited vegetation clearing. For these reasons, station construction would result in a negligible impact under NEPA and a less than significant impact under CEQA.

Heavy Maintenance Facility Alternatives

As listed in Table 3.8-6, the access tracks for the Castle Commerce Center HMF, including the more than 5 miles of track extending from Merced to the HMF site, would cross four natural streams; none of the other HMF alternatives would cross natural water bodies. Only the Castle Commerce Center HMF and the Fagundes HMF would cross canals and ditches, with eight and one crossing, respectively. Developing the Castle Commerce Center HMF could disturb four natural water bodies; however, runoff would be contained on site in an infiltration basin and therefore would result in a negligible effect under NEPA and a less than significant impact under CEQA.

Temporary Water Quality Impacts

Soil-disturbing activity during construction (i.e., excavation and grading) can lead to erosion and sedimentation resulting from the exposure of bare soils, which are more likely to erode than vegetated areas that provide infiltration, retention, and dispersion. Table 3.8-7 lists the construction area disturbance for each alternative and HMF site. These areas would be cleared of vegetation or otherwise physically disturbed during construction.

Table 3.8-7
Acres Disturbed During Construction by HST Alternatives

Alternative	Acres Temporarily Disturbed	Acres of Permanent Footprint[a]
UPRR/SR 99 Alternative		
North-South Alignment, Design Options, and Wye Combinations		
West Chowchilla design option with Ave 24 Wye[b]	2,304	1,935
East Chowchilla design option with Ave 24 Wye	2,339	1,894
East Chowchilla design option with Ave 21 Wye	2,414	2,014
Design Options to Downtown Fresno Station		
Mariposa Street Station Alternative	70	65
Kern Street Station Alternative	66	64
Total UPRR/SR 99 Alternative Range of Impact	**2,370 to 2,484**	**1,958 to 2,079**
BNSF Alternative		
North-South Alignment and Wye Combinations[b]		
BNSF Alternative with Ave 24 Wye	2,422	2,042
BNSF Alternative with Ave 21 Wye	2,192	1,945
Le Grand Design Options		
Mission Ave	503	450
Mission Ave East of Le Grand	486	420
Mariposa Way	478	391
Mariposa Way East of Le Grand	459	393
Design Options to Downtown Fresno Station		
Mariposa Street Station Alternative	70	65

Alternative	Acres Temporarily Disturbed	Acres of Permanent Footprint[a]
Kern Street Station Alternative	66	64
Impact of Components Combined		
BNSF Alternative with Ave 24 Wye	2,947 to 2,995	2,497 to 2,557
BNSF Alternative with Ave 21 Wye	2,717 to 2,765	2,400 to 2,460
Total BNSF Alternative Range of Impact	**2,717 to 2,995**	**2,400 to 2,557**
Hybrid Alternative		
North-South Alignment with Ave 24 Wye	2,657	2,297
North-South Alignment with Ave 21 Wye	2,595	2,152
Design Options to Downtown Fresno Station		
Mariposa Street Station Alternative	70	65
Kern Street Station Alternative	66	64
Total Hybrid Alternative Range of Impact	**2,661 to 2,727**	**2,216 to 2,362**
Heavy Maintenance Facility Alternatives		
Castle Commerce Center	371	319
Harris-DeJager	401	400
Fagundes	231	226
Gordon-Shaw	381	381
Kojima Development	395	375

[a] Acreages are rounded to the nearest whole number.
[b] Does not include the Le Grand design options.

All HST alternatives would involve ground disturbance for project construction. Stream crossings would be particularly vulnerable to degraded water quality because construction would occur in the stream channel and contaminants would have a direct path to surface water. Bridge supports in areas of high groundwater or in surface water would require excavation in the stream channel and dewatering of the work area. The proximity of flowing water to active construction could provide a direct path for construction-related contaminants to reach surface water. Construction in areas of high groundwater, which in particular would occur in Merced County, could require dewatering for bridge column construction, potentially resulting in harmful discharges to surface waters.

The risk of polluted runoff and the potential for sedimentation effects on water quality would be minimized through implementation of various control and design measures detailed in the SWPPP, the Waste Discharge Requirements for Dewatering and Other Low Threat Discharges to Surface Waters, and the General Construction Permit and Spill Prevention Plan. These procedures identify pollutant sources that could affect water quality, and identify, implement, and maintain BMPs to reduce pollutants and nonstormwater discharges in construction site runoff. With the implementation of these standard minimization and avoidance measures, effects from construction on surface water quality would be moderate under NEPA and impacts would be less than significant under CEQA.

