CALIFORNIA HIGH-SPEED TRAIN

Program Environmental Impact Report/Environmental Impact Statement

BAY AREA TO MERCED REGION

HYDROLOGY AND WATER QUALITY TECHNICAL EVALUATION

January 2004

Prepared for:

California High-Speed Rail Authority

U.S. Department of Transportation
Federal Railroad Administration

CALIFORNIA HIGH SPEED RAIL AUTHORITY

U.S. Department of Transportation
Federal Railroad Administration

CALIFORNIA HIGH-SPEED TRAIN PROGRAM EIR/EIS

BAY AREA TO MERCED REGION
Hydrology and Water Quality
Technical Evaluation

Prepared by:

Parsons

2233 Watt Avenue, Suite 330

Sacramento, CA 95825

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ACRONYMS

ACFWCD Alameda County Flood Control and Water Conservation District, an entity of the County of Alameda Public Works Department

ACWD Alameda County Water District

AGT's Above-Ground Tanks

BMP's Best Management Practices

CCMP Comprehensive Conservation and Management Plan for the San Francisco Bay Estuary

CDWR California Department of Water Resources

CEQA California Environmental Quality Act

CFR Code Federal Regulations

CWA Clean Water Act

EIR Environmental Impact Report

EIS Environmental Impact Statement

FAA Federal Aviation Administration

FEMA Federal Emergency Management Administration

FHWA Federal Highway Administration

FTA Federal Transit Administration

FRA Federal Railroad Administration

GIS Geographic Information System

HST high-speed train

MID Merced Irrigation District

NEPA National Environmental Policy Act

NFIP National Flood Insurance Program

NMFS National Marine Fisheries Service

NPDES National Pollutant Discharge Elimination System

NPS Non-Point Source

NWP	Nationwide permit
NRCS	Natural Resources Conservation Service
PCJPB	Peninsula Corridor Joint Powers Board
RWQCB	Regional Water Quality Control Board
RTP	Regional Transportation Plan
SBCWD	San Benito County Water District
SCVWD	Santa Clara Valley Water District
SFPUC	San Francisco Public Utilities Commission
SJRGA	San Joaquin River Group Authority
SLDMWA	San Luis & Delta-Mendota Water Authority
SLIC's	Spills, Leaks, Investigations, and Cleanups
STATSGO	NRCS State Soil Geographic GIS database
STIP	State Transportation Improvement Program
SWANCC	*Solid Waste Agency of Northwestern Cook County versus United States Army Corps of Engineers et al*. United States Supreme Court Decision
SWRCB	State Water Resources Control Board
TMDL	Total Maximum Daily Load
USACE	U. S. Army Corps of Engineers
USBOR	U. S. Bureau of Reclamation
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U. S. Geological Survey
UST's	Underground Storage Tanks

1.0 INTRODUCTION

The California High-Speed Rail Authority (Authority) was created by the Legislature in 1996 to develop a plan for the construction, operation, and financing of a statewide, intercity high-speed passenger train system.[1] After completing a number of initial studies over the past six years to assess the feasibility of a high-speed train system in California and to evaluate the potential ridership for a variety of alternative corridors and station areas, the Authority recommended the evaluation of a proposed high-speed train system as the logical next step in the development of California's transportation infrastructure. The Authority does not have responsibility for other intercity transportation systems or facilities, such as expanded highways, or improvements to airports or passenger rail or transit used for intercity trips.

The Authority adopted a *Final Business Plan* in June 2000, which reviewed the economic feasibility of a 1,127-kilometer-long (700-mile-long) high-speed train system. This system would be capable of speeds in excess of 321.8 kilometers per hour (200 miles per hour [mph]) on a dedicated, fully grade-separated track with state-of-the-art safety, signaling, and automated train control systems. The system described would connect and serve the major metropolitan areas of California, extending from Sacramento and the San Francisco Bay Area, through the Central Valley, to Los Angeles and San Diego. The high-speed train system is projected to carry a minimum of 42 million passengers annually (32 million intercity trips and 10 million commuter trips) by the year 2020.

Following the adoption of the Business Plan, the appropriate next step for the Authority to take in the pursuit of a high-speed train system is to satisfy the environmental review process required by federal and state laws which will in turn enable public agencies to select and approve a high speed rail system, define mitigation strategies, obtain necessary approvals, and obtain financial assistance necessary to implement a high speed rail system. For example, the Federal Railroad Administration (FRA) may be requested by the Authority to issue a *Rule of Particular Applicability*, which establishes safety standards for the high-speed train system for speeds over 200 mph, and for the potential shared use of rail corridors.

The Authority is both the project sponsor and the lead agency for purposes of the California Environmental Quality Act (CEQA) requirements. The Authority has determined that a Program Environmental Impact Report (EIR) is the appropriate CEQA document for the project at this conceptual stage of planning and decision-making, which would include selecting a preferred corridor and station locations for future right-of-way preservation and identifying potential phasing options. No permits are being sought for this phase of environmental review. Later stages of project development would include project-specific detailed environmental documents to assess the impacts of the alternative alignments and stations in those segments of the system that are ready for implementation.

The decisions of federal agencies, particularly the Federal Railroad Administration (FRA) related to high-speed train systems, would constitute major federal actions regarding environmental review under the National Environmental Policy Act (NEPA). NEPA requires federal agencies to prepare an Environmental Impact Statement (EIS) if the proposed action has the potential to cause significant environmental impacts. The proposed action in California warrants the preparation of a Tier 1 Program-level EIS under NEPA, due to the nature and scope of the comprehensive high-speed train system proposed by the Authority, the need to narrow the range of alternatives, and the need to protect/preserve right-of-way in the future. FRA is the federal lead agency for the preparation of the Program EIS, and the Federal Highway Administration (FHWA), the U.S. Environmental Protection Agency (EPA), the U.S. Corps of Engineers (USACE), the Federal Aviation Administration (FAA), the U.S. Fish and Wildlife Service (USFWS), and the Federal Transit Administration (FTA) are cooperating federal agencies for the EIS.

A combined Program EIR/EIS is to be prepared under the supervision and direction of the FRA and the Authority in conjunction with the federal cooperating agencies. It is intended that other federal, state,

[1] Chapter 796 of the Statutes of 1996; SB 1420, Kopp and Costa.

regional, and local agencies will use the Program EIR/EIS in reviewing the proposed program and developing feasible and practicable programmatic mitigation strategies and analysis expectations for the Tier 2 detailed environmental review process which would be expected to follow any approval of a high speed train system.

The statewide high-speed train system has been divided into five regions for study: Bay Area-Merced, Sacramento-Bakersfield, Bakersfield-Los Angeles, Los Angeles-San Diego via the Inland Empire, and Los Angeles-Orange County-San Diego. This Cultural Resources Technical Evaluation for the Bay Area – Merced Region is one of five such reports being prepared for each of the regions on the topic, and it is one of fifteen technical reports for this region. This report will be summarized in the Program EIR/EIS and it will be part of the administrative record supporting the environmental review of alternatives.

1.1 Alternatives (No-Project, Modal, HST)

1.1.1. No-Project Alternative

The No-Project Alternative serves as the baseline for the comparison of Modal and High-Speed Train alternatives (Figure 1). The No-Project Alternative represents the state's transportation system (highway, air, and conventional rail) as it existed in 1999-2000 and as it would be after implementation of programs or projects currently programmed for implementation and projects that are expected to be funded by 2020. The No-Project Alternative addresses the geographic area serving the same intercity travel market as the proposed high-speed train (generally from Sacramento and the San Francisco Bay Area, through the Central Valley, to Los Angeles and San Diego). The No-Project Alternative satisfies the statutory requirements under CEQA and NEPA for an alternative that does not include any new action or project beyond what is already committed.

The No-Project Alternative defines the existing and future statewide intercity transportation system based on programmed and funded (already in funded programs/financially constrained plans) improvements to the intercity transportation system through 2020, according to the following sources of information:

- State Transportation Improvement Program (STIP)
- Regional Transportation Plans (RTPs) for all modes of travel
- Airport plans
- Intercity passenger rail plans (California Rail Plan 2001-2010, Amtrak Five- and Twenty-year Plans)

As with all of the alternatives, the No-Project Alternative will be assessed against the purpose and need topics/objectives for congestion, safety, air pollution, reliability, and travel times.

Figure 1:
No-Project Alternative – California Transportation System

1.1.2 Modal Alternative

There are currently only three main options for intercity travel between the major urban areas of San Diego, Los Angeles, the Central Valley, San Jose, Oakland/San Francisco, and Sacramento: vehicles on the interstate highway system and state highways, commercial airlines serving airports between San Diego and Sacramento and the Bay Area, and conventional passenger trains (Amtrak) on freight and/or commuter rail tracks. The Modal/System Alternative consists of expansion of highways, airports, and intercity and commuter rail systems serving the markets identified for the High-Speed Train Alternative. Figure 2 shows the modal alternative for the Bay Area-to-Merced Corridor. The Modal Alternative uses the same inter-city travel demand (not capacity) assumed under the high-end sensitivity analysis completed for the high-speed train ridership in 2020. This same travel demand is assigned to the highways and airports and passenger rail described under the No-Project Alternative, and the additional improvements or expansion of facilities is assumed to meet the demand, regardless of funding potential and without high-speed train service as part of the system.

The additional improvements or expansion of facilities is assumed to meet the demand, regardless of funding potential and without high-speed train service as part of the system.

The Modal Alternative for the Bay Area-to-Merced region consists of two major sets of proposed improvements (see Figure 2):

- Improvements to Highways: Consisting of additional highway lanes to provide sufficient highway capacity and associated interchange reconfiguration, crossing bridge widening, ramp widening, cross street and intersection widening (Figure 1.1-2). Within the region, these improvements, therefore, would occur along proposed portions of Interstate (I) 5, I-880. I-580, I-80, and State Route (SR) 152. Table 1 lists the proposed highway improvements in the Bay Area-to-Merced region.
- Improvements to Airports: Primarily consisting of improvements to terminal gates and runways to provide sufficient landside and airside capacity and associated taxiways, ground access, parking, terminal and support facilities and airports that can serve the same geographic area and demand as the proposed High-Speed Train (HST) Alternative. Within the study area corridor, these proposed improvements would occur at San José International Airport and Oakland International Airport (Figure 1.2-3). Table 2 lists the airport improvements associated with the airports.

Table 1: Proposed Modal Alternative Highway Improvements
Bay Area to Merced

Highway Corridor	Segment (From – To)	No. of Additional Lanes[1] (Total – Both Directions)	No. of Existing Lanes (Total - Both Directions)	Type of Improvement
Segment 1: Merced to San José				
SR 152	SR 99 to I-5	2	1-2	widening
SR 152	I-5 to US 101	2	1-2	widening
US 101	SR 152 to Gilroy	2	2-3	widening
US 101	Gilroy to I-880	2	2-5	widening
Segment 2: San José to San Francisco				
US 101	I-880 to Redwood City	2	4-5	widening
US 101	Redwood City to SFO	2	4-5	widening
US 101	San Francisco International Airport (SFO) to San Francisco	2	4-6	widening
Segment 3: San José to Oakland				
I-880	US 101 to Fremont/Newark	2	3-4	widening
I-880	Fremont/Newark to I-238	2	3-4	widening
I-880	I-238 to I-80	2	2-4	widening
Segment 4: I-580 to I-5 (via I-238)				
I-580	I-880 to I-5 (via I-238)	2	4-6	widening
Segment 5: San Francisco to Sacramento				
I-80	San Francisco to I-880	2	5-6	widening
I-80	I-880 to I-5 (Sacramento)	2	4-6	widening

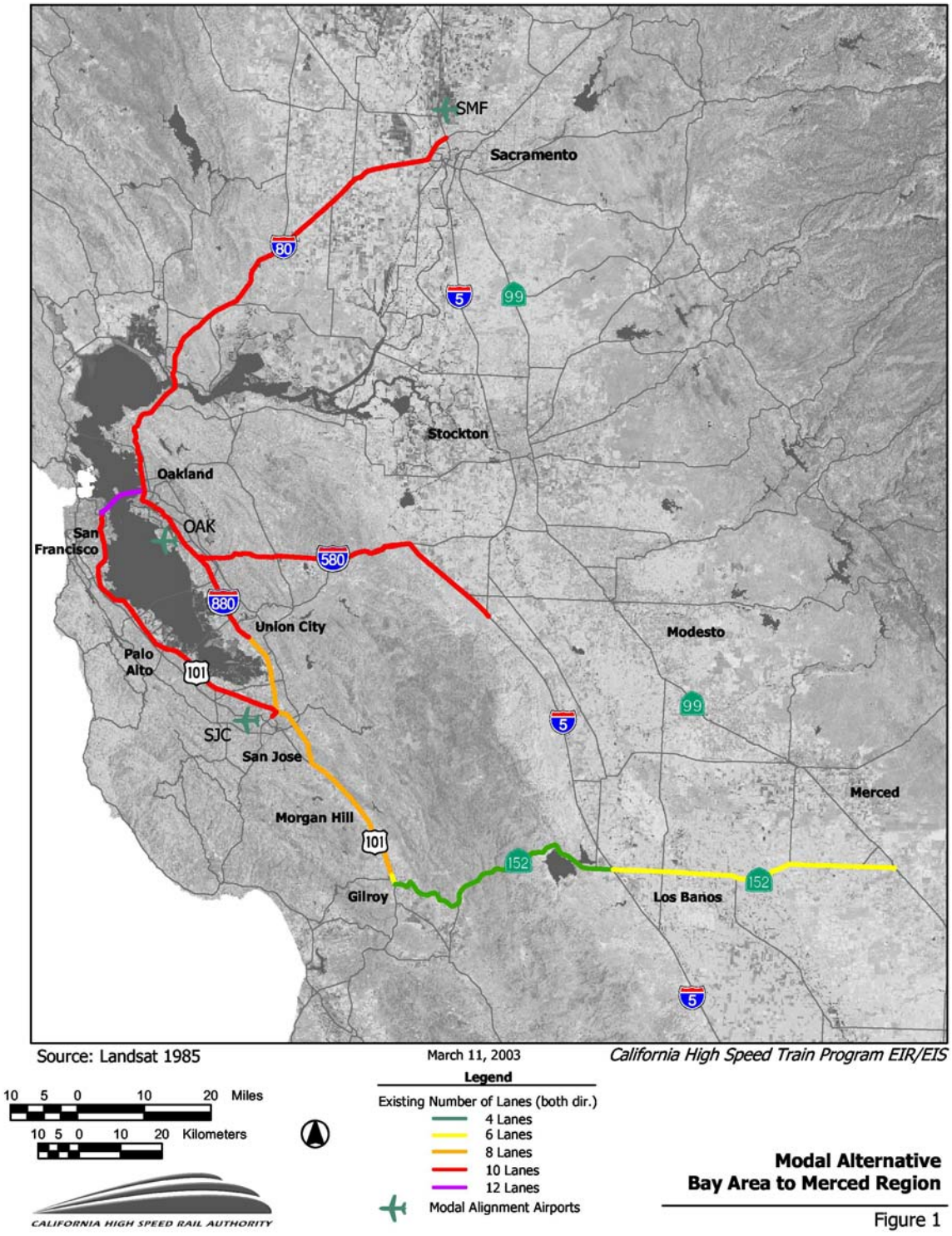
[1] Represents the number of through lanes in addition to the total number of existing lanes that approximate an equivalent level of capacity to serve the representative demand.

Table 2: Proposed Modal Alternative Airport Improvements – Year 2020
Bay Area to Merced

Airport Name	Additional Gates	Additional Runways
San José International Airport	14	one
Oakland International Airport	19	one

Source: Parsons Brinckerhoff, November 2002

Figure 2:
Modal Alternative – Bay Area-to-Merced Region



1.1.3 High Speed Train Alternative

The Authority has defined a statewide high speed train (HST) system capable of speeds in excess of 200 miles per hour (mph) (320 kilometers per hour [km/h]) on dedicated, fully grade-separated tracks, with state-of-the-art safety, signaling, and automated train control systems. State of the art high speed steel-wheel-on-steel-rail technology is being considered for the system that would serve the major metropolitan centers of California, extending from Sacramento and the San Francisco Bay Area, through the Central Valley, to Los Angeles and San Diego. Figure 3 shows the High Speed Train Alternative for the Bay Area-to-Merced Corridor.

The High-Speed Train Alternative includes several corridor and station options. A steel-wheel on steel-rail, electrified train, primarily on exclusive right-of-way with small portions of the route on shared track with other rail is planned. Conventional "non-electric" improvements are also being considered along the existing LOSSAN rail corridor from Los Angeles to San Diego. The train track would be either at-grade, in an open trench or tunnel, or on an elevated guideway, depending on terrain and physical constraints.

For purposes of comparative analysis, the HST corridors will be described from station-to-station within each region, except where a by-pass option is considered when the point of departure from the corridor will define the end of the corridor segment.

The Bay Area-to-Merced corridor can be broadly divided into three regional segments. Each segment has several alternative alignments for all or a portion of the length of the segment. Each segment may be further subdivided for analyzing and reporting potential impacts. The various segment options, along with station locations, are described below.

1.1.3.1 Segment 1 – Merced to San José

In this segment, all alignments would be on an exclusive guideway with separate tracks for high-speed trains and would connect to the Sacramento-to-Bakersfield high-speed train corridor. Two separate corridors are being studied:

Corridor 1A. This corridor would run between Merced and San José, via Pacheco Pass and Gilroy. Two options for the alignment are being considered:

- Gilroy Option: This alignment would extend from Merced through the San Joaquin Valley and Pacheco Pass, through Gilroy, and then north along the Caltrain/Union Pacific Railroad (UPRR) rail corridor. Within this option, two suboptions are under consideration – the alignment of each is a reflection of the design speed.

  Stations would include Los Baños (near I-5) in the San Joaquin Valley, Gilroy (near the existing Caltrain Station), and the existing San José (Diridon) Station.

- Gilroy Bypass Option: This alignment would extend from Merced through the San Joaquin Valley and Pacheco Pass and then north along the Caltrain/UPRR rail corridor.

  Stations would include Los Baños (near I-5) in the San Joaquin Valley, Morgan Hill (near the existing Caltrain Station), and the existing San José (Diridon) Station.