UPRR/SR 99 Alternative

The UPRR/SR 99 Alternative with the East Chowchilla design option and Ave 21 Wye would result in the highest construction disturbance, at more than 2,400 acres. With approximately 2,300 acres of disturbance, the UPRR/SR 99 Alternative with the West Chowchilla design option and Ave 24 Wye would result in the least amount of construction disturbance among the UPRR/SR 99 Alternative combinations.

BNSF Alternative

The BNSF Alternative with the Ave 24 Wye would result in the highest construction disturbance, at more than 2,900 acres. With less than 2,700 acres of disturbance, the BNSF Alternative with the Ave 21 Wye would result in the least amount of construction disturbance among the BNSF alternatives. The Mariposa Way design options would have slightly less construction disturbance than the Mission Ave design options.

Hybrid Alternative

The Hybrid Alternative would disturb about 2,300 acres, which is similar to the UPRR/SR 99 Alternative and less than the BNSF Alternative.

Downtown Merced and Downtown Fresno Stations

Although the stations are within developed urban areas, construction of the stations could provide additional sources of polluted runoff to the local stormwater system, or otherwise degrade water quality. The SWPPP would specify BMPs to be implemented during construction that would minimize the potential for contaminated runoff. Due their location in urban areas and the commitment to implementation of BMPs, the project could have temporary moderate impacts on water quality under NEPA and less than significant impacts under CEQA.

Heavy Maintenance Facility Alternatives

Streams lie beside or pass through all five of the alternative HMF sites. Canal Creek crosses the southeastern portion of the Castle Commerce Center HMF site. Ash Slough, Berenda Creek, and Berenda Slough are located along the boundaries of the Fagundes, Gordon Shaw, and Kojima Development sites, respectively. Dutchman Creek lies at the northern edge of the Harris-DeJager site. Without the implementation of BMPs, the area of disturbance during construction of the HMF could result in high temporary sediment loads and possible channel disturbance to one or more of these creeks. As a result of the project's stormwater management and treatment design features, the project could have temporary moderate impacts under NEPA and less than significant impacts under CEQA.

Common Groundwater Impacts

Excavation could affect groundwater quality during dewatering activities if groundwater is encountered. Bridge supports in areas of shallow groundwater or in surface water would require excavation and dewatering. If a slurry is used as part of the drilling method, any groundwater encountered would be removed and disposed of with the drilling slurry. If a drilled hole needs to be dewatered, groundwater would be disposed of according to the requirements for the NPDES permit. The amounts of dewatering are likely to be relatively small and to occur across widely spaced locations. The effect on the regional groundwater levels would be negligible under NEPA and less than significant under CEQA.

Construction activities could result in accidental releases of construction-related hazardous materials that might affect groundwater. Excavations could provide a direct path for construction-related contaminants to reach groundwater. Excavation could disturb known and undocumented soil or groundwater contamination, resulting in the migration of contaminated groundwater further into the groundwater table. The HST alternatives all would have the same potential for inadvertent contamination of groundwater. As described in Section 3.10, Hazardous Materials and Wastes, a construction management plan would be prepared to guide the response to undocumented soil or groundwater contamination, resulting in a negligible impact under NEPA and a less than significant impact under CEQA.

As described in Section 3.6, Public Utilities and Energy, the project would result in a substantial reduction in water use even during construction, due primarily to a reduction in irrigated agricultural lands. This could be a beneficial effect under both NEPA and CEQA, depending on existing groundwater use and the amount of groundwater used for construction.

UPRR/SR 99, BNSF, and Hybrid Alternatives

Construction of the at-grade and elevated sections of track could use between 462 and 530 acre-feet of water per year, depending upon the alternative. Groundwater could supply a portion or all of this water. As described in Section 3.6, Public Utilities and Energy, current water use along the alignment ranges from 4,892 acre-feet per year (UPRR/SR 99 Alternative) to 6,703 acre-feet per year (BNSF Alternative). Given that groundwater supplies many of these existing water uses, regional drawdown could be reduced. Impacts on the groundwater basin would be negligible and less than significant (and potentially beneficial) under both NEPA and CEQA.

Definitions

Retention Pond – A pond designed to hold and infiltrate most or all of the runoff that it receives.