Figure 3a:
High Speed Rail Alternative – Bay Area-to-Merced Region

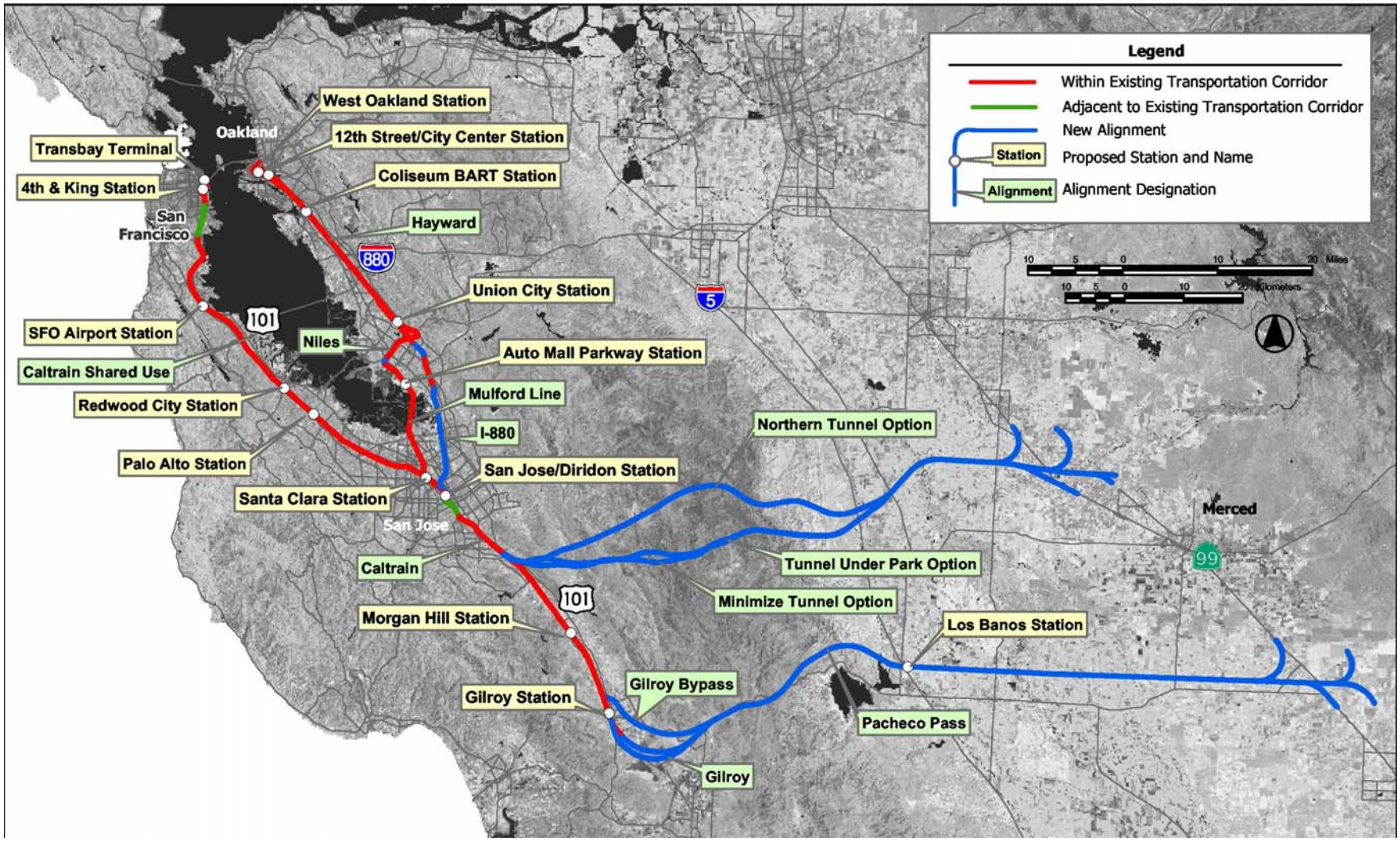
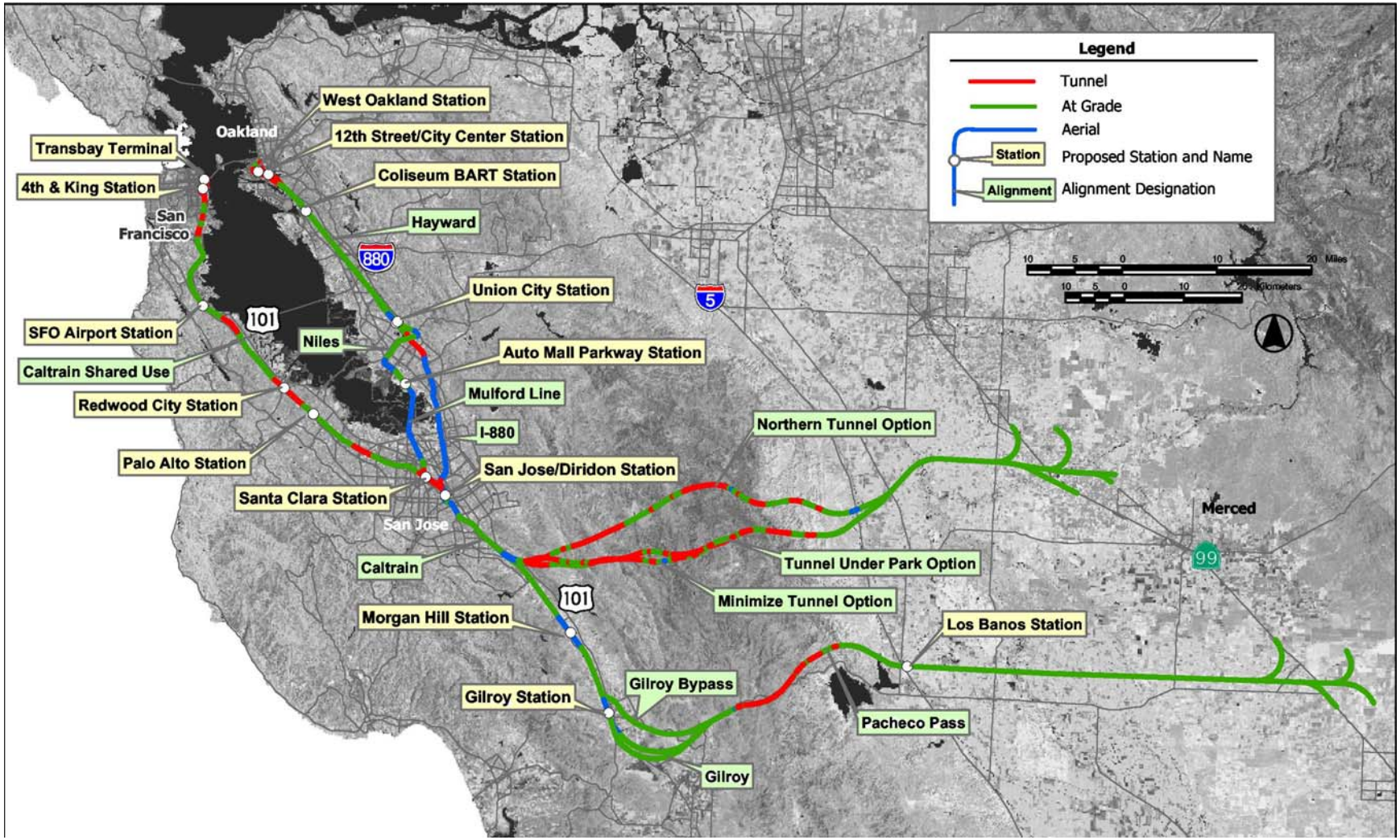


Figure 3b:
High Speed Rail Alternative – Bay Area-to-Merced



Corridor 1B. This corridor would run between Merced and San José, via Atwater and across the Diablo Mountain Range and would include one station – at the existing San José (Diridon) Caltrain Station. Three options for the alignment are being considered:

- Northern Tunnel Option: This alignment would emanate from the BNSF rail corridor or the UPRR corridor near the town of Atwater, north of Merced. The alignment would extend west across the San Joaquin Valley passing north of the town of Newman. The tracks would cross the Diablo Mountain Range in a series of tunnels, passing north of Henry Coe State Park. The alignment then would connect with the Caltrain/UPRR rail corridor north of SR 85.
- Tunnel Under Park Option: This alignment is similar to the Northern Tunnel Option except that the segment through the Diablo Mountain Range would cross Henry W. Coe State Park primarily in tunnel. The alignment then would connect with the Caltrain/UPRR rail corridor north of SR 85.
- Minimize Tunnel Option: This alignment is similar to the Tunnel Under Park Option except that the segment through the Diablo Mountain Range would cross Henry W. Coe State Park primarily at-grade. The alignment then would connect with the Caltrain/UPRR rail corridor north of SR 85.

1.1.3.2 Segment 2 –San José to San Francisco

There is one alignment being considered in this segment; it would provide for high-speed trains sharing tracks with Caltrain commuter trains. The entire alignment would be grade-separated, and all Caltrain stations would have four tracks or by-pass tracks.

Stations would include an optional station at Santa Clara; a station in either Palo Alto or Redwood City; a station in Millbrae near the San Francisco International Airport; and in San Francisco, a station at Fourth and King streets and at the lower level of the proposed new Transbay Terminal.

1.1.3.3 Segment 3 –San José to Oakland

There are two options under consideration for the alignment in this segment.

- I-880 Option: From San José, this alignment would follow north along I-880 and then transition to UPRR's Hayward rail line.

  Stations would include the planned Warm Springs Bay Area Rapid Transit (BART) Station in Fremont or the Union City BART Station; the Oakland Airport/Coliseum BART Station; and either the West Oakland Station or the 12th Street/City Center Station in Oakland.

- Mulford Line Option: From San José, this alignment would travel north along UPRR's Mulford rail line to the UPRR's Niles Line and then onto UPRR's Hayward line.

  Stations would include the Auto Mall Parkway Station or the Union City BART Station; the Oakland Airport/Coliseum BART Station; and in Oakland, either the West Oakland Station or the 12th Street/City Center Station.

2.0 BASELINE/AFFECTED ENVIRONMENT

In order to develop existing conditions for subsequent analysis in relation to the proposed project, data were collected and compiled from federal and state resource agencies, published sources, and electronic databases. No field or on-site visits were made for this initial, planning-level review. This is a screening level analysis of data useful in comparing the alternatives.

2.1 STUDY AREA

The Study Area for hydrology and water quality is defined as: (1) a 100-foot buffer from the centerline of the High-Speed Train Alternative's proposed alignments and the direct footprint of new station facilities, including a 100-foot buffer from new station facilities; and (2) a 100-foot buffer from the Modal Alternative's direct corridor footprint and/or direct footprint of facilities, including corridors and facilities that would undergo upgrades/expansions.

2.2 REGULATORY ENVIRONMENT

2.2.1 Federal Regulations

Clean Water Act of 1977 and 1987

The purpose of the Clean Water Act (CWA) is to restore and maintain the chemical, physical, and biological integrity of the nation's waters through prevention, and elimination of pollution. The Clean Water Act is applicable to any discharge of a pollutant into waters of the United States. Key sections of the CWA include:

1. Section 404 permits for dredge or fill materials from U.S. Army Corps of Engineers.
2. Section 402 permits (National Pollutant Discharge Elimination System [NPDES] permit) for all other discharges are obtained from U.S. Environmental Protection Agency (EPA) or appropriate state agency, which in most cases in the appropriate Regional Water Quality Control Board (RWQCB).
3. Section 401 water quality certification is required from the appropriate RWQCB's.
4. All projects must be consistent with the state Non-point Source Pollution Management Program (Section 319).

Section 401 (33 U.S.C. 1341 and 40 CFR 121): Section 401 of the CWA requires a water quality certification from the State Water Resources Control Board (SWRCB) or RWQCB's when a project:

1. Requires a federal license or permit (a Section 404 permit is the most common federal permit for highway or rail projects), and
2. Will result in a discharge to waters of the United States. Such certification may be conditioned. Project activities that typically result in a discharge subject to Section 401 water quality certification are the construction and subsequent operation of a facility.

The SWRCB revised the state regulations for the 401 Water Quality Certification Program. These revisions went into effect on June 24, 2000. The likelihood of a passive waiver has been reduced by the revised regulations that certification must be issued or denied before any federal deadline.

Section 402 (33 U.S.C. 1342 and 40 CFR 122): This section of the CWA establishes a permitting system for the discharge of any pollutant (except dredge or fill material) into waters of the United States. A National Pollutant Discharge Elimination System (NPDES) permit is required for all point discharges of

pollutants to surface waters. A point source is a discernible, confined, and discrete conveyance, such as by pipe, ditch, or channel.

Section 404 (33 U.S.C. 1344, 33 CFR Part 323, and 40 CFR Part 230): Section 404 of the CWA establishes a permit program administered by the U.S. Army Corps of Engineers (ACOE), which regulates the discharge of, dredged or fill material into waters of the United States (including wetlands). The Section 404(b) (1) guidelines allow the discharge of dredged or fill material into the aquatic system only if there is no practicable alternative that would have less adverse impacts.

Since 1984, with the implementation of its settlement agreement final regulations, the USACE began to regulate the discharge of fill into isolated waters. The 1984 draft regulations also included the now expired Nationwide permit (NWP) 26 for discharges into isolated waters and other waters above the headwaters. NWP 26 has been replaced, in large part, by NWP 39, and other NWP's, effective June 1, 2000. Lacking information about migratory bird use, the USACE assumed jurisdiction over seasonal wetlands, including seasonal pools and ponds, that are isolated or above the headwaters hinging its regulatory authority on the Migratory Bird Species Act. The USACE operated under the assumption until the January 2001 United States Supreme Court decision *Solid Waste Agency of Northwestern Cook County versus United States Army Corps of Engineers et al*. commonly known as the SWANCC decision. The Court apparently removed the jurisdictional status of isolated intrastate waters including vernal pools, abandoned, water-filled quarry pits, some ponds and lakes without outlets, isolated wetlands, seeps and seasonally wet depressions.

Current policy statements issued by USACE General Counsel assert that, "the Corps' ecological judgment about the relationship between waters and their adjacent wetlands provides an adequate basis for legal judgment that adjacent wetlands may be defined as waters under the Act. In sum, the holding, the facts, and the reasoning of *United States versus Riverside Bayview Homes* continued to provide authority for the USEPA and the Corps to assert CWA jurisdiction over, *inter alia*, all of the traditional navigable waters, all interstate waters, and all tributaries to navigable or interstate waters, upstream to the highest reaches of the tributary systems, and over all wetlands adjacent to any and all of these waters."

Distinct from NEPA or CEQA, the project would be subject to the Clean Water Act regulatory process (which also may include documentation to comply with the Rivers and Harbors Act). This process involves a wetland delineation and Ordinary High Water Mark Determination (and a determination of Section 10 Waters, as applicable), verification of the wetland delineation, a pre-application meeting, and a permit package. Typically, the permit package consists of an application, drawings, Analysis of Alternatives, and a mitigation plan. The project will require a Department of the Army permit, specifically an Individual Permit. In addition, a Section 404(b) 1 Analysis of Alternatives would be required to ascertain, on economic and ecological grounds why one project configuration or route should be chosen over another. This is subject to public notice and comment. A wetland mitigation and monitoring plan would be needed, to accompany the permit package. In addition, the USACE (and or/USEPA) may request a Section 7 Consultation with either the National Marine Fisheries Service (NMFS) and/or United States Fish and Wildlife Service (USFWS), to comply with the federal Endangered Species Act. This consultation requires supplementary documentation, specifically a Biological Assessment, and would result in the NMFS and/or USFWS issuance of a Biological Opinion and Incidental Take Statement.

Wild and Scenic Rivers Act of 1968, as Amended (16 U.S.C. 1271-1287; 36 CFR251, 297; 43 CFR 8350)

The purpose of the Wild and Scenic Rivers Act is to preserve and protect wild and scenic rivers and immediate environments for benefit of present and future generations. It is applicable to all projects which affect designated wild, scenic, and recreational rivers and immediate environment and rivers under study for inclusion into the system. The Act prohibits federal agencies from undertaking activities that would adversely affect the values for which the river was designated. The Act is administered by a variety of state and federal agencies. Designated river segments flowing through federally managed

lands are administered by the land-managing agency (e.g., U.S. Forest Service, Bureau of Land Management and the National Park Service). River segments flowing through private lands are administered by the state in conjunction with local government agencies. On projects that affect designated rivers or their immediate environments, consultation will occur through the NEPA process between the state lead agency and the land-managing agencies.

Safe Drinking Water Act of 1944, as Amended (42 U.S.C. 300[f])

The purpose of the Safe Drinking Water Act is to ensure public health and welfare through safe drinking water. The Act is applicable to all public drinking water systems and reservoirs (including rest area facilities). It is also applicable to actions that may have a significant impact on an aquifer or wellhead protection area that is the sole or principal drinking water. This act requires coordination with EPA when an area designated as a principal or sole source aquifer may be impacted by a proposed project. In California, the EPA has designated the following as sole source aquifers: Campo-Cottonwood, Fresno, Ocotillo-Coyote Wells, Santa Margarita, and Scotts Valley.

Executive Order 11988 – Floodplain Management
(U.S. DOT Order 5650.2; 23 CFR 650, Subpart A)

Executive Order 11988 directs all federal agencies to avoid all short-term and long-term adverse impacts associated with floodplain modification and to avoid direct and indirect support of development within 100-year floodplains whenever there is a reasonable alternative available.

Projects that encroach upon 100-year floodplains must be supported with additional specific information. The U.S. Department of Transportation Order 5650.2, titled "Floodplain Management and Protection," prescribes "policies and procedures for ensuring that proper consideration is given to the avoidance and mitigation of adverse floodplain impacts in agency actions, planning programs and budget requests." The order does not apply to areas with Zone C (areas of minimal flooding as shown on Federal Emergency Management Agency [FEMA] Flood Insurance Rate Maps [FIRM]). The order requires that attention be given and findings made in environmental review documents indicating any risks, impacts, and support from the proposed transportation facility.

Flood Disaster Protection Act
(42 U.S.C. 4001-4128; DOT Order 5650.2, 23 CFR 650 Subpart A; and 23 CFR 771)

The purpose of the Flood Disaster Protection 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.

2.2.2 State Regulations and Agencies

California Department of Fish and Game
(Sections 1601-1603 [Streambed Alteration])

Under Sections 1601-1603 of the Fish and Game Code, agencies are required to notify the California Department of Fish and Game (CDFG) prior to any project which would divert, obstruct or change the natural flow or bed, channel or bank of any river, stream or lake. Preliminary notification and project review generally occurs during the environmental process. When an existing fish or wildlife resource may be substantially adversely affected, the CDFG is required to propose reasonable project changes to protect the resource. These modifications are formalized in a "streambed alteration agreement" which becomes part of the plans, specifications and bid documents for a project.

In order to complete the Section 1601, detailed surveys of top-of-bank including the drip-edge of the canopies of any fringing riparian vegetation would be required for the crossing or encroachment on all

incised channels along the project route or in the vicinity of project amenities. A riparian mitigation and monitoring plan would be submitted along with the application for a Streambed Alteration Agreement.

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

The Porter-Cologne Act is the basic water quality control law for California. The act is implemented by the SWRCB and the nine RWQCB's. The boards implement the permit provisions (Section 402), certain planning provisions (sections 205, 208, and 303 of the federal CWA). This means that the state issues one discharge permit for purposes of both state and federal law. Under state law, the permit is officially called waste discharge requirement. Under federal law, the permit is officially called a NPDES permit. The Porter-Cologne Act requires that anyone who is discharging waste or proposing to discharge waste that could affect the quality of the state's water must file a "report of waste discharge" with that RWQCB.