Detention Pond – A pond designed to temporarily store and slowly release the runoff that it receives.

Swale – A shallow ditch used to temporarily convey, store, or filter runoff.

Heavy Maintenance Facility Alternatives

Construction water use for the HMF would be approximately 114 acre-feet per year (see Section 3.6, Public Utilities and Energy). A groundwater well could supply water. As described in Section 3.6 (Public Utilities and Energy), current water use on the HMF sites ranges from 69 acre-feet per year (Castle Commerce Center Alternative) to 568 acre-feet per year (Kojima Development Alternative). To the extent that groundwater supplies these existing water uses, regional drawdown would be reduced and impacts on the groundwater basin would be beneficial under both NEPA and CEQA.

Common Floodplains Impacts

Temporary Impacts on Floodplains

Construction in a floodplain temporarily could impede or redirect flood flows because of the presence of construction equipment and materials in the floodplain, depending on the activity occurring within a specific area. The majority of this area lies within shallow (1 to 3 feet of inundation) flood zones. The eastern side of the Castle Commerce Center HMF site lies in the floodplain. Portions of the Fagundes HMF site are in the Ash Slough channel, the southern portion of the Gordon-Shaw HMF site is in a flood hazard zone, and the Kojima Development HMF site borders Berenda Slough. Only the Harris-DeJager HMF site falls completely outside the floodplain; therefore, it would have no impact on the floodplain. Because construction workers and local districts would monitor weather conditions for heavy storms (and potential flood flows), construction equipment would be able to relocate to minimize the potential flood risk. Therefore, during construction, the HST alternatives would have a negligible effect under NEPA and a less than significant impact under CEQA.

Project Impacts

Common Surface Water Impacts

Any of the HST alternatives would result in permanent impacts on hydraulic capacity and floodplains. Water quality impacts could result from runoff associated with roadways and HMFs. However, water quality design measures would be implemented to reduce the potential for adverse water quality impacts.

Permanent Impacts on Hydraulic Capacity and Connectivity of Natural Water Bodies, Including Floodways

Direct impacts on surface water from operation of the project would include changes to the hydrology and connectivity of natural water bodies in the study area. Table 3.8-6 lists the number of natural and artificial water body crossings, each of which could require bridge abutments on banks and support piers in the water channel. These bridge components could obstruct the ability of the water body to convey peak flows by reducing its channel capacity and possibly by raising flood elevations locally. The design for each crossing would maintain the existing hydraulic capacity, resulting in a minimal rise in existing flood or high water elevations. Elevated crossings could require support piers in the water channel. At-grade crossings of stream channels would require bridge abutments on banks and support piers in the water channel, or in some cases the alignment would cross natural water bodies using box culverts. Final design would minimize the number of piers on banks and in channels to the extent possible. Section 3.7, Biological Resources and Wetlands, addresses the San Joaquin River Restoration Program.

Although the alignment would be pervious, the compacted ground underneath necessary to support the facility would have reduced infiltration. Drainage pipes under the portions of at-grade track would collect stormwater for discharge to drainage swales running parallel to the track. Drainage systems within the portions of elevated track would collect and discharge stormwater to the local stormwater system in urban areas or to the local drainage system via swales in rural areas. Where the alignment travels through urban areas, impermeable surfaces are common because of past land development, so in most cases, existing stormwater systems would convey track runoff. Culverts would be installed at canals and ditches that would be designed to maintain or provide greater hydraulic conveyance capacity.

Increased stormwater runoff from the project could exceed the capacity of a receiving water body, causing or exacerbating drainage problems. Substantial alteration of the existing drainage pattern would increase the rate or amount of surface runoff in a manner that could cause flooding, erosion, or sedimentation. These effects to the hydraulic capacity and connectivity of natural water bodies for all would be negligible under NEPA, and impacts would be less than significant under CEQA because culverts would be installed to maintain or provide greater hydraulic conveyance capacity of the existing canal, ditch, or adjacent culvert, and drainage systems would collect and discharge stormwater to the local stormwater system in urban areas or to the local drainage system via swales in rural areas.

UPRR/SR 99, BNSF, and Hybrid Alternatives

All three alternatives would result in permanent piers and bridge abutments in streams. The UPRR/SR 99 Alternative with the East Chowchilla design option and Ave 21 Wye would have the least potential stream channel disturbance (20 crossings; see Table 3.8-6).