In addition, the Porter-Cologne Act is being used by the RWQCB's to regulate isolated wetlands and vernal pools that are no longer being regulated by the USACE as a result of SWANCC.

2.2.3 State Water Resources Control Board

The State Board's mission is to preserve, enhance and restore the quality of California's water resources, and ensure their proper allocation and efficient use for the benefit of present and future generations. The State Water Resources Control Board (SWRCB) was created by the Legislature in 1967. The joint authority of water allocation and water quality protection enables the SWRCB to provide comprehensive protection for California's waters. The SWRCB consists of five full-time salaried members, each filling a different specialty position. Board members are appointed to four-year terms by the Governor and confirmed by the Senate. There are nine Regional Water Quality Control Boards (RWQCB's). The mission of the RWQCB's is to develop and enforce water quality objectives and implementation plans which will best protect the beneficial uses of the State's waters, recognizing local differences in climate, topography, geology and hydrology.

Each of the boards would require both a Section 401 Regional Water Quality Control Board Certification application (to include an Analysis of Alternatives and a wetland mitigation and monitoring plan) and Section 402 NPDES permit.

2.2.4 Regional Water Quality Control Boards

Central Coast Regional Water Quality Control Board

One of nine Regional Water Quality Control Boards in California, the Central Coast Regional Board (Region 3) has jurisdiction over a 300-mile long by 40-mile wide section of the State's central coast, including the Pajaro River watershed, which would be impacted by the project. Headquartered in San Luis Obispo, the Board's geographic area encompasses all of Santa Cruz, San Benito, Monterey, San Luis Obispo, and Santa Barbara Counties as well as the southern one-third of Santa Clara County, and small portions of San Mateo, Kern, and Ventura Counties. Included in the region are urban areas such as the Monterey Peninsula and the Santa Barbara coastal plain; prime agricultural lands as the Salinas, Santa Maria, and Lompoc Valleys; National Forest lands, extremely wet areas like the Santa Cruz mountains; and arid areas like the Carrizo Plain.

The Regional Board implements a Basin Plan by issuing and enforcing waste discharge requirements to individuals, communities, or businesses whose waste discharges can affect water quality. These requirements can be either State Waste Discharge Requirements for discharges to land, or federally delegated National Pollutant Discharge Elimination System (NPDES) permits for discharges to surface water. Methods of treatment are not specified. When such discharges are managed so that: 1) they

meet these requirements; 2) water quality objectives are met; and, 3) beneficial uses are protected, water quality is controlled.

Central Valley Regional Water Quality Control Board

The Central Valley Region (Region 5) is the State's largest, encompassing 60,000 square miles, or about 40 percent of the State's total area. Thirty-eight of California's 58 counties are either completely or partially within the Regional Board's boundaries, formed by the crests of the Sierra Nevada on the east, the Coast Ranges and Klamath Mountains on the west, the Oregon border on the north, and the Tehachapi Mountains on the south. Included are 11,350 miles of streams, 579,110 acres of lakes and the largest contiguous groundwater basin in California. The Sacramento and San Joaquin Rivers, along with their tributaries, drain the major part of this large area through an inland Delta, prior to emptying into San Francisco Bay. The Delta is the focal point of the state's two largest water conveyance projects, the State Water Project and the federal Central Valley Project. Together, the Sacramento and San Joaquin Rivers and the Delta furnish over half of the state's water supply. The southern third of the Central Valley contains the Tulare Lake Basin, a closed hydrographic unit, except during extremely wet years. The Central Valley is one of the most important agricultural centers of the world. Its largest city is Sacramento, the state capital. The Regional Board's headquarters is in Sacramento with branch offices in Redding and Fresno.

The Sacramento Main Office has program responsibilities in both the Lower Sacramento River Watershed (Colusa, Glenn, Sacramento, Sutter, Yolo, and Yuba Counties, and the Central Valley portion of El Dorado, Lake, Napa, Nevada, Placer, Sierra, and Solano Counties); and the Lower San Joaquin River Watershed (Amador, Calaveras, San Joaquin, Stanislaus, and Tuolumne Counties; and portions of Alameda, Alpine, and Contra Costa Counties that are in the Central Valley) including the Sacramento-San Joaquin Delta. This office also provides administrative, technical and information technology support, fosters programmatic consistency, and coordinates enforcement activities for the entire region.

The Fresno Branch Office has program responsibilities in the Upper San Joaquin River Watershed and the Tulare Lake Basin (Fresno, Kings, Madera, Mariposa, Merced, and Tulare Counties; and the portions of Kern, Los Angeles, San Benito, San Luis Obispo, and Ventura Counties that are in the Central Valley).

Major programs focus on Agricultural Regulatory, Above-Ground Tanks (AGT), Basin Planning, CALFED, Confined Animal Facilities, Department of Defense and Department of Energy, Landfills and Mining, Non-Point Source (NPS), Spills, Leaks, Investigations, and Cleanups (SLIC), Storm Water, Total Maximum Daily Load (TMDL), Underground Storage Tanks (UST), Wastewater Discharges to Land, Wastewater Discharges to Surface Waters (National Pollutant Discharge Elimination System (NPDES), Water Quality Certification, and Watershed Management.

Basin Plans (one for the Tulare Basin and one for the Sacramento River and San Joaquin River Basins) and the planning process associated with them are required by both federal and state law. The Basin Plans are the framework for the Regional Board's activities. They include designation of beneficial uses of waters, water quality objectives to meet those uses and description of programs and actions that need to be implemented to achieve the objectives. For surface waters, these components are water quality standards under federal law. Every three years, a comprehensive review of the Basin Plan is conducted to determine whether revisions are needed. The Regional Board has determined that the following issues are high priority: regulatory guidance to address water bodies dominated by NPDES discharges; regulatory guidance for salinity and boron discharges to the San Joaquin River; organophosphate pesticide control efforts; groundwater quality issues in the Tulare Basin; policies for maintaining drinking water quality in the Delta; mercury load reduction program; dissolved oxygen problems in the San Joaquin River near Stockton; and regulatory policies for selenium in the San Joaquin River.

San Francisco Bay Regional Water Quality Control Board

The San Francisco Bay Regional Water Quality Control Board regulates surface water and groundwater quality in San Francisco Bay region. The primary responsibility of the Regional Board is to protect the quality of the surface and groundwater within the Region for beneficial uses. The duty is carried out by formulating and adopting water quality plans for specific ground or surface water bodies, by prescribing and enforcing requirements on domestic and industrial waste dischargers, and by requiring cleanup of water contamination and pollution. Specific responsibilities and procedures of the Board are outlined in the Porter-Cologne Water Quality Control Act. The Board addresses issues of general policy, allowable discharges, cleanups, and enforcement actions.

The Board's jurisdiction includes San Francisco, San Pablo, Suisun, and Tomales Bays, all streams and rivers that flow into them (beginning at a point just west of Antioch), ocean waters, and groundwaters. The Regional Board's mission is to address regionwide water quality concerns through the creation and update of its Basin Plan. The Basin Plan is the master policy document that contains descriptions of the legal, technical, and programmatic bases of water quality regulation in the San Francisco Bay region.

Major programs include implementation of the Basin Plan, watershed management planning, and the San Francisco Estuary Project. The San Francisco Estuary Project is a cooperative program aimed at promoting effective, environmentally sound management of the San Francisco Bay Estuary while protecting and restoring its natural resources. In 1993, the Estuary Project reached its goal of developing a Comprehensive Conservation and Management Plan (CCMP). The CCMP addresses five critical concerns: decline of biological resources, increased pollutants, freshwater diversion and altered flow regime, dredging and waterway modification, and intensified land use.

2.2.5 Local Permitting Agencies- Water Districts (provided for informational purposes only)

Alameda County Flood Control and Water Conservation District

The County of Alameda Public Works Agency, acting in its capacity as the Alameda County Flood Control and Water Conservation District (ACFWCD), is responsible for most major flood control operations of Alameda County from Emeryville and Oakland south to Fremont. The Agency works in collaboration with the cities throughout the County. The ACFCD is divided into ten flood control zones, each of which is located within a drainage basin that collects storm water runoff and transports it to the Bay. The ACFWCD may be reached at:

info@acpwa.org

Telephone (510) 670-5480

County of Alameda
Public Works Agency
399 Elmhurst Street
Hayward, California 94544-1395

Alameda County Water District

The Alameda County Water District (ACWD) provides drinking water to the cities of Hayward, Fremont, and Newark. Sources of water include the Central Valley Project, Hetch Hetchy System, and Alameda Creek and associated aquifers. Inflatable rubber dams capture water from Alameda Creek and divert it into several abandoned gravel quarry ponds adjacent to one of the proposed project alignments. The District may be reached at:

Telephone: 510-659-1970
Fax: 510-770-1793

ACWD Administrative Offices
43885 South Grimmer Boulevard
Fremont, CA 94538

Central California Irrigation District

The Central California Irrigation District is a purveyor of irrigation water in western Merced and Stanislaus counties. Several of the District's facilities may be affected by the project. The District may be contacted through the San Luis-Delta Mendota Water Authority (see later section).

Del Puerto Water District

The Del Puerto Water District furnishes irrigation water to users in western Merced and Stanislaus counties. District's facilities may be affected by the project. The Del Puerto Water District may be contacted through the San Luis-Delta Mendota Water Authority (see later section).

Grassland Water District

The Grassland Water District is a purveyor of irrigation water and manager of wetlands in western Merced County. Several of the District's facilities and the Grassland State Wildlife Area may be affected by the project. The Grassland Water District is a California Water District formed under Section 34000 of the State Water Code. The District is approximately 51,537 acres in size with the majority of this land in wetland habitat. The District's primary function is the delivery of water to the landowners within its boundaries. The canal system for carrying out water deliveries is approximately 110 miles in length and is operated and maintained by the District. The District may be contacted at:

info@grasslandwetlands.com

Telephone (209) 826-5188
Fax (209) 826-4984

Grassland Water District
22759 S. Mercey Springs Road
Los Banos, CA 93635

Merced Irrigation District

The Merced Irrigation District (MID) regulates irrigation water in eastern Merced County. There are more than 140,000 acres of farmland located within the District's boundaries, of which approximately 70 percent are irrigated with the District water. The District serves nearly 2,000 Merced County growers, who produce over 25 different crops each year, including almonds, corn, alfalfa, and cotton. In 1919, when the District was officially formed, about 40,000 acres were irrigated. Today, that figure stands at more than 110,000 acres, using about 320,000 acre-feet of water, including sphere-of-influence sales to the El Nido Irrigation District, Le Grand-Athlone Water District and individual growers around the perimeter of the District. The water is stored behind the New Exchequer and McSwain Dams. More than 750 miles of canals bring the water to the District's customers. Work around the canals in eastern Merced County such as the Livingston Canal, may require coordination with MID. Contact information for MID is:

mercedid@mercedid.org
Telephone: (209) 722-5761
Fax: (209) 722-6421

Mailing address:
Merced Irrigation District

P.O. Box 2288
Merced, CA 95344-0288

Street address:
Merced Irrigation District
744 W. 20th Street
Merced, CA 95340

San Benito County Water District

Since irrigation pumping began in the Hollister Valley in 1878, water levels have declined as much as 180 feet. To compensate, ground-water recharge, surface deliveries have been implemented by the San Benito County Water District (SBCWD), a water conservation and flood control district, using imported water from the U.S. Bureau of Reclamation's Central Valley Project. The mission of the District is to preserve the economic and environmental wealth and well-being of San Benito County through the control, management and conservation of waters and the provision of water services in a practical, cost-effective and responsible manner. The San Benito County Water District regulates activities in the ditches and streams of San Benito County, including Tequisquita Creek and the ditches within The Bolsa. The Bolsa is a low-lying basin, which drains into the Pajaro River. The southern Gilroy option may impact ditches and streams on the floor of The Bolsa. Below is contact information for the District.

sbcwd.com

Telephone: (831) 637-8218
FAX: (831) 637-7267

San Benito County Water District
30 Mansfield Road
P. O. Box 899
Hollister, CA 95024

San Joaquin River Group Authority

The San Joaquin River Group Authority (SJRGA) is a consortium of water purveyors and governmental agencies that administers the San Joaquin Agreement. The San Joaquin River Group Authority (SJRGA) includes these member agencies: Modesto Irrigation District, Turlock Irrigation District, Merced Irrigation District, South San Joaquin Irrigation District, and Oakdale Irrigation District; the San Joaquin River Exchange Contractors Water Authority and its member agencies Central California Irrigation District, San Luis Canal Company, Firebaugh Canal Water District and Columbia Canal Company; the Friant Water Users Authority on behalf of its member agencies; and the City and County of San Francisco. The San Joaquin River Agreement proposes, among other things, a San Joaquin River flow and State Water Project export study during the April-May Pulse Flow Period and a mechanism by which the State Water Resources Control Board can issue an order to implement the San Joaquin River Portion of the 1995 Water Quality Control Plan for the San Francisco Bay and Sacramento-San Joaquin River Delta Estuary system. The SJRGA may be reached at:

San Joaquin River Group Authority
400 Capitol Mall, Suite 900
Sacramento, CA 95814

San Francisco Public Utilities Commission

The San Francisco Public Utilities Commission (SFPUC) is the purveyor of Hetch Hetchy water to several communities in the South San Francisco Bay region and the City and County of San Francisco. The proposed project may affect several of the District's facilities including the Hetch Hetchy Aqueduct, which

directs water from the watershed of the Tuolumne River in the Sierra Nevada to Crystal Springs Reservoir on the San Mateo Peninsula. The SFPUC may be contacted at:

Telephone (650) 871-2023
FAX (650) 872-5984

San Francisco Public Utilities Commission
Water Supply and Treatment Division
1000 El Camino Real
Milbrae, CA 94030

San Luis and Delta-Mendota Water Authority

The San Luis & Delta-Mendota Water Authority (SLDMWA) was established in January of 1992 and consists of 32 water agencies representing approximately 2,100,000 acres of federal and exchange water service contractors within the western San Joaquin Valley, San Benito and Santa Clara counties. One of the primary purposes of establishing the Authority was to assume the operation and maintenance (O&M) responsibilities of certain United States Bureau of Reclamation (USBOR) Central Valley Project facilities. In addition, the Authority serves the information and representation needs of member water districts by developing, providing and disseminating information to legislative, administrative and judicial bodies concerning a variety of issues such as Sacramento and San Joaquin Delta exports, water supply, water quality, water development, conservation, distribution, drainage, contractual rights, surface and groundwater management, and any other common interest of the member agencies. Contact information for the San Luis & Delta-Mendota Water Authority is:

youtellus@sldmwa.org
Telephone: 209.826.9696
Fax: 209.826.9698/209.826.8040

San Luis-Delta Mendota Water Authority
Los Baños Administration Office
P.O. Box 2157
Los Baños, CA 93635

San Mateo County Department of Public Works

The Department of Public Works provides efficient, economical and responsive transportation; infrastructure systems and maintenance; facilities engineering, design and development; and utilities services to residents of San Mateo County and for County government agencies. Services are provided in a manner ensuring safe, cost-effective, convenient, and attractive facilities for use by employees and the general public. A permit may be required for work in or adjacent to streams in San Mateo County. Contact information for the San Mateo County Department of Public Works is:
Telephone: (650) 363-4100
Fax: (650) 361-8220

County of San Mateo, Department of Public Works
Public Works Administration
555 County Center, 5th floor
Redwood City, CA 94063-1665

Santa Clara Valley Water District

The Santa Clara Valley Water District (SCVWD) is the primary water resources agency for Santa Clara County, California. It acts not only as the county's water wholesaler, but also as its flood protection agency and is the steward for its streams and creeks, underground aquifers and district-built reservoirs.

Work around the streams in Santa Clara County may require an encroachment permit from SCVWD. Contact information for SCVWD is:

mklemencic@valleywater.org
Telephone: (408) 265-2600
Fax: (408) 266-0271

Santa Clara Valley Water District
5750 Almaden Expressway
San Jose, CA 95118-3686

The Santa Clara Valley Urban Runoff Pollution Prevention Program

The Santa Clara Valley Urban Runoff Pollution Prevention Program is an association of thirteen cities and towns in the Santa Clara Valley, who work together with Santa Clara County and the Santa Clara Valley Water District. Program participants share a common permit to discharge storm water to South San Francisco Bay, California. The Program incorporates regulatory, monitoring and outreach measures aimed at improving the water quality of South San Francisco Bay and the streams of the Santa Clara Valley. The Program concentrates its efforts on identifying pollution sources and implementing pollution prevention measures that are within the authority and ability of its co-permittee's. Contact information for the Santa Clara Valley Urban Runoff Pollution Prevention Program is:

Telephone: 1-800-794-2482

Santa Clara Valley Urban Runoff Pollution Prevention Program
699 Town and Country Village
Sunnyvale, CA 94086

2.3 FLOODPLAINS

The Federal Emergency Management Administration (FEMA) has identified floodplains and Special Flood Hazard Areas of the National Flood Insurance Program (NFIP) in or near the project alignments (Figure 4a). The 100-year floodplains of the proposed alignments (excluding the modal alternative) include those associated with the streams bordering San Francisco Bay, Coyote Creek, the Guadalupe River, the Pajaro River, San Joaquin River, and Merced River.

Six classifications for FEMA occur within the modal and hi speed rail segments.

Zone A
Zone A is the flood insurance rate zone that corresponds to the 100-year floodplains that are determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no Base Flood Elevations or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

Zone ANI
Zone ANI is the flood insurance rate zone that corresponds to areas that are not included in a particular rated flood zone. These areas may not have been previously surveyed or documented.

Zone D
The Zone D designation on NFIP maps is used for areas where there are possible but undetermined flood hazards. In areas designated as Zone D, no analysis of flood hazards has been conducted. Mandatory

flood insurance purchase requirements do not apply, but coverage is available. The flood insurance rates for properties in Zone D are commensurate with the uncertainty of the flood risk.