Depending upon the design option chosen, the BNSF Alternative could cross a single federal flood control project (Authority and FRA 2011). Both the Mission Ave and the Mission Ave East of Le Grand design options for the BNSF Alternative would cross the Owens Creek Diversion Channel about 8 miles east of Merced. The span clearance height over the Diversion Channel would meet the requirements of the USACE and the CVFPB to avoid the need for a Section 408 Permit. This design would not encroach on the channel or its levee. The permit review for this crossing would be combined with the CVFPB encroachment permit process.

Heavy Maintenance Facility Alternatives

All HMF sites would include approximately 65 acres of impervious surface. There would be an additional 90 acres for ballasted storage tracks, which are relatively impervious because of compaction of the ground surface below. This increase in impervious surface at a single location could result in increased stormwater runoff. Without adequate stormwater facilities to collect, retain, and treat the stormwater, these facilities could alter existing drainage, thus resulting in local flooding or channel erosion. The Castle Commerce Center HMF site is partially developed; therefore, the HMF would have a smaller absolute increase in impervious surface than the other proposed HMF sites, which are undeveloped. Unique to the Castle Commerce Center HMF site would be an additional 17 acres of impervious area resulting from the more than 5 miles of spur track extending from Merced. The design for the HMF site would include infiltration ponds or detention basins that, based on engineering evaluations, are adequate to reduce the potential for impacts of stormwater runoff on nearby streams.

Permanent Impacts on Surface Water Quality

The technology proposed for the HST System does not require large amounts of lubricants or hazardous materials for operation. The electric trains would use a regenerative braking technology, resulting in reduced physical braking and associated wear. The at-grade tracks and the elevated guideways are assumed to be less than significant pollutant-generating surfaces.

The project would relocate 2 miles of SR 99 and reconstruct several interchanges in the Fresno area. The project would also construct new grade-separated roads at a number of project rail crossings elsewhere in the project area. These new sources of road runoff from the new crossings, relocated highways, or frontage roads could negatively affect water quality. However, water quality design measures would be implemented to reduce the potential for adverse water quality impacts. Effects to surface water quality from the HST tracks and relocated roads would be moderate under NEPA and impacts would be less than significant under CEQA because runoff from the rights-of-way would be directed as sheet flow into the adjacent drainage systems or directed through swales to infiltration basins, the technology proposed for the HST System does not require large amounts of lubricants or hazardous materials for operation, and water quality design measures would be implemented.

The HST stations would be in the existing urban areas of Downtown Merced and Downtown Fresno. Few, if any, new potential pollution sources would be constructed and there would be minimal impact on existing water quality. HST users could park in a structure, which would have less surface area for generation of polluted stormwater than surface parking. Activities associated with the stations are similar to those currently conducted in the downtown areas, such as office use, pedestrian uses, and parking. These similar uses would have negligible effects on stormwater quality under NEPA. Under CEQA, impacts would be less than significant.

At the HMF, most train maintenance would occur under roofed areas. Diesel fuel, gasoline, and lubricants would be stored in large underground tanks and would not pose a risk to water quality. However, train and service vehicle washing could occur outdoors. Runoff from this activity would be contained within the site wastewater system and therefore would not pose a threat to water quality.

Maintenance and other vehicles could be fueled in open areas. In addition, the HMF would employ approximately 1,500 workers, with 2-lane access roads and parking for up to 2,000 vehicles provided. The HMF, including fueling facilities, would be subject to state and federal hazardous materials regulations (see Section 3.10, Hazardous Materials and Wastes). An Industrial SWPPP would be maintained for the site. Stormwater runoff would be treated either through detention basins, bioswales, or other stormwater BMPS and, therefore, would not carry contaminants that could affect the local water quality of nearby receiving water bodies

During project operations, stormwater runoff from station parking lots, the HMF, and railroad rights-of-way could potentially result in degradation of water quality. However, runoff from the rights-of-way would be directed as sheet flow into the adjacent drainage systems or directed through swales to infiltration basins. The basins are designed as a water quality control measure. No runoff from the project would be discharged directly to any surface water bodies. Runoff from bridges, overpasses, underpasses, and aerial structures would be collected and discharged to infiltration basins or adjacent drainage systems. Stormwater runoff from the HMF would result in negligible effects to surface water quality under NEPA and less than significant impacts under CEQA.