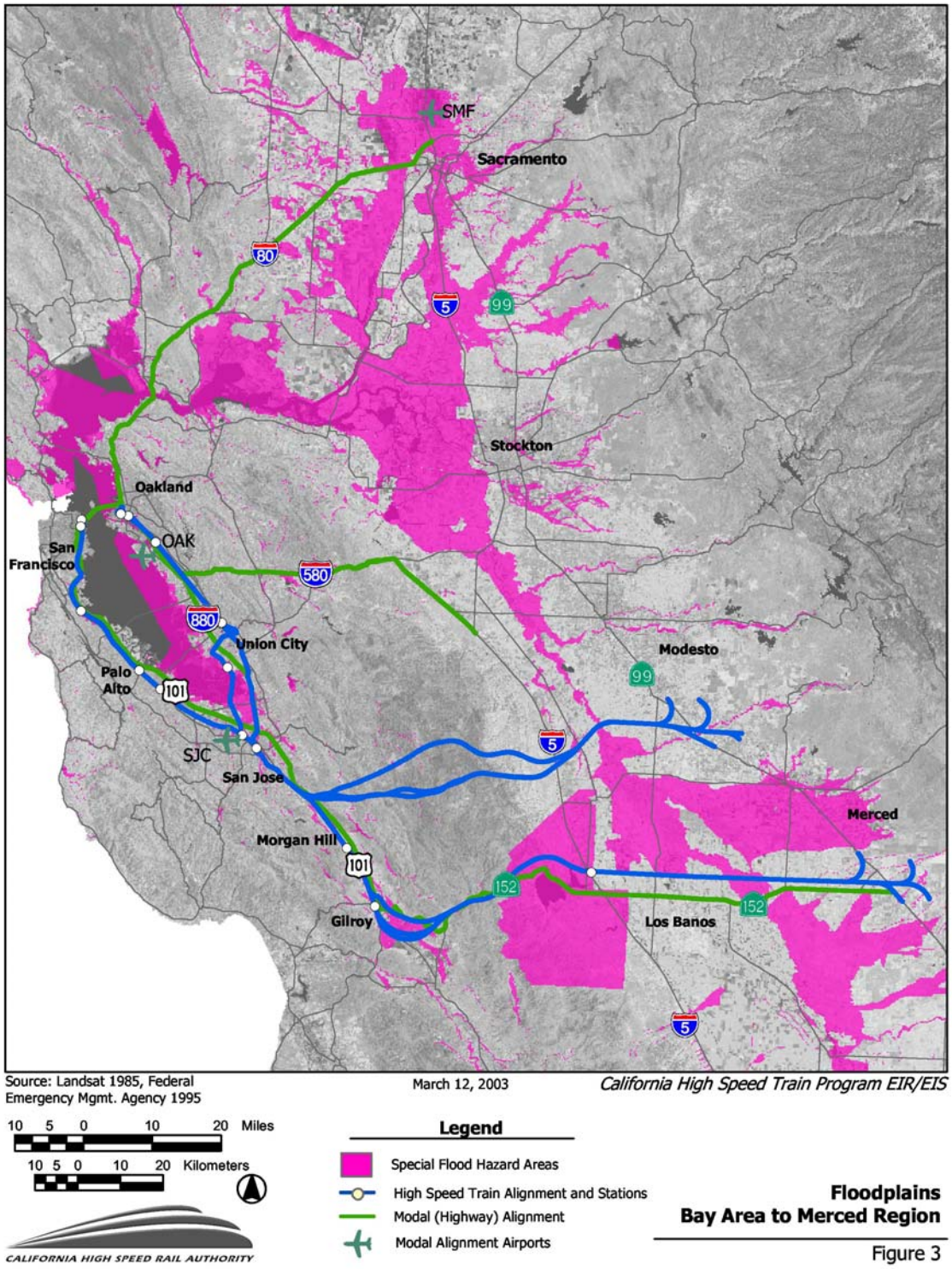
Zone V

Zone V is the flood insurance rate zone that corresponds to the 100-year coastal floodplains that have additional hazards associated with storm waves. No approximate hydraulic analyses have been performed for such areas. Mandatory flood insurance purchase requirements apply.

Zone X

Zones X are the flood insurance rate zones that correspond to areas outside the 100-year floodplains, areas of 100-year sheet flow flooding where average depths are less than 1 foot, areas of 100-year stream flooding where the contributing drainage area is less than 1 square mile, or areas protected from the 100-year flood by levees.

Figure 4a:
Map of Floodplains – Bay Area to Merced Region



2.4 SURFACE WATERS

The surface waters which coincide with the HST project area (except the modal alternative) may be divided into three watersheds: streams flowing into San Francisco Bay, streams of the Pajaro River watershed, and the ditches, drains, and tributaries of San Joaquin River (Figure 4b). A detailed listing of surface waters of the HST project appears in Table 4. These are blue-line streams subject to regulation at the Federal, State, and Local level, which would be potentially impacted by the project.

A manual study of the USGS topographic quadrangle maps revealed the names of blue-line stream to be impacted by the HST project. The surface waters of the HST project alignments and options (excluding the modal alternative), and Impaired Waterbodies from the 1998 California 303(d) List and TMDL Priority Schedule are summarized in Tables 4 and 5. Summary GIS data for the HST Alternative are presented in Section 4.

Manual data on blue-line streams from USGS quadrangle maps for the Modal Alternative is not presented and must await the Tier 2 analysis. However, summary GIS data for the Modal Alternative are presented in Section 4.

A brief discussion of the HST waterbodies follows:

San Francisco Bay

On the west side of San Francisco Bay on the Peninsula, the project would cross several streams and tidal channels in the existing Peninsula Corridor Joint Powers Board (Caltrain) right-of-way. These include Colma Creek, Easton Creek, Sanchez Creek, and San Francisquito Creek.

In the East Bay, the project would cross several streams and tidal channels including San Lorenzo Creek, Mission Creek Alameda Creek, Canada Del Aliso Creek, Aqua Caliente Creek, Agua Fria Creek, and Toroges Creek. In addition, the western optional route to Santa Clara, which follows an existing Union Pacific Railroad line, would cross relatively expansive tidal flats and salt evaporators, and the estuaries of Coyote Creek and the Guadalupe River.

Within the South Bay the project would impact several major streams including Coyote Creek, Penitencia Creek, Los Gatos Creek, Stevens Creek, San Tomas Aquino Creek, and the Guadalupe River. The Diablo Direct route's three alternatives would have considerable impacts on the mountain streams, which feed Coyote Creek and could contribute to the siltation of Anderson and Coyote reservoirs (Table 3).

Figure 4b:
Surface Waters – Bay Area to Merced Region

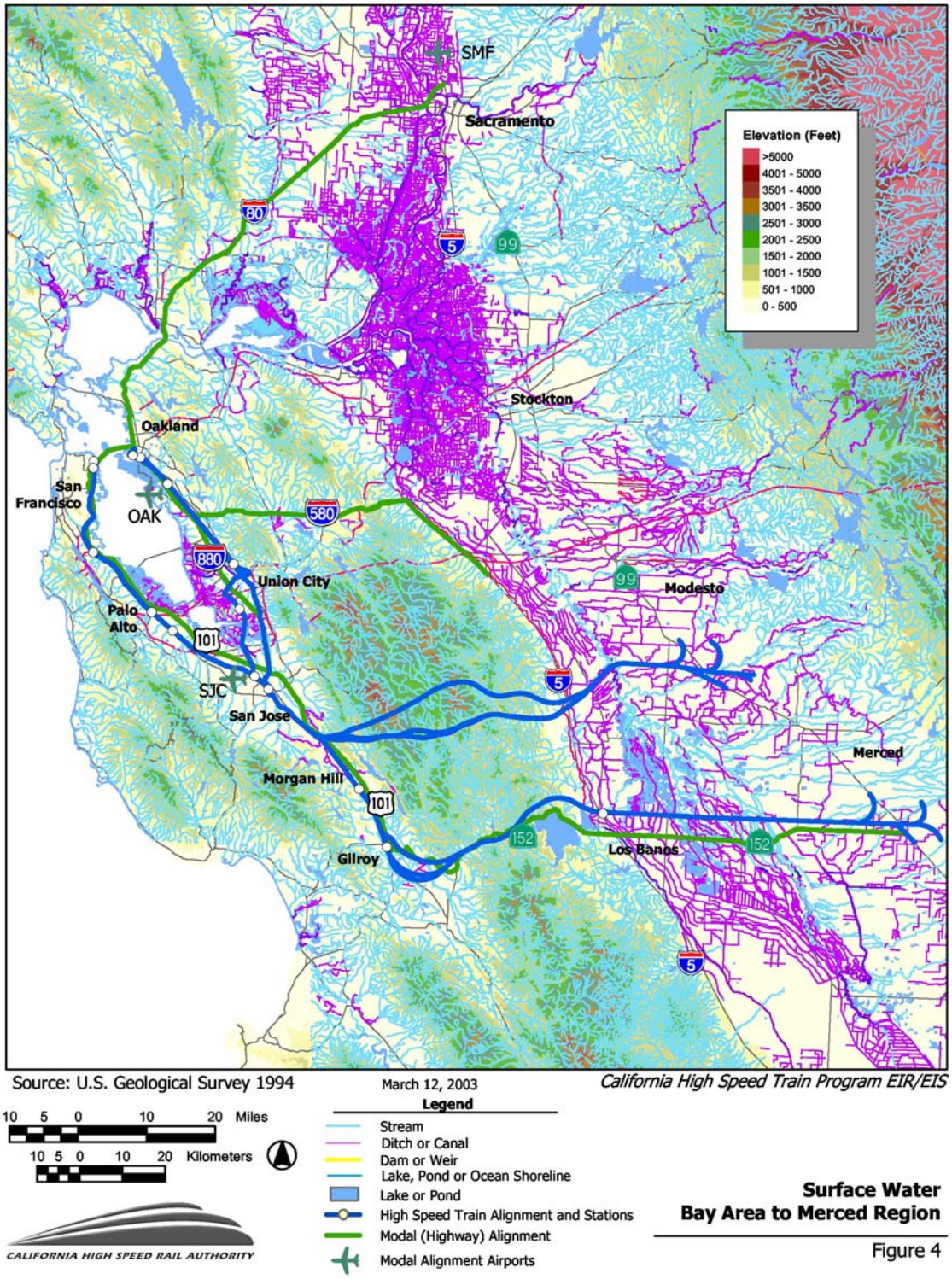


Table 3: Surface Waters and Impaired Waterbodies which Intersect the Proposed High Speed Rail Corridor Oakland to San Jose Segment

Name	Type of Waterbody
Lake Merritt Tidal Channel (North Segment)	Tidal basin
Lake Merritt Tidal Channel (South Segment)	Tidal basin
Unnamed Tidal Channel	Tidal basin edge
Lion Creek	Tidal channel & possible wetland
Unnamed Tidal Channel	Tidal channel & possible wetland
Arroyo Viejo Creek	Perennial stream
Unnamed Tidal Channel	Tidal channel & possible wetland
San Leandro Creek	Perennial stream
Estudillo Canal	Perennial stream
San Lorenzo Creek	Perennial stream
Ward Creek	Perennial stream
Tributary to Alameda Creek	Intermittent stream
Dry Creek (West Reach)	Perennial stream
Tributary to Alameda Creek (West Reach)	Intermittent stream
Quarry Lakes	Several lakes in an abandoned gravel quarry
Alameda Creek (West Reach)	Perennial stream
Tule Pond	Two man-made ponds
Ponds in Fremont Central Park	Man-made pond
Mission Creek	Perennial stream
Tributary to Mission Creek	Intermittent stream
Cañada del Aliso Creek	Intermittent stream
Unnamed Creek south of Grimmer Boulevard	Intermittent stream
Agua Caliente Creek	Intermittent stream
Agua Fria Creek	Intermittent stream
Toroges Creek	Intermittent stream
Unnamed Ditch N of Kato Road	Intermittent stream
Unnamed Creek N of Kato Road	Intermittent stream
Lower Penitencia Creek	Tidal channel
Coyote Creek	Perennial stream
Guadalupe River	Perennial stream
Via Newark and Santa Clara (West Branch)	
Dry Creek (East Reach)	Perennial stream
Tributary to Alameda Creek (East Reach)	Intermittent stream
Alameda Creek (East Reach)	Perennial stream
Unnamed Creek at I-880	Intermittent stream
Plummer Creek	Tidal channel

Table 3: Surface Waters and Impaired Waterbodies which Intersect the Proposed High Speed Rail Corridor Oakland to San Jose Segment

Name	Type of Waterbody
Mowry Slough	Tidal channel
Tributary to Mowry Slough	Tidal channel
Albrae Slough	Tidal channel
Salt Evaporators North of Mud Slough	Salt evaporators
Mud Slough	Tidal channel
Coyote Creek	Tidal channel
Saltmarsh S of Coyote Creek	Tidal marsh
Salt Evaporators South of Coyote Creek	Salt evaporators
Alviso Salt Marsh	Tidal marsh
Guadalupe River	Tidal channel

NOTE: for planning purposes only; based on a manual tabulation of specific routes plotted on USGS quads. Streams that flow over tunnelized segments of the project alignments are not listed. **Bold-type** denotes an Impaired Waterbody from the 1998 California 303(d) List and TMDL Priority Schedule.

Pajaro River Watershed

The State Route 152 Route, including the two Gilroy options would impact streams that contribute flows to the Pajaro River, a tributary of Monterey Bay (Association of Monterey Bay Area Governments 1999). These streams include Carnadero Creek, Llagas Creek, Pacheco Creek, Pajaro River, and Tequisquita Creek (Table 4).

Table 4: Surface Waters and Impaired Waterbodies2 which Intersect the High Speed Rail Corridor, San Francisco to Merced (Chowchilla) Segment

Name	Type of Waterbody
China Basin tidal channel	Tidal basin edge
Islais Creek	Tidal basin edge
Unnamed tidal channel	Tidal channel & possible wetland
Unnamed marsh	Possible wetland
Visitacion Tidal Basin "A"	Tidal basin edge & saltmarsh
Visitacion Tidal Basin "B"	Tidal basin edge
Unnamed marsh	Tidal basin edge & saltmarsh
Unnamed marsh	Possible wetland
San Francisco Bay (Oyster Point Tidal Basin)	Bay edge
Unnamed marsh	Tidal basin edge & saltmarsh
Colma Creek	Tidal estuary
Unnamed tidal channel	Tidal channel
Unnamed tidal channel	Tidal channel
South Lomita Canal & adjacent wetlands	Channelized stream
Unnamed tidal channel	Tidal channel
Unnamed tidal channel	Tidal channel
Unnamed tidal channel	Tidal channel
Mills Creek	Tidal channel & riparian
Easton Creek	Tidal channel & riparian
Sanchez Creek	Tidal channel, ditch & saltmarsh
Sanchez Creek tributary and wetlands	Channelized tributary stream & wetlands
San Mateo Creek	Tidal channel & riparian
Seal Slough tributary "A"	Tidal channel & riparian
Seal Slough tributary "B"	Tidal channel & riparian
Laurel Creek	Tidal channel & riparian
Belmont Creek	Tidal channel
Pulgas Creek	Tidal channel
Cordilleras Creek	Tidal channel & riparian
Arroyo Ojo de Agua	Tidal channel
Redwood Creek	Tidal channel
San Francisquito Creek	Perennial stream
Matadero Creek	Perennial stream
Barron Creek	Perennial stream

Table 4: Surface Waters and Impaired Waterbodies2 which Intersect the High Speed Rail Corridor, San Francisco to Merced (Chowchilla) Segment

Name	Type of Waterbody
Adobe Creek	Perennial stream
Permanente Creek	Perennial stream
Stevens Creek	Perennial stream
Calabazas Creek	Perennial stream
Saratoga Creek	Perennial stream
San Tomas Aquino Creek	Perennial stream
Los Gatos Creek	Perennial stream
Guadalupe River	Perennial stream
Canoas Creek	Ditch
Diablo Range Direct (Via San Jose to Winton)	
Northern Alignment Option	
Coyote Creek	Perennial stream
Evergreen Canal	Abandoned canal
Metcalf Canyon	Intermittent stream
Las Animas Creek	Intermittent stream
San Felipe Creek	Perennial stream
Cow Creek	Perennial stream
Isabel Creek	Perennial stream
Tributary to Isabel Valley Reservoir	Intermittent stream
Tributary to Arroyo Bayo	Intermittent stream
Arroyo Bayo	Intermittent stream
Tributary to Jumpoff Creek	Intermittent stream
Jumpoff Creek	Intermittent stream
Tributary to Jumpoff Creek	Intermittent stream
San Antonio Creek	Intermittent stream
Tributary to San Antonio Creek	Intermittent stream
North Fork Orestimba Creek	Intermittent stream
Long Canyon	Intermittent stream
Tributary to North Fork Orestimba Creek	Intermittent stream
Tributary to North Fork Orestimba Creek	Intermittent stream
Tributary to North Fork Orestimba Creek	Intermittent stream
Crow Creek	Intermittent stream
Tributary to Crow Creek	Intermittent stream
Crow Creek	Intermittent stream
Tributary to Crow Creek	Intermittent stream
Crow Creek	Intermittent stream
Tributary to Crow Creek	Intermittent stream
Tributary to Oso Creek	Intermittent stream

Table 4: Surface Waters and Impaired Waterbodies2 which Intersect the High Speed Rail Corridor, San Francisco to Merced (Chowchilla) Segment

Name	Type of Waterbody
Tributary to Oso Creek	Intermittent stream
Tributary to Oso Creek	Intermittent stream
California Aqueduct	Canal
Delta Mendota Canal	Canal
Orestimba Creek	Intermittent stream
Minimize Tunnel Option	
Coyote Creek	Perennial stream
Evergreen Canal	Abandoned canal
Las Animas Creek	Perennial stream
Carlin Canyon	Perennial stream
Brushy Canyon	Perennial stream
Grizzley Creek	Intermittent stream
East Fork Coyote Creek	Perennial stream
Skunk Hollow Gulch	Perennial stream
Tributary to Red Creek	Intermittent stream
Red Creek	Intermittent stream
Robinson Creek	Intermittent stream
Robinson Creek	Intermittent stream
Tributary to Robinson Creek	Intermittent stream
Tributary to Robinson Creek	Intermittent stream
Tributary to Robinson Creek	Intermittent stream
Tributary to Robinson Creek	Intermittent stream
Robinson Creek	Intermittent stream
Tributary to Robinson Creek	Intermittent stream
Tributary to South Fork Orestimba Creek	Intermittent stream
Tributary to South Fork Orestimba Creek	Intermittent stream
Tributary to South Fork Orestimba Creek	Intermittent stream
South Fork Orestimba Creek	Intermittent stream
South Fork Orestimba Creek	Intermittent stream
South Fork Orestimba Creek	Intermittent stream
South Fork Orestimba Creek	Intermittent stream
North Fork Orestimba Creek	Intermittent stream
Tributary to Orestimba Creek	Intermittent stream
Tunnel Under Henry Coe State Park Option	
Coyote Creek	Perennial stream
Evergreen Canal	Abandoned canal
Metcalf Canyon	Intermittent stream
Shingle Valley Creek	Perennial stream

Table 4: Surface Waters and Impaired Waterbodies2 which Intersect the High Speed Rail Corridor, San Francisco to Merced (Chowchilla) Segment

Name	Type of Waterbody
Las Animas Creek	Perennial stream
San Felipe Creek	Perennial stream
East Fork Coyote Creek (Long Canyon)	Perennial stream
South Fork Orestimba Creek	Intermittent stream
Orestimba Creek	Intermittent stream
Tributary to Orestimba Creek	Intermittent stream
Tributary to Orestimba Creek	Intermittent stream
Tributary to Orestimba Creek	Intermittent stream
Orestimba Creek	Intermittent stream
Tributary to Orestimba Creek	Intermittent stream
Orestimba Creek	Intermittent stream
Orestimba Creek	Intermittent stream
Orestimba Creek	Intermittent stream
California Aqueduct	Canal
Delta Mendota Canal	Canal
Main Canal	Canal
Unnamed ditch at Kilburn Road	Ditch
Old oxbow of the San Joaquin River	Wetland
San Joaquin River between Mile 110 and Mile 111	Wetland
West branch unnamed slough south of August Road	Wetland
East branch unnamed slough south of August Road	Wetland
Horse Drain	Wetland
Lateral No. 6 Ditch	Wetland
Lateral No. 7 Ditch	Wetland
Highline Canal	Canal
Merced River between Mile 21 and Mile 22	Wetland
Livingston Canal	Canal
Livingston Canal	Canal
Livingston Canal	Canal
North Bloom Lateral Ditch	Ditch
South Bloom Lateral Ditch	Ditch
State Route 152 Route (Via Gilroy to Chowchilla)	
Fisher Creek	Intermittent stream
Unnamed ditch	ditch
East Llagas Creek	Intermittent stream
Llagas Creek	Intermittent stream
Llagas Creek	Intermittent stream
West Fork Llagas Creek	Intermittent stream

Table 4: Surface Waters and Impaired Waterbodies2 which Intersect the High Speed Rail Corridor, San Francisco to Merced (Chowchilla) Segment

Name	Type of Waterbody
Miller Slough	Intermittent stream
Gilroy Bypass Option	
Llagas Creek	Intermittent stream
Dexter Creek	Intermittent stream
Jones Creek	Intermittent stream
San Ysidro Creek	Intermittent stream
San Felipe Lake	Lake
Ortega Creek	Stream
Alternative Alignment for 145 kph Station Siding Speed Option	
Unnamed tributary to Llagas Creek	Intermittent stream
Uvas Creek	Intermittent stream
Carnadero Creek	Intermittent stream
Unnamed ditch	Ditch
Pajaro River	Intermittent stream
Unnamed ditch	Ditch
Unnamed ditch	Ditch
Tequisquita Slough	Intermittent stream
Unnamed ditch	Ditch
Pacheco Creek	Intermittent stream
Tributary to Ortega Creek	Intermittent stream
Gilroy Station Option	
Unnamed tributary to Llagas Creek	Ditch
Gilroy Sewage Disposal Ponds	Constructed ponds
Unnamed ditch	Ditch
Pajaro River	Intermittent stream
Millers Canal	Ditch
Unnamed ditch	Ditch
Unnamed ditch	Ditch
Unnamed ditch	Ditch
Unnamed ditch	Ditch
Tequisquita Slough	Intermittent stream
Unnamed ditch	Ditch
Unnamed ditch	Ditch
Pacheco Creek	Intermittent stream
Tributary to Ortega Creek	Intermittent stream
Tributary to Pacheco Creek	Intermittent stream
Tributary to Pacheco Creek	Intermittent stream
Elephant Head Creek	Intermittent stream

Table 4: Surface Waters and Impaired Waterbodies2 which Intersect the High Speed Rail Corridor, San Francisco to Merced (Chowchilla) Segment

Name	Type of Waterbody
Tributary to Pacheco Creek	Intermittent stream
Tributary to Pacheco Creek	Intermittent stream
Pacheco Creek	Intermittent stream
Tributary to Pacheco Creek	Intermittent stream
South Fork Pacheco Creek	Perennial stream
Pacheco Creek	Intermittent stream
Tributary to San Luis Reservoir	Intermittent stream
Tributary to San Luis Reservoir	Intermittent stream
Cottonwood Creek	Intermittent stream
Romero Creek	Intermittent stream
Tule Lake	Pond
Tributary to Romero Creek	Intermittent stream
Romero Creek	Intermittent stream
California Aqueduct	Aqueduct
Delta Mendota Canal	Aqueduct
Outside Canal	Canal
Tributary to San Luis Wasteway	Intermittent stream
Main Canal	Canal
Marsh east of Main Canal	Marsh
Playa west of San Luis Wasteway	Playa
San Luis Wasteway	Intermittent stream
Outlet of lake west of Volta	Lake and marsh
Unnamed ditch in Volta	Ditch
Unnamed ditch east of Volta	Ditch
Unnamed ditch west of Los Banos Creek	Ditch
Los Banos Creek	Intermittent stream
Unnamed ditch east of Los Banos Creek	Ditch
Unnamed creek east of Los Banos Creek	Intermittent stream
Unnamed ditch at Mexican Lane	Ditch
Unnamed ditch	Ditch
Unnamed ditch at North Mercey Springs Road	Ditch
Arroyo Canal	Canal
San Luis Canal	Canal
Marsh west of Mud Slough	Marsh
Mud Slough	Slough
San Pedro Canal	Canal
Marsh and playa east of Mud Slough	Marsh and playa
Boundary Drain	Slough

Table 4: Surface Waters and Impaired Waterbodies2 which Intersect the High Speed Rail Corridor, San Francisco to Merced (Chowchilla) Segment

Name	Type of Waterbody
Devon Drain	Slough
Marsh west of West Delta Canal	Marsh
West Delta Canal	Canal
Unnamed ditch	Ditch
Unnamed ditch	Ditch
Unnamed ditch	Ditch
Unnamed ditch	Ditch
Unnamed ditch	Ditch
Unnamed ditch	Ditch
Delta Canal	Canal
East Delta Canal	Canal
Belmont Drain	Slough
Poso Drain	Slough
Delta No. 1 Canal	Canal
Unnamed ditch	Ditch
Unnamed ditch	Ditch
Unnamed ditch	Ditch
Unnamed ditch	Ditch
West San Juan Drain	Slough
West San Juan Drain No. 1	Slough
Unnamed ditch	Ditch
San Juan Canal	Canal
San Juan Drain	Slough
O'Banion Duck Ponds	Constructed ponds
Playa east of O'Banion Duck Ponds	Playa
Temple Santa Rita Canal	Canal
West Santa Rita Drain	Slough
Unnamed ditch	Ditch
Tributary ditch to the Escano Ditch	Ditch
Diary Field Ditch No. 1	Ditch
Salt Slough	Slough
Tributary to Wood Slough	Slough
Wood Slough	Slough
Tributary to Wood Slough	Slough
Riverside Canal	Canal
San Joaquin River North of Mile 170	Intermittent stream
Mariposa Slough	Slough
Eastside Bypass	Canal

Table 4: Surface Waters and Impaired Waterbodies2 which Intersect the High Speed Rail Corridor, San Francisco to Merced (Chowchilla) Segment

Name	Type of Waterbody
Chowchilla River	Intermittent stream
Chowchilla River	Intermittent stream
Chowchilla River	Intermittent stream
Chowchilla River	Intermittent stream
Justin Canal	Canal
Ash Slough	Wash
Berenda Slough	Wash
Califa Canal	Canal

NOTE: for planning purposes only; based on manual tabulation of specific routes plotted on USGS quads. Streams that flow over tunnelized segments of the project alignments are not listed. **Bold-type** denotes an Impaired Waterbody from the 1998 California 303(d) List and TMDL Priority Schedule.

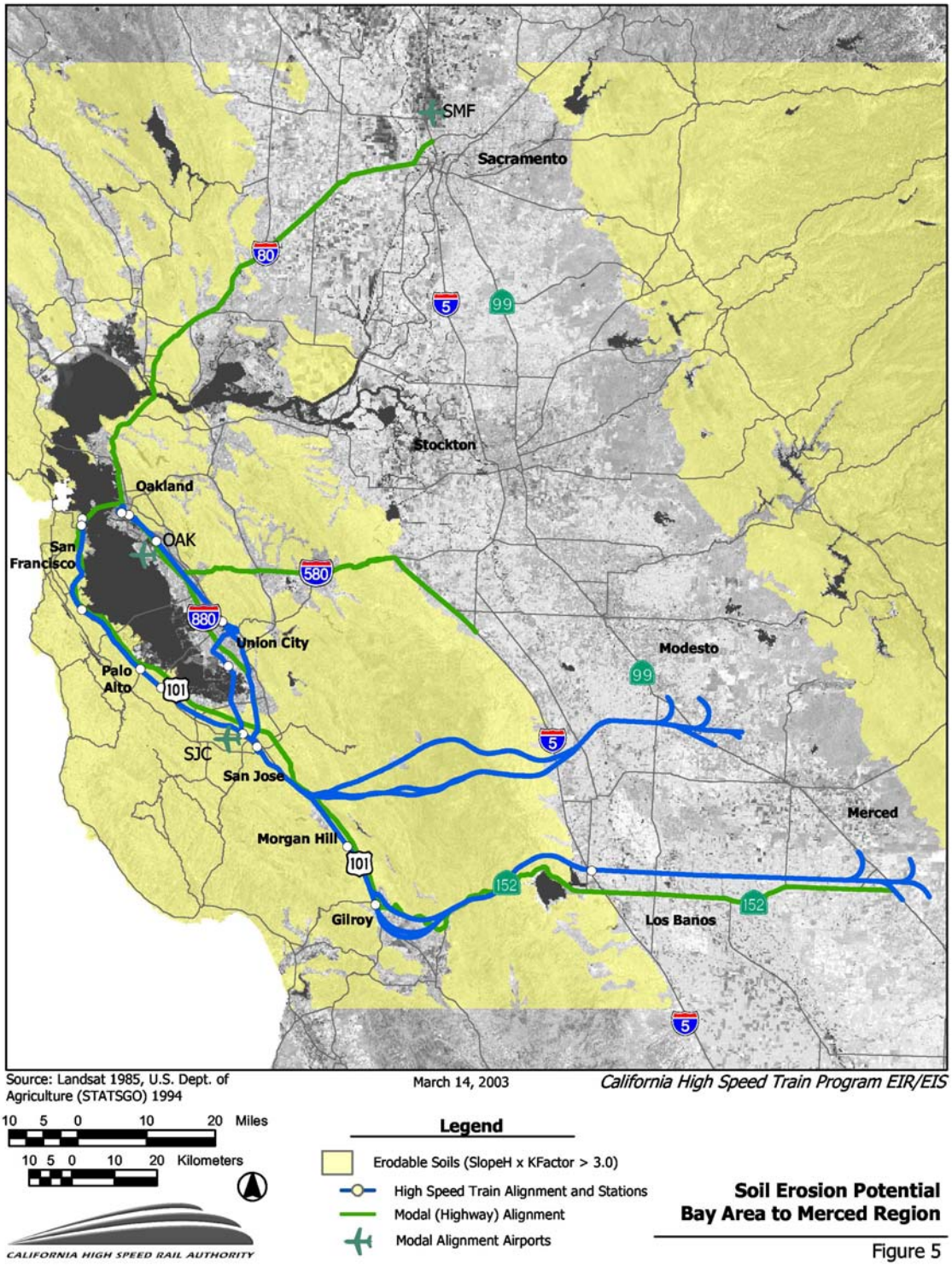
San Joaquin River Watershed

East of the Diablo Range and the divide that corresponds with the boundary between Santa Clara County and Merced and Stanislaus counties, the project would impact streams of the watershed of the San Joaquin River. The Diablo Range Direct route would impact Crow Creek, Orestimba Creek, and cross the San Joaquin River near Rivermile 111. In addition, the Merced River near Livingston would be impacted. To the south along the Route 152 Route, the project would impact Cottonwood Creek, a tributary of San Luis Reservoir, Romero Creek, and numerous low-lying wetlands, ditches and sloughs, which feed the San Joaquin River including the Berenda Slough, Chowchilla River, Devon Drain, Mud Slough, Salt Slough, and San Luis Wasteway. The proposed route would cross the San Joaquin River downstream of Rivermile 170 (Table 4).

2.5 EROSION

Soil surveys were studied from Alameda, Madera, Merced, San Benito, San Francisco, San Mateo, Santa Clara, and Stanislaus counties including Arkley (1962), Arkley (1964), Ferrari & McElhiney (2002), Helseth (1968), Hokholt & Kashiwagi (1993), Isgrig (1969), Lindsey (1974), Nazar (1990), Stromberg et al. (1962), and Welch (1981). A review of the county soil surveys, which cover the proposed alignments, provided some information on erodable soils, namely qualitative descriptions in some instances, and T-factors for others. The newer county soil surveys (e.g. Ferrari & McElhiney 2002) rate soil erodability as slight, moderate, or severe. A detailed listing of soil associations and qualitative assessments of erodability of the project appears in the Appendix. A map of erodable soils appears in Figure 5.

Figure 5
Soil Erosion Potential – Bay Area to Merced Region



2.6 GROUNDWATER

Groundwater of the Merced to Bay Area High Speed Rail Project is catalogued by the United States Geological Survey (USGS) in "Segment 1" of its *Groundwater Atlas of the United States* (USGS 2003) and by the State of California Department of Water Resources (CDWR) Special Bulletin 118 (CDWR 2003). Of the five major aquifers in California and Nevada, only two occur in the region covered by the project. These are the "Coastal Basins Aquifers" and "Central Valley Aquifer System." Narrative discussion follows; groundwater aquifers are mapped in Figure 6:

Coastal Basins Aquifers

According to the USGS the Coastal Basins Aquifers occupy a number of basins in coastal areas in California. All of the basins are in geologic structural depressions filled with marine and alluvial sediments formed by faulting and folding of the Earth's crust (USGS 2003). Six of these coastal aquifers, the Castro Valley Groundwater Basin, Gilroy-Hollister Valley Groundwater Basin, Livermore Valley Groundwater Basin, Napa-Sonoma Valley Groundwater Basin, San Francisco area groundwater basins, and the Santa Clara Valley Groundwater Basin underlie the proposed project, including the modal alternative.

Castro Valley Groundwater Basin

The Castro Valley Groundwater Basin (No. 2-8) lies in a coastal valley north of Hayward along Interstate Hwy. 580 and State Hwy. 238. The Hayward fault makes-up its western boundary. Pleistocene alluvium is the principal water-bearing formation (CDWR 2003).

Gilroy-Hollister Valley Groundwater Basin

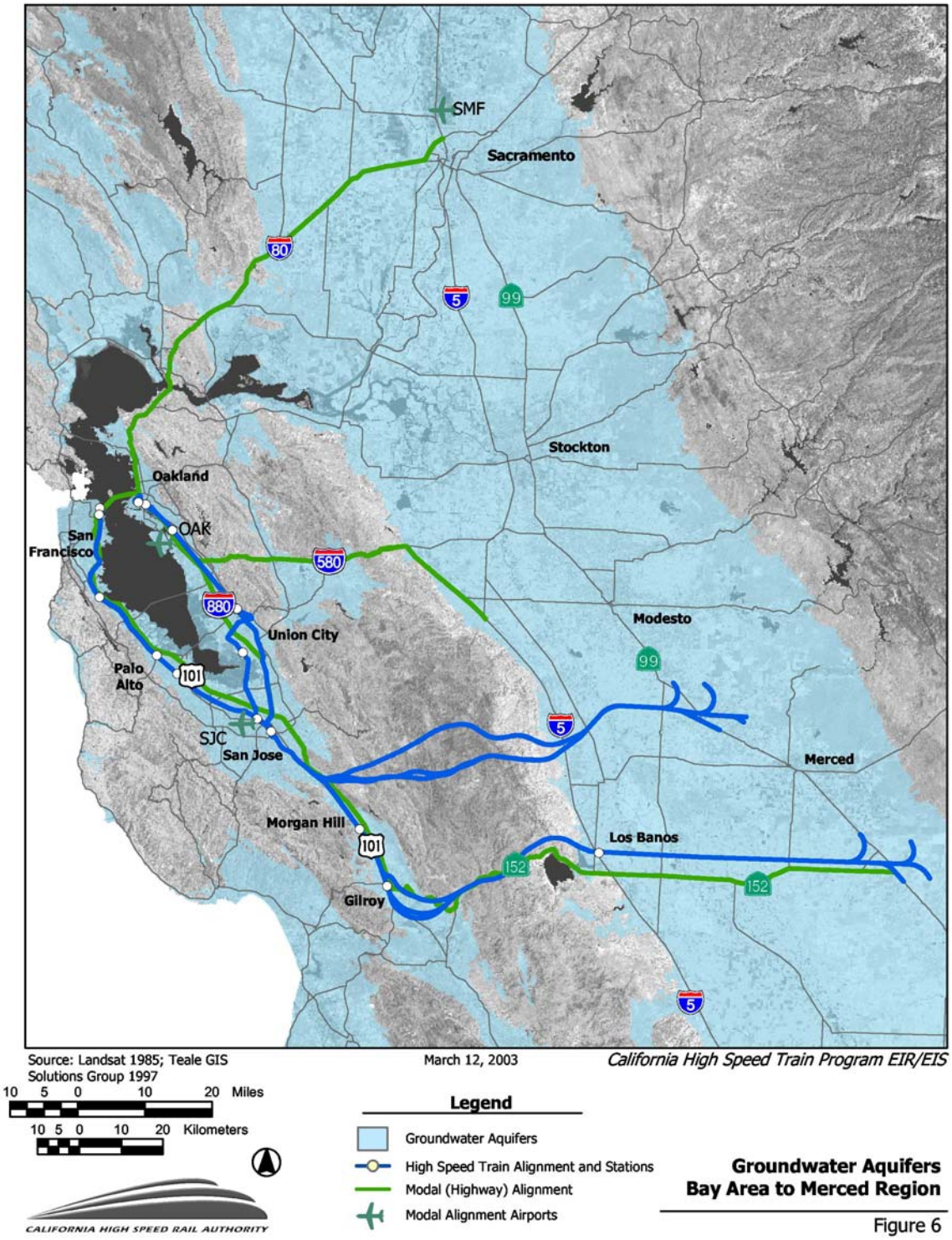
The Gilroy-Hollister Valley Groundwater Basin lies between the Diablo Range on the east and the Gabilan Range and Santa Cruz Mountains to the west. Three sub-basins intersect the project: Hollister Area, Llagas, and The Bolsa.

<u>Hollister Area Groundwater Sub-basin (No. 3-3.03)</u>
Located in the northeast portion of the Gilroy-Hollister Valley Groundwater Basin, the Hollister Area Groundwater Sub-basin is bounded on the west by the Calaveras fault and The Bolsa Sub-basin. The Diablo Range makes up the north and east boundaries, and the Gabilan Range and Santa Cruz Mountains are to the south and west. Tertiary and Quaternary rocks and sediments are the principal water-bearing strata (CDWR 2003).

<u>Llagas Groundwater Sub-basin (No. 3-3.01)</u>
The Llagas Groundwater Sub-basin is approximately 15 miles long and 3 miles wide at the north end, and 6 miles wide to the south near the Pajaro River. It consists of both confined and forebay zones. The Llagas Groundwater Sub-basin is connected with The Bolsa Sub-basin to the south and the Santa Clara and Coyote sub-basins to the north (SCVWD 2003).