Common Groundwater Impacts

Permanent Impacts on Groundwater Quality and Volume

Portions of the study area serve as recharge areas for the San Joaquin River and its tributaries, primarily along active stream channels containing substantial amounts of sands and gravels (see Section 3.9, Geology, Soils, and Seismicity). In these areas, the project (by putting piers in the channels) would reduce infiltration and groundwater recharge because the alternatives would increase impermeable surfaces and would redirect runoff. Because of the narrow, linear project footprint, impacts on groundwater recharge would be negligible under NEPA and less than significant under CEQA. In addition, because groundwater is currently used for irrigation and/or domestic supply along at least some of the project alignment footprint, aquifer impacts would be reduced because no water would be used along the alignment. This would be a negligible impact under NEPA and a less than significant impact under CEQA.

UPRR/SR 99, BNSF, and Hybrid Alternatives

Because the HST system is electrically powered, the track runoff would carry few pollutants. In areas with infiltrative soils, stormwater could percolate into the natural and landscaped areas without affecting groundwater quality. As described in Section 3.6 (Public Utilities and Energy), current water use on the alignment footprint ranges from 4,892 acre-feet per year (UPRR/SR 99 Alternative) to 6,703 acre-feet per year (BNSF Alternative). Water use would decline to zero along the alignment footprint. The UPRR/SR 99, BNSF, and Hybrid alternatives would have a beneficial impact on groundwater quality under both NEPA and CEQA.

Downtown Merced and Downtown Fresno Stations

The station sites are in urbanized areas with little potential for groundwater recharge and with existing stormwater systems and stormwater quality control programs. The stations, therefore, would have a negligible impact on groundwater volumes, infiltration, and quality under NEPA and a less than significant impact under CEQA.

Heavy Maintenance Facility Alternatives

The HMFs would increase impervious surfaces in the study area because they would be located primarily on agricultural land. Because the Castle Commerce Center HMF site is already mostly developed, it would have the least increase in new impervious surface, although the track leading from the Merced HST Station to the Castle Commerce Center HMF site would increase impervious surfaces. Nevertheless, because permeable areas surround the HMF sites (including Castle Commerce) and runoff from HMF impermeable surfaces would remain onsite in filtration ponds or would filtrate through the permeable areas immediately offsite, the impact on groundwater recharge would be negligible under NEPA and less than significant under CEQA.

The HMF sites would have outdoor washing and fuel storage areas, as well as parking lots, that could generate polluted stormwater runoff. The HMF would include a system to recycle the wash water from the train sets to reduce water consumption and improve water quality in discharge water. An Industrial SWPPP would be maintained for the site, and stormwater runoff would be treated either through detention basins, bioswales, or other stormwater BMPS. Therefore, percolation of contaminated stormwater into groundwater is unlikely; effects on groundwater quality would result in negligible effects under NEPA and less than significant impacts under CEQA.

Estimates show that the operation of the HMF would require approximately 50 acre-feet of water per year (refer to Section 3.6, Public Utilities and Energy). As described in Section 3.6, current water use on the HMF sites is estimated to range from 69 acre-feet per year (Castle Commerce Center HMF) to 568 acre-feet per year (Kojima Development HMF). For four of the HMF sites where groundwater use is currently much higher (Castle Commerce Center, Kojima Development, Gordon-Shaw, and Harris-DeJager), the net result would be a decrease in groundwater use. At these four sites, potential impacts on the groundwater basin would be beneficial under both NEPA and CEQA. At the Fagundes HMF site, there is limited groundwater use (estimated to be 3.1 acre-feet per year for dairy operations). Groundwater modeling results indicate that 50 acre-feet per year of additional pumping at this sites (averaging about 35 gallons per minute) would result in a drawdown of the shallow aquifer drawdown of approximately 0.1 foot, which is below detectable levels. Therefore, the impact on groundwater would be negligible under NEPA and less than significant under CEQA.

Common Floodplains Impacts

Permanent Impacts on Floodplains

As discussed under Construction Period Impacts, each stream crossing would be designed to maintain existing hydrology and connectivity, but some physical changes could occur. Stream crossings could reduce the watercourse's ability to convey peak flows by reducing its channel capacity, resulting in floodplain impacts. Some streams would receive culverts. Most stream crossings would require bridges and the placement of piers in the floodplain, or in the case of the San Joaquin River, a FEMA-designated floodway. Design of these bridge crossings would include measures to mitigate the effects of placing piers in the floodplains and floodways. In all cases, the design would maintain the crossing's existing flow conveyance capacity. Hydrologic modeling would be necessary to demonstrate that proposed mitigation measures, such as minor enlargement of the channel cross section, would maintain existing channel capacity. Impacts would be negligible under NEPA and less than significant under CEQA.

Table 3.8-8 details the area of the permanent project footprint within special flood hazard zones (as defined in Table 3.8-5). The study area has a relatively flat gradient that slopes gently to the west or southwest. During periods of high stream flow, shallow overland flooding, which can range from 1 to 3 feet in depth, tends to pond against canal berms, levees, and road and railroad embankments that are perpendicular to the land gradient. The project could divert shallow floods from overflowing channels by serving as an obstacle to the shallow overland flow if sufficient culverts or cross drainage were not provided. In areas where the project is elevated, there would be little potential for such diversion. Where the project is adjacent to existing rail or highway embankments, such flood barriers might already exist. New impacts would be most likely to occur where project tracks do not run parallel to existing embankments. The hydraulic modeling studies discussed above would incorporate adequately sized culverts and other flow measures into the project to avoid the possibility of diverting or redirecting flood flows or increasing the water surface elevation in the 100-year floodplain by more than 0.1 foot. Impacts would be negligible under NEPA and less than significant under CEQA.

UPRR/SR 99, BNSF, and Hybrid Alternatives

As listed in Table 3.8-8, areas lying within the SFHA would range from 362 acres to 656 acres. For all three alternatives, the combination with the Ave 21 Wye would have the most acreage within the SFHA. The effect of the BNSF Alternative design options east of Le Grand would be slightly less than that of the design options through Le Grand. The BNSF Alternative with the Ave 24 Wye combined with the Mission Ave East of Le Grand design option would have the least area in an SFHA and the BNSF Alternative with the Ave 21 Wye and the Mariposa Way design option would have the largest area in the SFHA.

Table 3.8-8

HST Alternatives Area in the Special Flood Hazard Area (acres)

Alternative	FEMA Zone[a]			
	A	AE	AH	AO
UPRR/SR 99 Alternative				
North-South Alignment, Design Options, and Wye Combinations				
West Chowchilla design option with Ave 24 Wye[b]	53	5	81	328
East Chowchilla design option with Ave 24 Wye	46	5	94	348
East Chowchilla design option with Ave 21 Wye	146	5	94	334
Total Range of Impacts for the UPRR/ SR 99 Alternative[c]	**46 to 146**	**5**	**81 to 94**	**328 to 348**
BNSF Alternative				
North-South Alignment and Wye Combinations[b]				
BNSF Alternative with Ave 24 Wye	61	14	0	126
BNSF Alternative with Ave 21 Wye	195	14	0	126
Le Grand Design Options				
Mission Ave	69	0	3	211
Mission Ave East of Le Grand	83	0	1	145

Alternative	FEMA Zone[a]			
	A	AE	AH	AO
Mariposa Way	16	0	23	209
Mariposa Way East of Le Grand	37	0	28	172
Impacts of Components Combined				
BNSF Alternative with Ave 24 Wye	76 to 144	14	1 to 28	271 to 337
BNSF Alternative with Ave 21 Wye	210 to 277	14	1 to 28	271 to 337
Total Range of Impacts for BNSF Alternative[c]	**76 to 277**	**14**	**1 to 28**	**271 to 337**
Hybrid Alternative				
North-South Alignment with Ave 24 Wye	65	16	1	341
North-South Alignment with Ave 21 Wye	175	13	1	290
Total Range of Impacts for Hybrid Alternative[c]	**65 to 175**	**13 to 16**	**1**	**290 to 341**
Heavy Maintenance Facility Alternative				
Castle Commerce Center	18	0	0	123
Harris-DeJager	3	0	0	3
Fagundes	1	0	0	0
Gordon-Shaw	23	0	0	18
Kojima Development	18	0	0	0

[a] Acreages are rounded to the nearest whole number. See Table 3.8-5 for Special Flood Hazard Zone Designations.

[b] Does not include any of the Le Grand design options.

[c] Total range of impacts for each alternative calculated by adding the number of impacts among design options with the lowest and highest number of impacts for the north-south alignment

Most of the UPRR/SR 99 Alternative would be adjacent to existing roads and railroads, with less potential to divert shallow floods. Because it has greater distances that do not follow existing embankments compared with the UPRR/SR 99 Alternative, the BNSF Alternative would have a greater likelihood of diverting shallow flooding. Similarly, the Hybrid Alternative would not follow existing embankments in the Chowchilla area and would have a greater likelihood of diverting shallow floods.