<u>The Bolsa Sub-basin (No. 3-3.02)</u>
The Bolsa Sub-basin lies within the northwest portion of the Gilroy-Hollister Valley Groundwater Basin. It is bounded on the north by the Pajaro River and to the southwest by the Sargent anticline. Groundwater occurs in the alluvium of Holocene age, in older alluvium of Pleistocene age, and in the Purisima Formation of Pliocene age (AMBAG 1999, CDWR 2003).

Figure 6
Groundwater Aquifers – Bay Area to Merced Region



Livermore Valley Groundwater Basin

The Livermore Valley Groundwater Basin (No. 2-10) lies in the Livermore Valley along Interstate Hwy. 580 and east of Interstate Hwy. 680. The Livermore Formation is the principal water-bearing formation.

Napa-Sonoma Valley Groundwater Basin

On the north side of San Pablo Bay, the modal alternatives would coincide with the Napa-Sonoma Valley Groundwater Basin. The principal sub-basin is the Napa-Sonoma Lowlands Sub-basin.

Napa-Sonoma Lowlands Sub-basin (No. 2-2.03)

The sub-basin occupies a lowland area immediately north of San Pablo Bay. The sub-basin is bounded on the north by the Mayacamas Mountains and to the northwest and northeast by the Sonoma and Napa valleys. The marshlands of San Pablo Bay make up the southern extent of the sub-basin. The primary water-bearing formations include Holocene alluvium and Pleistocene alluvial deposits belonging to the Huichica Formation (CDWR 2003).

San Francisco Area Groundwater Basins

Several localized groundwater basins occur in and around San Francisco. These are the Downtown, Islais Valley, South San Francisco, Visitacion Valley, and Westside groundwater basins. The Westside Groundwater Basin (No. 2-35) is the largest one in the city. The San Andreas Fault and Pacific Ocean form its western boundary. Its southern boundary is bedrock that separates it from the San Mateo Plain Groundwater Sub-basin.

Santa Clara Valley Groundwater Basin

The Santa Clara Valley Groundwater Basin lies in a structural trough that parallels the northwest-trending Coast Ranges (USGS 2003). The trough contains San Francisco Bay and is bounded by the Santa Cruz Mountains on the southwest and the Diablo Range on the northeast. The groundwater basin is 75 miles long and 45 miles wide. The Santa Clara Valley, which occupies the southern end of the groundwater basin, is 60 miles long and 30 miles wide. Sub-basins include the East Bay Plain, Niles, San Mateo Plain, Santa Clara Valley, and Coyote groundwater basins (CDWR 2003). The Santa Clara Valley Water District (SCVWD) *Groundwater Management Plan* (SCVWD 2001) indicates that the Santa Clara Valley and Coyote sub-basins are interconnected. To the south, it connects with the Gilroy-Hollister Valley Groundwater Basin which contains The Bolsa and Llagas groundwater sub-basins (SCVWD 2001, CDWR 2003). At the northern end of the Santa Clara Valley Aquifer, in addition to the East Bay Plain and San Mateo Plain sub-basins, Alameda Creek supports a groundwater cone, locally known as the Niles Cone.

East Bay Plain Groundwater Sub-basin (No. 2-9.04)

The East Bay Plain Sub-basin is a northwest trending alluvial plain bounded on the north by San Pablo Bay and on the south by the Niles Cone. The aquifer system in the East Bay consists of unconsolidated sediments of Quaternary Age (CDWR 2003).

Niles Cone Groundwater Sub-basin (No. 2-9.01)

The Niles Cone Sub-basin is bounded on the east by the Diablo Range and on the west by San Francisco Bay. Alameda Creek is the principal stream of the sub-basin. Coyote Creek flows along the southern margin of the sub-basin. The Niles Cone Sub-basin is chiefly composed of the alluvial fan of Alameda Creek. However, the Hayward fault which cuts across the apex of the Alameda Creek alluvial fan impedes the westward flow of water. As a result of large differences in water levels between the upper and lower sides of the fault, the Niles cone is often divided into two sub-basins. Four aquifers have been identified in the Niles Cone: Newark, Centerville, Fremont, and “Deep” (CDWR 2003).

San Mateo Plain Groundwater Sub-basin (No. 2-9.03)
The San Mateo Plain Sub-basin occupies a structural trough, sub-parallel to the northwest trending Coast Ranges at the southwest end of San Francisco Bay. The bay constitutes the eastern boundary and the Santa Cruz Mountains make-up the western edge of the sub-basin. The water-bearing formations include the Santa Clara formation of Pliocene or early Pleistocene age, and Quaternary alluvial deposits (CDWR 2003).

Santa Clara Valley Groundwater Sub-basin (No. 2-9.02)
Managed by the Santa Clara Valley Water District, the Santa Clara Valley Groundwater Basin is 22 miles long and 15 miles wide, which is bounded to the south by the Coyote Narrows. A confined zone within the northern end of the sub-basin is overlaid by clay layers rendering these layers impermeable. The southern area is unconfined (SCVWD 2001).

Coyote Groundwater Sub-basin (Not Catalogued by CDWR)
The Coyote Groundwater Basin is in the Upper Santa Clara Valley between Anderson Dam and the Coyote Narrows. It is managed by the Santa Clara Valley Water District. It is 7 miles long and 2 miles wide. To the south the Coyote Groundwater Basin forms a groundwater divide with the Llagas sub-basin. The groundwater divide is generally coincident with the surface watershed divisions between the Pajaro River and Coyote Creek. At Coyote Narrows to the north, the Coyote sub-basin flows into the Santa Clara Valley sub-basin (SCVWD 2001).

Central Valley Aquifer System

The Central Valley Aquifer System includes the San Joaquin and Sacramento valleys. The San Joaquin Valley, where the proposed project is sited, is a structural trough up to 200 miles long and 70 miles wide. The trough is filled with sediments up to 32,000 feet deep. The geologic unit that contains the groundwater reservoir is the Tulare Formation. To the north of the Sacramento-San Joaquin River Delta is the Sacramento Valley, which is a trough similar to the San Joaquin Valley (CDWR 2003).

Sacramento Valley Groundwater Basin

To the north of the high speed rail routes in the area of the modal alternative, the Sacramento Valley Groundwater Basin exists. The three sub-basins, which intersect elements of the modal alternative, are the North American, South American, and Yolo sub-basins.

North American Sub-basin (No. 5-21.64)
A portion of the modal alternative would be built in the vicinity of the North American Sub-basin. The North American Sub-basin lies in the eastern central portion of the Sacramento Groundwater Basin. The eastern boundary of the North American Sub-basin is a north-south line of Sierra Nevadan rocks that extends from the Bear River to Folsom Lake just east of Lincoln. The Bear River is its northern boundary. To the west, the Feather River is its western boundary, and the Sacramento is its southern boundary. Water-bearing strata include Miocene/Pliocene volcanics, older alluvium, and younger alluvium (CDWR 2003).

Solano Sub-basin (No. 5-21.66)
Also involved with the modal alternative is the Solano Sub-basin. Its boundaries are defined by Putah Creek to the north, the Sacramento River to the east, the Mokelumne River on the southeast, and the San Joaquin River on the south. Fresh water-bearing units include alluvium and the Tehama Formation (CDWR 2003).

South American Sub-basin (No. 5-21.65)
Like the North American Sub-basin, a portion of the modal alternative coincides with the South American Sub-basin. The sub-basin is bounded on the east by the Sierra Nevada, on the west by the Sacramento

River, on the north by the American River, and on the south by the Cosumnes and Mokelumne Rivers. Water-bearing rocks are the same as the North American Sub-basin (CDWR 2003).

Yolo Sub-basin (No. 5-21.67)
The Yolo Sub-basin, located in the southern portion of the Sacramento Valley Basin is entirely within Yolo County. It is bounded on the east by the Sacramento River, on the north by Cache Creek, on the south by Putah Creek, and to the west by the Coast Range. Water-bearing formations include sedimentary deposits that are Pliocene and Holocene in age. Freshwater tends to be borne in the Tehama Formation or younger alluvium (CDWR 2003).

San Joaquin Valley Groundwater Basin

The San Joaquin Groundwater Basin has been identified by the State of California Department of Water Resources, Division of Planning and Local Assistance, San Joaquin District. The Tulare formation is the primary source of groundwater in the San Joaquin Groundwater Basin and is separated into three zones, the Upper Tulare Aquifer, the Corcoran Clay Layer, and the Lower Tulare Aquifer. The Upper and Lower Tulare aquifers are separated from each other by the impermeable Corcoran Clay Layer. The groundwater sub-basins of the San Joaquin Groundwater Basin that coincide with the project route include the Chowchilla, Delta-Mendota, and Merced groundwater basins (CDWR 2003).

Delta-Mendota Groundwater Sub-basin (No. 5-22.07)
The Delta-Mendota Groundwater Sub-basin is bounded on the west by the Coast Ranges and on the north by the Stanislaus/San Joaquin County line. The eastern boundary follows the San Joaquin River. To the south it is bounded by the Westside Groundwater Sub-basin (CDWR 2003). Groundwater in the Delta-Mendota Sub-basin occurs in three water-bearing zones. These include the lower zone, which contains confined fresh water in the lower section of the Tulare Formation, an upper zone, which contains confined, semi-confined, and unconfined water; and a zone within 25-feet of the surface.

Chowchilla Groundwater Sub-basin (No. 5-22.05)
The Chowchilla Groundwater Sub-basin includes lands in Madera and Merced counties at the southeastern end of the project route. Hydrogeologic units consist of unconsolidated deposits of Pleistocene and Holocene age (CDWR 2003).

Cosumnes Groundwater Sub-basin (No. 5-22.16)
The Cosumnes sub-basin is bounded on the south and southwest by the Eastern San Joaquin Sub-basin and to the north and northwest by the South American Sub-basin. The modal alternative would involve portions of all three of these sub-basins. The Cosumnes sub-basin aquifer system is composed of alluvial and volcanic deposits of Late Tertiary to Quaternary age (CDWR 2003).

Eastern San Joaquin Sub-basin (No. 5-22.01)
The modal alternative would be built over portions of the Eastern San Joaquin Sub-basin. The sub-basin is bounded by the Mokelumne River on the north and northwest, the San Joaquin River to the west, the Stanislaus River to the south, and deposits of consolidated bedrock to the east. Water-bearing strata consist of the Alluvium and Modesto/Riverbank formations, flood plain deposits, and the Laguna and Mehrten formations (CDWR 2003).

Madera Groundwater Sub-basin (No. 5-22.06)
The extreme southeastern portion of the project coincides with the Madera Groundwater Sub-basin. The sub-basin is bounded on the south by the San Joaquin River, on the west by the Columbia Canal Service Area, on the north by the Chowchilla sub-basin, and on the east by the bedrock of the Sierra Nevada. Hydrogeologic units consist of unconsolidated deposits of Pleistocene and Holocene age (CDWR 2003).

Merced Groundwater Sub-basin (No. 5-22.04)
The Merced Groundwater Sub-basin underlies the eastern end of the project. It includes lands south of the Merced River between the San Joaquin River on the west and the crystalline basement rocks of the Sierra Nevada foothills on the east. Geologic units of the sub-basin include the Ione Formation, Valley Springs Formation, and Mehrten Formation (CH2MHILL 2001, CDWR 2003).

Modesto Groundwater Sub-basin (No. 5-22.02)
The modal alternative would be built over portions of the Eastern Modesto Sub-basin. The sub-basin lies between the Stanislaus River on the north and Tuolumne River to the south. The San Joaquin River makes-up the western boundary. On the east, the sub-basin is bounded by crystalline basement rocks of the Sierra Nevada. The primary hydrogeologic units include the Ione Formation of Miocene age, the Valley Springs Formation of Eocene Age, and the Miocene or Pliocene Mehrten Formation (CDWR 2003).

Tracy Groundwater Sub-basin (No. 5-22.15)
The modal alternative would be built over portions of the Tracy Sub-basin. The sub-basin is defined by sedimentary deposits of the Diablo Range to the west, by the Mokelumne and San Joaquin rivers to the north, the San Joaquin River to the east, and the San Joaquin-Stanislaus county line on the south. Water is extracted from the Tulare Formation, floodplain deposits, and alluvium (CDWR 2003).

Turlock Groundwater Sub-basin (No. 5-22.03)
Portions of the proposed routes, including the modal alternative would be built over the Turlock Groundwater Sub-basin, which lies between the Tuolumne and Merced rivers. The San Joaquin River makes-up the western boundary of the sub-basin, and Sierra Nevadan basement rocks comprise the eastern boundary (CDWR 2003).

Suisun-Fairfield Valley Groundwater Basin

The modal alternative covers a portion of the Suisun-Fairfield Valley Groundwater Basin (No. 2-3), which lies immediately north of Suisun Bay. The basin is bounded by the foothills of the Coast Range to the west and the Vaca Mountains to the north. On the east low ridges of rock, which extend to the Montezuma Hills to the southeast, constitute the remainder of the eastern boundary of the basin. Suisun Bay and its extensive marshes are to the south. Water-bearing units include the Sonoma volcanics, Pleistocene alluvium, and Holocene alluvium (CDWR 2003).

3.0 METHODOLOGY FOR IMPACT EVALUATION

The methodology employed for impact evaluation consists of a combination of both qualitative and quantitative assessment. A qualitative assessment was used for general comparisons of the three alternatives, on a segment-by-segment basis, when discussing issues such as runoff rates, sedimentation or other items that require a more detailed approach than what is warranted for this document. Based on each alternative, general conclusions are generated to support the relative change in impact between the alternatives. The No-Project Alternative is the primary basis of comparison. The impacts as a result of the Modal and High-speed Train Alternatives would be characterized as High, Medium or Low as compared to the No-Project Alternative.

A high impact to hydrology and/or water quality would generally be defined as the following:

- Proposed project will result in a substantial encroachment on a floodplain as defined in Executive Order 11998 for Floodplain Management (40 CFR 6.302[a]), or is located in a 100-year floodplain without adequate mitigation measures.

- Proposed project will result in violations of federal, state, or local water quality standards, or will contribute to violation when evaluated cumulatively with other projects in the region.
- Provisions to prevent contamination of surface waters and/or aquifers are not adopted as a part of the proposed project.
- Proposed project will result in substantial alteration in hydrology, including increased stormwater runoff, or increased groundwater discharge or reduction of groundwater recharge.

For medium or low impacts, the results are proportionately less for the hydrology and water quality information presented above. Additional potential impacts to hydrology and water quality include increased/decreased runoff and stormwater discharge from alteration in the amount of paved surfaces, increased or decreased contribution of automotive-based non-point source contamination, impacts on areas of groundwater discharge or infiltration.

For the quantitative assessment, readily available information such as wetland areas, stream locations, impacts on areas with existing water quality problems, flood zones, and soil information is used to assess the magnitude of the impact. For the purposes of this analysis, the study area is defined to include the following: (1) for the High-speed Train Alternative, direct corridors proposed for alternative alignments, including up to a 100-foot buffer from the corridors, the direct footprint of new station facilities, including a 100-foot buffer from new station facilities (geospatial data for the Bay Area to Merced stations were unavailable at the time of writing of this document); and (2) for the Modal Alternative, direct corridors for facilities which would undergo upgrades, including up to a 100-foot buffer from the upgraded facilities. Facility upgrades were combined into one or the other of 22 modal components (geospatial data for airports were unavailable at the time of writing of this document).

To evaluate the quantitative impacts to water quality from the proposed High-Speed Train and Modal alternatives, the following was conducted:

- The acreage of floodplains defined as Special Flood Hazard Areas (SFHA's) (as defined by the FEMA on FIRM's) within the study area was determined.
- The acreage of surface waters (lakes) or linear feet (rivers or streams) within the study area was determined. Surface waters are defined as lakes, rivers, and streams as identified on U.S. Geological Survey (USGS) 1:24,000 scale digital line graphs (DLG's). The linear feet of surface water was calculated based on the flow-path length of rivers and streams within the study area. Lake surface areas represent the impoundment at maximum capacity.
- The location of impaired waters defined as waters identified on the CWA 303(d) list (as distributed by the SWRCB) within the study area was determined.
- The location of potential erosive conditions was identified as those areas with a combination of erosive soils and high slopes, evaluated as the product of "kfact" and "slopeh" (listed in the STATSGO database). Those conditions where "kfact" x "slopeh" is greater than 3.0 are potentially susceptible to erosion, and acreage of these areas within the study area was determined.

A manual review of USGS quadrangle maps and NRCS soil surveys, which covered the proposed alternatives, was also undertaken.

Geographical Information System data was exported to EXCEL spreadsheets. These spreadsheets were sorted using the desired parameter in ascending order, and the acreages of like attributes were arithmetically summed using EXCEL. Attributes and EXCEL sums were transferred to the summary tables.

4.0 HYDROLOGY AND WATER QUALITY IMPACTS

4.1 NO-PROJECT ALTERNATIVE

The No-Project Alternative assumes that others would complete projects (both public works and private development) including local, state, and interstate transportation system improvements designated in existing plans and programs. No additional hydrological and water quality impacts would occur beyond those addressed in environmental documents for those projects.

4.2 MODAL ALTERNATIVE

Impacts identified for highway and airport expansions are discussed below. In terms of impacts to 100-year floodplains and USGS blue-line features, the modal alternative is the most environmentally damaging alternative.

4.2.1 Floodplains

Based on the GIS data, more than 2,800 acres of the 100-year floodplain would be impacted by the sum total of all the modal components (Table 5, Appendix). This is a significant impact. However, since almost all of the modal projects would extend existing infrastructure already in the 100-year floodplain, and since mitigation would be proposed, the impacts following mitigation was be reduced to less than significant. The impacts to the 100-year floodplain by the Modal Alternative are more than twice as great as the HST alternatives.

4.2.2 Surface Waters

The modal alternative would impact more than 2 million lineal feet of streams and more than 660 acres of other waterbodies (Table 5, Appendix). This is a significant impact. Existing infrastructure (bridges, culverts, abutments, and fill) would be extended to accommodate additional travel lanes, and EIR level mitigation is possible. However, the efficacy of Clean Water Act mitigation for impacts to wetlands and waters of the United States is a problem. For example, along the Interstate Highway 880 corridor between Oakland and San Jose, almost all onsite wetland mitigation sites have been taken for recent freeway widening projects. Mitigation along the I-880 corridor would need to be undertaken offsite to the detriment of biotic resources. In other areas, there is simply no more room for expanding freeways unless resources, homes, and businesses are relocated.

It is unlikely that the federal, State, and local regulatory agencies would permit any more fill in San Francisco Bay except for reconstruction of the major suspension bridges, which is already underway. Therefore, the hydraulics of tidal channels may not be affected to a great degree. However, a multitude of small, tidally influenced estuaries exist along the edges of San Francisco Bay, and the modal alternative has the potential to adversely affect the hydraulics of these channels. With mitigation, the affects on tidal hydraulics could be reduced to less than significant.