Heavy Maintenance Facility Alternatives

Portions of the Castle Commerce Center, Gordon-Shaw, and Kojima Development HMF sites lie within a floodplain, with 141, 41, and 18 acres each in an SFHA. The other two sites have approximately 3 acres or less in an SFHA.

3.8.6 Project Design Features

The Authority and FRA have considered avoidance and minimization measures consistent with the Statewide Program EIR/EIS (Authority and FRA 2005) and the Bay Area to Central Valley Program EIR/EIS (Authority and FRA 2008) commitments. During project design and construction, the Authority and FRA would implement measures to reduce impacts on water resources, as discussed in Section 3.8.5, Environmental Consequences. These measures are considered to be part of the project and are described in the following text. Additionally, the project would require an Individual Section 404 Permit from USACE. This permit would have conditions to further minimize water quality impacts.

Project Design Features for Stormwater Management and Treatment. During the detailed design phase, evaluate each receiving stormwater system's capacity to accommodate project runoff. As necessary, design onsite stormwater management measures, such as detention or selected upgrades to the receiving system, to provide adequate capacity. Design and construct onsite stormwater management facilities to capture runoff and provide treatment prior to discharge for pollutant-generating surfaces, including station parking areas, access roads, new road over- and underpasses, reconstructed interchanges, and new or relocated roads and highways. Consider the use of constructed wetland systems, biofiltration and bioretention systems, wet ponds, organic mulch layers, planting soil beds, and vegetated systems (biofilters) such as vegetated swales and grass filter strips. Use portions of the HMF site for onsite infiltration of runoff, if feasible, or for stormwater detention, if not. Incorporate vegetated set-backs from streams, such as Canal Creek and Berenda Creek.

Project Design Features for Flood Protection. Design the project both to remain operational during flood events and to minimize increases in 100-year flood elevations, including the following:

- In SFHAs, raise the track at least 4 feet above the 100-year flood elevation.
- Minimize development within the floodplain as appropriate. Avoid placement of facilities in the floodplain (e.g., at the Castle Commerce Center HMF site and the Gordon-Shaw HMF) or raise the ground with fill above the base-flood elevation.

Design of the crossings would maintain a floodwater surface elevation of no greater than 0.1 foot above current levels (zero rise within designated floodways). The following design considerations would minimize the effects of pier placement in the floodways:

- Design site crossings to be as nearly perpendicular to the channel as feasible to minimize bridge length.
- Orient piers to be parallel to the expected high water flow direction to minimize flow disturbance.
- Elevate bridge crossings at least 3 feet above the high water surface elevation to provide adequate clearance for floating debris or as required by local agencies. (The CVFPB requires that the bottom members [soffit] of a proposed bridge must be at least 3 feet above the design floodplain. The required clearance may be reduced to 2 feet on minor streams at sites where significant amounts of stream debris are unlikely.).
- Conduct engineering analyses of channel scour depths at each crossing to evaluate the depth for burying the bridge piers. Implement scour-control measures to reduce erosion potential.
- Use quarry stone, cobblestone, or their equivalent for erosion control along rivers and streams, complemented with native riparian plantings or other natural stabilization alternatives that would restore and maintain a natural riparian corridor, where feasible.
- Place bedding materials under the stone protection at locations where the underlying soils require stabilization resulting from streamflow velocity.

Construction Stormwater Pollution Prevention Plan. The SWRCB Construction General Permit (2009-0009 DWQ) (SWRCB 2009) establishes three erosion risk levels that are based on site erosion and receiving-water risk factors. A preliminary analysis indicates that most of the project would fall under Erosion Risk Level 1, the lowest risk level. The portion of the project vicinity draining to the San Joaquin River would fall under Erosion Risk Level 2. Erosion Risk Level 2 measures also would be carried out anywhere in the project vicinity where construction activities are conducted within or immediately adjacent to sensitive environmental areas such as streams, wetlands, and vernal pools.

The Construction General Permit requires preparation and implementation of a SWPPP, which would provide BMPs to minimize potential short-term increases in sediment transport caused by construction, including erosion control requirements, stormwater management, and channel dewatering for affected stream crossings. These BMPs could include measures to provide permeable surfaces where feasible and to retain and treat stormwater onsite. Other BMPs include strategies to manage the overall amount and quality of stormwater runoff. Typical BMPs include:

- Practices to minimize the contact of construction materials, equipment, and maintenance supplies with stormwater.
- Limiting fueling and other activities using hazardous materials to areas distant from surface water, providing drip pans under equipment, and daily checks for vehicle condition.
- Practices to reduce erosion of exposed soil, including soil stabilization, watering for dust control, perimeter silt fences, placement of rice straw bales, and sediment basins.
- Practices to maintain water quality including silt fences, stabilized construction entrances, grass buffer strips, ponding areas, organic mulch layers, inlet protection, and Baker tanks and sediment traps to settle sediment.
- Practices to capture and provide proper offsite disposal of concrete washwater, including isolation of runoff from fresh concrete during curing to prevent it from reaching the local drainage system, and possible treatment with dry ice or other acceptable means to reduce the alkaline character of the runoff (high pH) that typically results from new concrete.
- Development of a spill prevention and emergency response plan to handle potential fuel or other spills.
- Use of diversion ditches to intercept offsite surface runoff.
- Where feasible, avoidance of areas that may have substantial erosion risk, including areas with erosive soils and steep slopes.
- Where feasible, limit construction to dry periods when flows in water bodies are low or absent.

Central Valley Regional Water Quality Board, Order No. 5-00-175, Waste Discharge Requirements General Order for Dewatering and Other Low Threat Discharges to Surface Waters. This order is a permit that covers construction dewatering discharges and some other listed discharges that do not contain significant quantities of pollutants, and that either (1) are 4 months or less in duration, or (2) have an average dry-weather discharge that does not exceed 0.25 million gallons per day.

The CVFPB regulates specific river, creek, and slough crossings for flood protection. These crossings must meet the provisions of Title 23 of the California Code of Regulations. Title 23 requires that new crossings maintain hydraulic capacity through such measures as in-line piers, adequate streambank height (freeboard), and measures to protect against streambank and channel erosion. Section 208.10 requires that improvements, including crossings, be constructed in a manner that does not reduce the channel's capacity or functionality, nor that of any federal flood control project. The CVFPB reviews encroachment permit applications for approval of a new channel crossing or other channel modification. For a crossing proposed for a federal flood control project, the CVFPB coordinates review of the application with the USACE and other agencies, as necessary. Under Section 408 of the Rivers and Harbors Act, the USACE must approve any proposed modification that involves a federal flood control project. A Section 408 permit would be required if construction modifies a federal levee. A Section 208.10 permit would be required where the project encroaches on a federal facility but does not modify it.

Maintain Pre-Project Hydrology. Avoid increasing existing peak stormwater flows from the project site. This would be accomplished by emphasizing onsite retention of stormwater runoff using measures such as flow dispersion, infiltration, and evaporation, supplemented by detention, where required. Additional flow control measures could be implemented where local regulations or drainage requirements dictate.

Industrial Stormwater Pollution Prevention Plan. The stormwater general permit (97-03-DWQ) requires preparation of a SWPPP and a monitoring plan for industrial facilities, including vehicle maintenance facilities associated with transportation operations. The permit includes performance standards for pollution control.

3.8.7 NEPA Impacts Summary

The increased population would result in more traffic under the No Project Alternative. Increased pollutants in stormwater from roadways that do not have adequate stormwater facilities could degrade water quality. Some portion of the development needed for the increased population would likely occur on the urban fringe rather than in the urban centers served by the project, resulting in an increase in impervious area and an associated increase in stormwater runoff and potential decrease in groundwater recharge. Stormwater facilities associated with urban fringe development would reduce potential effects on local streams.

Effects during construction on drainage and stormwater runoff patterns, as well as groundwater quality, would be reduced to negligible levels with implementation of avoidance and minimization measures. Negligible effects on floodplains would result from construction activities. Avoidance and minimization measures would reduce effects to surface water quality to moderate levels.

During project implementation, effects on hydraulic capacity would be negligible since crossings not conducted on aerial structures would contain openings in embankments sufficient to pass the 100-year flood flows without increasing the flood elevation by more than 0.1 foot.

Effects on surface water quality from operation of the HST would be reduced to moderate levels with implementation of avoidance and minimization measures.

Beneficial effects on regional groundwater conditions could occur as a result of the project. Negligible effects on groundwater quality and floodplains would occur during project implementation.

3.8.8 CEQA Significance Conclusions

No significant impacts on hydrology and water resources have been identified.