The impacts to surface waters by the Modal Alternative are more than twice as great as the HST alternatives.

4.2.3 Run-off

Run-off from the Modal Alternative construction sites if not treated by BMP's would have a significant impact on the environment, including streams and other waterbodies in the vicinity of the various projects. However, all of these projects would be expected to comply with Section 402 of the Clean Water Act through the NPDES permitting process, and every project would be required to have a

Stormwater Pollution Prevention Plan. With the implementation of BMP's and the permit conditions, construction impacts would be reduced to a less than significant level.

Project build-out run-off, especially from paved areas, would also have a significant effect on the environment, and would exacerbate flooding. However, through design of detention basins, and implementation of other water quality BMP's, impacts to the environment from run-off, would be reduced to a less than significant level.

4.2.4 Stormwater Management

See previous section.

4.2.5 Erosion

Some of the soils within the Modal Alternative projects area are erosive (Table 5; Appendix Table 9). Erosion impacts would be temporary and due, in large part, to construction activities. The implications of erosion to the San Joaquin kit fox related Habitat Conservation Plans would be minimal, especially if hydroseeding of bare areas and grassland restoration occurs.

4.2.6 Groundwater

It is unlikely that the Modal Alternative would have a significant effect on groundwater resources despite the fact that most of the project would take place in basins, which contain well-documented groundwater resources (Appendix, Table 18). While pavement would reduce the available surface for water percolation, most of the incoming groundwater comes from run-off in the mountain ranges, which surround the groundwater basins. The greatest threat to groundwater resources is from overdraft practices of farmers.

Most of the non-point source pollutants are from agricultural practices such as grazing and farming, not automobiles, therefore the benefits of shifting from automobile to rail or airplane are probably negligible.

4.3 HIGH-SPEED TRAIN ALTERNATIVE

4.2.1 Floodplains

The southern route across the Diablo Range, which follows State Route 152, impacts a greater acreage of 100-year floodplains than the "Diablo Direct" more northern route. This is a potentially significant impact. Impacts to floodplains that would be associated with the State Route 152 route, particularly in The Bolsa region of southern Santa Clara County and northern San Benito County, would exacerbate flooding in the Pajaro River watershed, a watershed already plagued by flooding.

However, through careful redesign and excavation of the floodplain on the floor of The Bolsa, to detain 100-year flows, these impacts could be mitigated. Mitigation would also be feasible at other locations, provided that floodplain enhancement such as expanding wetland areas in areas now farmed, is implemented. In other areas of the 100-year floodplain classed as Prime Farmlands, conversion of agricultural land to wetland would be politically impossible.

4.2.2 Surface Waters

The impacts to surface waters and other waterbodies are summarized in Table 6. Of the two HST routes crossing the Diablo Range, the northern "Diablo Direct" route, specifically the Northern Alignment Option impacts fewer lineal feet of streams than the other routes crossing the mountains (Table 5, Appendix Table 7). Of the two routes from Oakland to San Jose, the western route would impact more lineal feet of streams than the eastern route. What these data do not show is that the "streams" are actually sensitive estuaries with fringing coastal salt marsh at the southern end of San Francisco Bay. These impacts are significant.

Through careful design, the impacts to tidally influenced estuaries, including the southern end of San Francisco Bay, though significant, could be reduced to less than significant. There are ample areas for wetland mitigation in the abandoned salt evaporators at the southern end of San Francisco Bay. On the other hand, opportunities for wetland mitigation along the I-880 corridor between Oakland and San Jose are scarce.

4.2.3 Run-off

Despite the fact that geospatial data are not yet available for the HST Stations and parking areas, the impact of the project on run-off is significant.

Run-off from the HST construction sites, especially the tunnel and cut-and-fill projects of the Diablo Range, if not treated by BMP's would have a significant impact on the environment, including streams of the Orestimba Creek and Coyote Creek watersheds. However, the project would be expected to comply with Section 402 of the Clean Water Act through the NPDES permitting process, and the project would be required to have a Stormwater Pollution Prevention Plan. With the implementation of BMP's and the permit conditions, construction impacts would be reduced to a less than significant level.

4.2.4 Stormwater Management

Project build-out run-off, especially from paved areas surrounding the HST Stations, would also have a significant effect on the environment, and would exacerbate flooding. However, through design of detention basins, and implementation of other water quality BMP's, impacts to the environment from run-off, would be reduced to a less than significant level.

4.2.5 Erosion

Some of the soils within of the HST project area are erosive (Table 5; Appendix Table 8). Erosion impacts would be temporary and due, in large part, to construction activities. The implications of erosion to the San Joaquin kit fox related Habitat Conservation Plans of the region would be transitory, especially if hydroseeding of bare areas and grassland restoration occurs.

4.2.6 Groundwater

It is unlikely that the HST Alternative would have a significant effect on groundwater resources since most of the tunneling and cut-and-fills will be in the mountains and away from the known groundwater basins. The remaining routes are in basins, which contain well-documented groundwater resources. However, some of these areas are already built-out (Appendix, Table 18). While pavement would reduce the available surface for water percolation, most of the incoming groundwater comes from run-off in the mountain ranges, which surround the groundwater basins. The greatest impact to groundwater resources is from overdraft practices of agricultural concerns and water agencies; and climatic factors which affect recharge of the aquifers.

Most of the non-point source pollutants are from agricultural practices such as grazing and farming, not automobiles, therefore the benefits of the HST alternative to groundwater resources are probably negligible.

Table 5: Analysis/Comparison Table Impacts to Hydrology & Water Quality
Bay Area to Merced

	Floodplains (acres)[1]	Surface Waters (acres/feet)[2]	303 (d) Impaired Waters[3]	Erodable Soils (acres)[4]
NO-PROJECT	See text	See text	See text	See text
MODAL				
Fremont/Newark to US-101	A = 126	0 8,230	Alameda Creek, Coyote Creek, Guadalupe River	80
Gilroy to SR-152	A = 6	0 2,920	Llagas Creek	0
I-238 to Fremont/Newark	A = 4	0 4,595	San Lorenzo Creek, Alameda Creek	0
I-5 to SR-99	A = 126	0 12,442	San Joaquin River	0
I-580/SR-120 to SR-152	A = 12	1 13,618	San Joaquin River, Orestimba Creek	192
I-80 to I-238	A = 7	0 1,263	San Leandro Creek	0
I-80 to Stockton	A = 860	7 27,772	Carquinez Strait, Sacramento River, Mokelumne River	0
I-880 to I-5 (Sacramento)	A = 294	0 27,228	San Leandro Creek, San Joaquin River, Mokelumne River	513

Table 5: Analysis/Comparison Table Impacts to Hydrology & Water Quality
Bay Area to Merced

	Floodplains (acres)[1]	Surface Waters (acres/feet)[2]	303 (d) Impaired Waters[3]	Erodable Soils (acres)[4]
I-880 to I-5 (via I-238)	A = 25	0 21,671	San Leandro Creek, San Lorenzo Creek	478
Merced to SR-152	A = 269	0 3,635	None known	0
Modesto to Merced	A = 95	0 5,198	Tuolumne River, Merced River	0
Redwood City to I-880	A = 176	0 8,590	San Francisco Bay	478
SFO to Redwood City	A = 87	4 7,979	San Francisco Bay, San Mateo Creek, San Francisquito Creek	336
SR-120 to Modesto	A = 7	0 2,409	Stanislaus River	0
SR-152 to Fresno	A = 95	0 4,461	San Joaquin River	0
SR-152 to SR-99	A = 1	0 1,960	San Joaquin River	69
Sacramento to SR-120	A = 306	0 13,121	Mokelumne River	0
San Francisco to I-880	A = 30	11 6,095	San Francisco Bay	54
San Francisco to San Francisco Airport (SFO)	A = 21	11 2,146	San Francisco Bay	259

Table 5: Analysis/Comparison Table Impacts to Hydrology & Water Quality
Bay Area to Merced

	Floodplains (acres)[1]	Surface Waters (acres/feet)[2]	303 (d) Impaired Waters[3]	Erodable Soils (acres)[4]
San Jose to Gilroy	A = 132	0 12,021	Coyote Creek, Llagas Creek	473
Stockton to I-580/SR-120	A = 63	0 5,730	San Joaquin River	0
US 101 to San Jose	A = 13	0 103	San Francisco Bay, San Mateo Creek, San Francisquito Creek, Matadero Creek, Permanente Creek, Calabazas Creek, Saratoga Creek, Los Gatos Creek, Guadalupe River	22
HST CORRIDORS[5]				
San Francisco to San Jose	A = 200	79 73,026	San Francisco Bay, San Mateo Creek, San Francisquito Creek, Matadero Creek, Permanente Creek, Calabazas Creek, Saratoga Creek, Los Gatos Creek, Guadalupe River	1,118
Oakland to San Jose				
Alignments				
East Branch	A = 180	119 121,255	San Leandro Creek, San Lorenzo Creek, Alameda Creek, Coyote Creek, Guadalupe River	191

Table 5: Analysis/Comparison Table Impacts to Hydrology & Water Quality
Bay Area to Merced

	Floodplains (acres)[1]	Surface Waters (acres/feet)[2]	303 (d) Impaired Waters[3]	Erodable Soils (acres)[4]
West Branch (via Newark and Santa Clara)	A = 206	95 197,031	Alameda Creek, Coyote Creek, Guadalupe River	207
Diablo Direct (San Jose to Winton) (Northern Route)				
Alignments				
Northern Alignment Option	A = 125	1 249,364	Coyote Creek, San Felipe Creek, Orestimba Creek, San Joaquin River, Merced River	1,679
Minimize Tunnel Option	A = 180	3 296,446	Coyote Creek, San Felipe Creek, Orestimba Creek, San Joaquin River, Merced River	1,558
Tunnel Under Henry Coe State Park Option	A = 171	0 312,359	Coyote Creek, San Felipe Creek, Orestimba Creek, San Joaquin River, Merced River	1,548
State Route 152 (San Jose to Chowchilla) (Southern Route)				
Alignments				
Gilroy Bypass Option	A = 482	107 436,560	Llagas Creek, Pajaro River, Salt Slough, San Joaquin River	1,529
145 kph Station Speed Option	A = 575	60 453,042	Llagas Creek, Pajaro River, Salt Slough, San Joaquin River	1,529

Table 5: Analysis/Comparison Table Impacts to Hydrology & Water Quality
Bay Area to Merced

	Floodplains (acres)[1]	Surface Waters (acres/feet)[2]	303 (d) Impaired Waters[3]	Erodable Soils (acres)[4]
Gilroy Station Option	A = 589	60 451,960	Llagas Creek, Pajaro River, Salt Slough, San Joaquin River	1,507

1 = See Table 7, Appendix
2 = See Table 8, Appendix
3 = Denotes an Impaired Waterbody from the 1998 California 303(d) List and TMDL Priority Schedule; see Tables 4 and 5 for HST
4 = See Tables 7-16, Appendix; STATSGO 1994
5 = Geospatial data for stations were not available at time of writing of this document

5.0 PREPARERS

Allen Cattell, Ph.D., Principal Planner

Dr. Cattell has eighteen years of experience in providing a wide range of environmental services related to NEPA and CEQA type projects with a focus on water quality and watershed assessment and management. His experience includes assessment of wastewater and thermal discharges, surface water runoff, storm drainage, dredge spoil disposal, TMDLs and impacts from land and shoreline development.

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7.0 APPENDIX - SUMMARY OF RAW DATA FROM GEOGRAPHICAL INFORMATION SYSTEM (GIS) DATA LAYERS

The results of the excerpts from EXCEL spreadsheet-based GIS output from 100 foot wide corridors of the various alignments are presented in Tables 5-18. Table 6 presents the Federal Emergency Management Authority (FEMA) Floodplain Acreage from GIS Data. Table 7 reports the raw GIS output from the USGS blue-line stream and surface waterbody data layer. Table's 8-17 report the GIS output from the STATSGO database, and lists the NRCS's qualitative assessment of erodability of soil components from the county soil surveys, for the various alternatives. Table 18 constitutes groundwater basin acreage from raw GIS data.

Table 6: Federal Emergency Management Authority (FEMA) Floodplain Acreage from Raw GIS Data, Bay Area to Merced Region

FEMA Zone	Modal[1]	San Francisco to San Jose	Oakland to San Jose East Branch	Oakland to San Jose West Branch	Merced to San Jose North Line Northern Alignment Option	Merced to San Jose North Line Minimize Tunnel Option	Merced to San Jose North Line Tunnel Under Henry Coe Option	Merced to San Jose South Line State Route 152 Gilroy Bypass Option	Merced to San Jose South Line 145 kph Siding Option	Merced to San Jose South Line Gilroy Station Option
A	2827 (2836)	200	180	206	125	180	171	482	575	589
ANI	31 (32)	0	0	0	0	0	0	0	0	0
D	2363 (2372)	323	69	171	723	634	643	1307	1185	1186
V	0 (0)	0	0	0	0	0	0	0	0	0
X	9041 (9069)	465	795	797	1483	1500	1498	1268	1351	1311
X500	1261 (1264)	24	84	72	66	66	66	91	130	129

1 = The first numerical value is the sum of FEMA zone acreages for the total modal; the numerical value in parentheses is the sum of acreages of individual components. Note that the discrepancy is due to overlapping buffer between some of the components.

FEMA Zone classifications: A = Areas within the 100-year floodplain: No base flood elevations determined; ANI = Area not included; D = Areas in which flood hazards are undetermined; V = Coastal flood with velocity hazard (wave action): n base flood elevations determined; X = Areas of 500-year flood: areas of 100-year flood with average depth of less than 1 foot or with drainage areas less than 1 square mile: and areas protected by levees from 100-year flood: X500 = Areas outside of the 500-year flood boundary

Table 7: United States Geological Survey (USGS) Surface Waters and Water bodies from GIS Raw Data 100-ft Buffer, Bay Area to Merced Region

Features	Modal	San Francisco to San Jose	Oakland to San Jose East Branch	Oakland to San Jose West Branch	Merced to San Jose North Line Northern Alignment Option	Merced to San Jose North Line Minimize Tunnel Option	Merced to San Jose North Line Tunnel Under Henry Coe Option	Merced to San Jose South Line State Route 152 Gilroy Bypass Option	Merced to San Jose South Line 145 kph Siding Option	Merced to San Jose South Line Gilroy Station Option
Streams (lineal feet)	2,039,748	73,026	121,255	197,031	249,364	296,446	312,359	436,560	453,042	451,960
Waterbody area (acres)[1]	663	79	119	95	1	3	0	107	60	60

Table 8: Soil Mapping Units from STATSGO, Erodability from County Soil Surveys, and Acreages for the Modal Alternative

Soil Mapping Unit	Erodability[1]	Acreage
ALTAMONT-DIABLO-FONTANA (CA249)	No information available	245
ALTAMONT-DIABLO-FONTANA (CA249)	No information available	259
ARBUCKLE-PLEASANTON-SAN YSIDRO (CA574)	No information available	475
ARBURUA-WISFLAT-BADLAND (CA367)	No information available	21
BARNABE-CANDLESTICK-BURIBURI (CA590)	Barnabe: High; Candlestick: High	18
BAYWOOD VARIANT-URBAN LAND-BAYWOOD (CA241)	Baywood Variant: T=5	48
BOTELLA-URBAN LAND-XERORTHENTS (CA596)	Botella: Slight	933
CALLA-CARBONA-VAQUERO (CA471)	No information available	195
CAPAY-EL SOLYO-VERNALIS (CA469)	No information available	109
CAPAY-ZACHARIAS-STOMAR (CA485)	No information available	405
CARBONA-CAPAY-CALLA (CA470)	No information available	261
CLEAR LAKE-CAPAY-STOCKTON (CA410)	Clear Lake: T=5	732
CLEAR LAKE-PESCADERO-CROPLEY (CA240)	Clear Lake: T=5	555
CLEAR LAKE-WRIGHT-HAIRE (CA203)	Clear Lake: T=5	67
COLUMBIA-COSUMNES-SAILBOAT (CA412)	No information available	38
DAMLUIS-BAPOS-LOS BANOS (CA365)	No information available	950
DANVILLE-BOTELLA-URBAN LAND (CA242)	Danville: T=5	283
DELHI-HILMAR-ATWATER (CA318)	No information available	596
DELHI-VERITAS-TINNIN (CA467)	No information available	431
DIABLO-SAN BENITO-SHERIDAN (CA572)	No information available	68
DIBBLE-MILLSHOLM-LOS OSOS (CA495)	No information available	259
DIERSSEN-CLEAR LAKE-EGBERT (CA409)	No information available	157

Table 8: Soil Mapping Units from STATSGO, Erodability from County Soil Surveys, and Acreages for the Modal Alternative

DINUBA-HANFORD-MODESTO (CA486)	No information available	163
DOSAMIGOS-DELDOTA-CHATEAU (CA363)	Dosamigos: Slight	38
DOSPALOS-BOLFAR-ALROS (CA360)	Dospalos: Slight	250
EGBERT-SAILBOAT-SYCAMORE (CA459)	No information available	562
FAGAN-HAIRE-CLEAR LAKE (CA239)	No information available	52
FRESNO-DINUBA-LEWIS (CA304)	No information available	255
GAVIOTA-VALLECITOS-LOS GATOS (CA578)	Gaviota: Very Severe	189
GRANGEVILLE-PACHAPPA-TRAVER (CA392)	No information available	503
GUARD-DEVRIES-RIOBLANCHO (CA474)	No information available	261
HAMBRIGHT-TOOMES-GILROY (CA497)	No information available	27
HANFORD-DELHI-TUJUNGA (CA307)	No information available	142
HENNEKE-MONTARA-OKIOTA (CA234)	Henneke: Very Severe	15
MERCED-TEMPLE-GRANGEVILLE (CA301)	No information available	21
MERRITT-COLUMBIA-TUJUNGA (CA468)	No information available	109
MILLSHOLM-FIFIELD-HONKER (CA369)	Millsholm: Moderate to High	126
MILLSHOLM-LOS OSOS-LOS GATOS (CA235)	Millsholm: Moderate to High	366
ONEIL-APOLLO-AYAR (CA366)	Oneil: Moderate to High	157
PACHECO-CAMPBELL-CLEAR LAKE (CA575)	No information available	51
PEDCAT-VOLTA-MARCUSE (CA362)	Pedcat: Slight to Moderate	14
PELTIER-EGBERT-RETRYDE (CA473)	No information available	75
REYES-NOVATO-TAMBA (CA202)	Reyes: Not subject to water erosion	59
RINCON FAMILY-MARVIN-TEHAMA (CA489)	No information	285

Table 8: Soil Mapping Units from STATSGO, Erodability from County Soil Surveys, and Acreages for the Modal Alternative

	available	
RINCON-SAN YSIDRO-LINNE (CA253)	No information available	104
ROSSMOOR-RYER-COLUMBIA (CA404)	No information available	29
SACRAMENTO-RYDE-EGBERT (CA488)	No information available	54
SALINAS-MOCHO-CROPLEY (CA548)	No information available	134
SAN JOAQUIN-BRUELLA-KIMBALL (CA411)	No information available	502
SAN JOAQUIN-COMETA-MADERA (CA309)	No information available	545
SAN JOAQUIN-GALT-CAPAY (CA403)	No information available	310
SAN YSIDRO-ANTIOCH-CAPAY (CA491)	No information available	96
SYCAMORE-YOLO-LAUGENOUR (CA244)	Sycamore: T=5	195
TIERRA-URBAN LAND-PERKINS (CA243)	Tierra: T=1	64
TOKAY-GREENFIELD-ACAMPO (CA475)	No information available	556
TRIANGLE-TURLOCK-BRITTO (CA361)	Triangle: Slight	79
URBAN LAND-CLEAR LAKE-NOVATO (CA214)	Urban Land: Not classified	314
URBAN LAND-SIRDRAK-BARNABE (CA587)	Urban Land: Not classified	34
URBAN LAND-XERORTHENTS-BOTELLA (CA595)	Urban Land: Not classified	692
VERNALIS-SAN EMIGDIO-GARRETSON (CA484)	Vernalis: Slight	165
WAUKENA-FRESNO-WILLOWS (CA476)	No information available	48
WILLOWS-CLEAR LAKE-PACHECO (CA568)	No information available	13
WOO-STANISLAUS-PAVER (CA364)	Woo: Slight	486
YOLO-BRENTWOOD-SYCAMORE (CA490)	No information available	438
YOLO-PLEASANTON-MOCHO (CA221)	No information available	2
ZACHARIAS-YOKOHL-HONCUT (CA317)	No information available	162
SOIL MAP UNIT NOT IDENTIFIED	No information	31

Table 8: Soil Mapping Units from STATSGO, Erodability from County Soil Surveys, and Acreages for the Modal Alternative		
	available	

1 = Source: Ferrari and McElhiney (2002); Kashiwagi and Hokholt (1991); Welch (1981)

Table 9: Soil Mapping Units and Acreages from STATSGO, and Erodability from County Soil Surveys for the San Francisco to San Jose Segment

Soil Mapping Unit	Erodability[1]	Acreage
BARNABE-CANDLESTICK-BURIBURI (CA590)	Barnabe: High; Candlestick: High	12
BOTELLA-URBAN LAND-XERORTHENTS (CA596)	Botella: Slight	473
REYES-NOVATO-TAMBA (CA202)	Reyes: Not subject to water erosion	78
URBAN LAND-SIRDRAK-BARNABE (CA587)	Sirdrak: Moderate to High; Barnabe: High	23
URBAN LAND-XERORTHENTS-BOTELLA (CA595)	Botella: Slight	609

1 = Source: Kashiwagi and Hokholt (1991)

Table 10: Soil Mapping Units and Acreages from STATSGO, and Erodability from County Soil Surveys for the Oakland to San Jose East Segment

Soil Mapping Unit	Erodability[1]	Acreage
BAYWOOD VARIANT-URBAN LAND-BAYWOOD (CA241)	Baywood Variant: T=5	109
BOTELLA-URBAN LAND-XERORTHENTS (CA596)	Botella: T=5	133
CLEAR LAKE-PESCADERO-CROPLEY (CA240)	Clear Lake: T=5	156
CLEAR LAKE-WRIGHT-HAIRE (CA203)	Clear Lake: T=5	14
DANVILLE-BOTELLA-URBAN LAND (CA242)	Danville: T=5	351
MILLSHOLM-LOS OSOS-LOS GATOS (CA235)	Millsholm: Moderate to High	40
REYES-NOVATO-TAMBA (CA202)	Reyes: T=1	24
SYCAMORE-YOLO-LAUGENOUR (CA244)	Sycamore: T=5	133
TIERRA-URBAN LAND-PERKINS (CA243)	Tierra: T=1	17
URBAN LAND-CLEAR LAKE-NOVATO (CA214)	Urban Land: Not classified	152

1 = Source: Welch (1981)

Table 11: Soil Mapping Units and Acreages from STATSGO and Erodability from County Soils Surveys for the Oakland to San Jose West Segment

Soil Mapping Unit	Erodability[1]	Acreage
BAYWOOD VARIANT-URBAN LAND-BAYWOOD (CA241)	Baywood Variant: T=5	109
BOTELLA-URBAN LAND-XERORTHENTS (CA596)	Botella: T=5	144
CLEAR LAKE-PESCADERO-CROPLEY (CA240)	Clear Lake: T=5	136
CLEAR LAKE-WRIGHT-HAIRE (CA203)	Clear Lake: T=5	14
DANVILLE-BOTELLA-URBAN LAND (CA242)	Danville: T=5	346
MILLSHOLM-LOS OSOS-LOS GATOS (CA235)	Millsholm: Moderate to High	45
REYES-NOVATO-TAMBA (CA202)	Reyes: T=1	140
SYCAMORE-YOLO-LAUGENOUR (CA244)	Sycamore: T=5	143
TIERRA-URBAN LAND-PERKINS (CA243)	Tierra: T=1	17
URBAN LAND-CLEAR LAKE-NOVATO (CA214)	Urban Land: Not classified	152

1 = Source: Welch (1981)

Table 12: Soil Mapping Units and Acreages from STATSGO, and Erodability from County Soils Surveys for the "Diablo Direct" Northern Alignment Option

Soil Mapping Unit	Erodability[1]	Acreage
ARBURUA-WISFLAT-BADLAND (CA367)	Arburua: Moderate to Severe; Wisflat: Severe	241
AZULE-INKS-ALTAMONT (CA577)	Altamont: High	32
BOTELLA-URBAN LAND-XERORTHENTS (CA596)	Botella: T=5	272
CAPAY-ZACHARIAS-STOMAR (CA485)	Capay: Slight	18
DAMLUIS-BAPOS-LOS BANOS (CA365)	Damluis: Slight	23
DELHI-HILMAR-ATWATER (CA318)	No information available	873
EDMINSTER-KESTERSON-DOSPALOS (CA359)	Kesterson: Slight	29
GAVIOTA-VALLECITOS-LOS GATOS (CA578)	Gaviota: Very Severe	143
GAVIOTA-VALLECITOS-PARRISH (CA579)	Gaviota: Very Severe	449
HENNEKE-MONTARA-OKIOTA (CA234)	Henneke: Very Severe	37
MERRITT-COLUMBIA-TUJUNGA (CA468)	Merritt: Slight	64
SALINAS-MOCHO-CROPLEY (CA548)	No information available	10
VERNALIS-SAN EMIGDIO-GARRETSON (CA484)	Vernalis: Slight	158
WAUKENA-FRESNO-WILLOWS (CA476)	No information available	27

1 = Source: Ferrari and McElhiney (2002); Lindsey 1974

Table 13: Soil Mapping Units and Acreages from STATSGO, and Erodability from County Soils Surveys for the "Diablo Direct" Minimize Tunnel Alignment Option

Soil Mapping Unit	Erodability[1]	Acreage
ARBURUA-WISFLAT-BADLAND (CA367)	Arburua: Moderate to Severe; Wisflat: Severe	137
AZULE-INKS-ALTAMONT (CA577)	No information available	56
BOTELLA-URBAN LAND-XERORTHENTS (CA596)	Botella: T=5	285
CAPAY-ZACHARIAS-STOMAR (CA485)	Capay: Slight	98
DELHI-HILMAR-ATWATER (CA318)	No information available	873
EDMINSTER-KESTERSON-DOSPALOS (CA359)	Kesterson: Slight	29
GAVIOTA-VALLECITOS-LOS GATOS (CA578)	Gaviota: Very Severe	142
GAVIOTA-VALLECITOS-PARRISH (CA579)	Gaviota: Very Severe	305
HENNEKE-MONTARA-OKIOTA (CA234)	Henneke: Very Severe	128
HONKER-GONZAGA-VALLECITOS (CA499)	Honker: Moderate	47
MERRITT-COLUMBIA-TUJUNGA (CA468)	No information available	64
VERNALIS-SAN EMIGDIO-GARRETSON (CA484)	Vernalis: Slight	187
WAUKENA-FRESNO-WILLOWS (CA476)	No information available	27

1 = Source: Ferrari and McElhiney (2002); Lindsey 1974

Table 14: Soil Mapping Units and Acreages from STATSGO, and Erodability from County Soils Surveys for the "Diablo Direct" Tunnel under Henry Coe Park Option

Soil Mapping Unit	Erodability[1]	Acreage
ARBURUA-WISFLAT-BADLAND (CA367)	Arburua: Moderate to Severe; Wisflat: Severe	136
AZULE-INKS-ALTAMONT (CA577)	No information available	68
BOTELLA-URBAN LAND-XERORTHENTS (CA596)	Botella: T=5	204
CAPAY-ZACHARIAS-STOMAR (CA485)	Capay: Slight	99
DELHI-HILMAR-ATWATER (CA318)	No information available	873
EDMINSTER-KESTERSON-DOSPALOS (CA359)	Kesterson: Slight	29
GAVIOTA-VALLECITOS-LOS GATOS (CA578)	Gaviota: Very Severe	119
GAVIOTA-VALLECITOS-PARRISH (CA579)	Gaviota: Very Severe	295
HENNEKE-MONTARA-OKIOTA (CA234)	Henneke: Very Severe	141
HONKER-GONZAGA-VALLECITOS (CA499)	Honker: Moderate	56
MERRITT-COLUMBIA-TUJUNGA (CA468)	No information available	64
VERNALIS-SAN EMIGDIO-GARRETSON (CA484)	Vernalis: Slight	187
WAUKENA-FRESNO-WILLOWS (CA476)	No information available	27

1 = Source: Ferrari and McElhiney (2002); Lindsey 1974, Nazar 1990

Table 15: Soil Mapping Units and Acreages from STATSGO and Erodability from County Soils Surveys for the "State Route 152" Gilroy Bypass Option

Soil Mapping Unit	Erodability[1]	Acreage
ARBUCKLE-PLEASANTON-SAN YSIDRO (CA574)	Arbuckle: Slight	361
BOTELLA-URBAN LAND-XERORTHENTS (CA596)	Botella: T=5	406
DAMLUIS-BAPOS-LOS BANOS (CA365)	Damluis: Slight; Bapos: Slight; Los Banos: Slight	115
DIABLO-SAN BENITO-SHERIDAN (CA572)	No information available	31
DOSAMIGOS-DELDOTA-CHATEAU (CA363)	Dosamigos: Slight	41
DOSPALOS-BOLFAR-ALROS (CA360)	Dospalos: Slight	293
FRESNO-DINUBA-LEWIS (CA304)	No information available	76
GAVIOTA-VALLECITOS-LOS GATOS (CA578)	Gaviota: Very Severe	244
GRANGEVILLE-PACHAPPA-TRAVER (CA392)	No information available	514
HENNEKE-MONTARA-OKIOTA (CA234)	Henneke: Very Severe	1
HONKER-GONZAGA-VALLECITOS (CA499)	Honker: Moderate	42
MERCED-TEMPLE-GRANGEVILLE (CA301)	No information available	43
MILLSHOLM-FIFIELD-HONKER (CA369)	Millsholm: Moderate to High	109
ONEIL-APOLLO-AYAR (CA366)	Oneil: Moderate to High	32
PACHECO-CAMPBELL-CLEAR LAKE (CA575)	No information available	113
PEDCAT-VOLTA-MARCUSE (CA362)	Pedcat: Slight to Moderate	99
SALINAS-MOCHO-CROPLEY (CA548)	No information available	67
SAN JOAQUIN-COMETA-MADERA (CA309)	No information available	394
TRIANGLE-TURLOCK-BRITTO (CA361)	Triangle: Slight	67
WILLOWS-CLEAR LAKE-PACHECO (CA568)	No information available	27
WOO-STANISLAUS-PAVER (CA364)	Woo: Slight	94

1 = Source: Ferrari and McElhiney (2002); Lindsey 1974; Nazar 1990

Table 16: Soil Mapping Units and Acreages from STATSGO, and Erodability from County Soils Surveys for the "State Route 152" Gilroy Siding 145 kph Option

Soil Mapping Unit	Erodability[1]	Acreage
ARBUCKLE-PLEASANTON-SAN YSIDRO (CA574)	Arbuckle: Slight	345
BOTELLA-URBAN LAND-XERORTHENTS (CA596)	Botella: T=5	406
DAMLUIS-BAPOS-LOS BANOS (CA365)	Damluis: Slight; Bapos: Slight; Los Banos: Slight	115
DIABLO-SAN BENITO-SHERIDAN (CA572)	No information available	23
DOSAMIGOS-DELDOTA-CHATEAU (CA363)	Dosamigos: Slight	41
DOSPALOS-BOLFAR-ALROS (CA360)	Dospalos: Slight	293
FRESNO-DINUBA-LEWIS (CA304)	No information available	76
GAVIOTA-VALLECITOS-LOS GATOS (CA578)	Gaviota: Very Severe	235
GRANGEVILLE-PACHAPPA-TRAVER (CA392)	No information available	514
HENNEKE-MONTARA-OKIOTA (CA234)	Henneke: Very Severe	1
HONKER-GONZAGA-VALLECITOS (CA499)	Honker: Moderate	42
MERCED-TEMPLE-GRANGEVILLE (CA301)	No information available	43
MILLSHOLM-FIFIELD-HONKER (CA369)	Millsholm: Moderate to High	109
ONEIL-APOLLO-AYAR (CA366)	Oneil: Moderate to High	32
PACHECO-CAMPBELL-CLEAR LAKE (CA575)	No information available	59
PEDCAT-VOLTA-MARCUSE (CA362)	Pedcat: Slight to Moderate	99
SALINAS-MOCHO-CROPLEY (CA548)	No information available	139
SAN JOAQUIN-COMETA-MADERA (CA309)	No information available	394
TRIANGLE-TURLOCK-BRITTO (CA361)	Triangle: Slight	67
WILLOWS-CLEAR LAKE-PACHECO (CA568)	No information available	132
WOO-STANISLAUS-PAVER (CA364)	Woo: Slight	94

1 = Source: Ferrari and McElhiney (2002); Lindsey 1974; Nazar 1990

Table 17: Soil Mapping Units and Acreages from STATSGO and Erodability from County Soils Surveys for the "State Route 152" Gilroy Station Option

Soil Mapping Unit	Erodability[1]	Acreage
ARBUCKLE-PLEASANTON-SAN YSIDRO (CA574)	Arbuckle: Slight	345
BOTELLA-URBAN LAND-XERORTHENTS (CA596)	Botella: T=5	406
DAMLUIS-BAPOS-LOS BANOS (CA365)	Damluis: Slight; Bapos: Slight; Los Banos: Slight	115
DIABLO-SAN BENITO-SHERIDAN (CA572)	No information available	23
DOSAMIGOS-DELDOTA-CHATEAU (CA363)	Dosamigos: Slight	41
DOSPALOS-BOLFAR-ALROS (CA360)	Dospalos: Slight	293
FRESNO-DINUBA-LEWIS (CA304)	No information available	76
GAVIOTA-VALLECITOS-LOS GATOS (CA578)	Gaviota: Very Severe	235
GRANGEVILLE-PACHAPPA-TRAVER (CA392)	No information available	514
HENNEKE-MONTARA-OKIOTA (CA234)	Henneke: Very Severe	1
HONKER-GONZAGA-VALLECITOS (CA499)	Honker: Moderate	42
MERCED-TEMPLE-GRANGEVILLE (CA301)	No information available	43
MILLSHOLM-FIFIELD-HONKER (CA369)	Millsholm: Moderate to High	109
ONEIL-APOLLO-AYAR (CA366)	Oneil: Moderate to High	32
PACHECO-CAMPBELL-CLEAR LAKE (CA575)	No information available	65
PEDCAT-VOLTA-MARCUSE (CA362)	Pedcat: Slight to Moderate	99
SALINAS-MOCHO-CROPLEY (CA548)	No information available	120
SAN JOAQUIN-COMETA-MADERA (CA309)	No information available	394
TRIANGLE-TURLOCK-BRITTO (CA361)	Triangle: Slight	67
WILLOWS-CLEAR LAKE-PACHECO (CA568)	No information available	119
WOO-STANISLAUS-PAVER (CA364)	Woo: Slight	94

1 = Source: Ferrari and McElhiney (2002); Lindsey 1974; Nazar 1990

Table 18: Groundwater Basin Acreage from Raw GIS Data, Bay Area to Merced Region

Groundwater Sub-basin Name	Modal	San Francisco to San Jose	Oakland to San Jose East Branch	Oakland to San Jose West Branch	Merced to San Jose North Line Northern Alignment Option	Merced to San Jose North Line Minimize Tunnel Option	Merced to San Jose North Line Tunnel Under Henry Coe Option	Merced to San Jose South Line State Route 152 Gilroy Bypass Option	Merced to San Jose South Line 145 kph Siding Option	Merced to San Jose South Line Gilroy Station Option
BOLSA AREA	20							21	90	80
CASTRO VALLEY	32									
CHOWCHILLA	687							798	798	798
COSUMNES	719									
DELTA-MENDOTA	2303				234	251	252	688	688	688
DOWNTOWN	95	94								
EAST BAY PLAIN	803		586	602						
EASTERN SAN JOAQUIN	1629									
HOLLISTER AREA	161							89	112	110
ISLAIS VALLEY	23	44								
LIVERMORE VALLEY	338									
LLAGAS AREA	406							369	384	372
MADERA	542							205	205	205
MERCED	947				265	265	265			
MODESTO	241									
NAPA-SONOMA LOWLANDS	88									
NILES CONE	312		327	383						

Groundwater Sub-basin Name	Modal	San Francisco to San Jose	Oakland to San Jose East Branch	Oakland to San Jose West Branch	Merced to San Jose North Line Northern Alignment Option	Merced to San Jose North Line Minimize Tunnel Option	Merced to San Jose North Line Tunnel Under Henry Coe Option	Merced to San Jose South Line State Route 152 Gilroy Bypass Option	Merced to San Jose South Line 145 kph Siding Option	Merced to San Jose South Line Gilroy Station Option
NORTH AMERICAN	112									
SAN MATEO PLAIN	423	283								
SANTA CLARA[1]	1002	416	215	250	269	271	268	483	483	483
SOLANO	465									
SOUTH AMERICAN	1049									
SOUTH SAN FRANCISCO	33	32								
SUISUN-FAIRFIELD VALLEY	219									
TRACY	743									
TURLOCK	518				725	725	725			
VISITACION VALLEY	90	94								
WESTSIDE	192	196								
YOLO	397									

1 = The Santa Clara Basin/Sub-basin includes the “Coyote Sub-basin” (see groundwater basin narratives).