

CALIFORNIA HIGH-SPEED TRAIN PROJECT EIR/EIS

DRAFT

The California High-Speed Train Project
Environmental Impact Report/ Environmental
Impact Statement
and

DRAFT

Section 4(f) Statement

Merced to Fresno Section

VOLUME I:

REPORT

Prepared by:

California High-Speed Rail Authority
770 L Street, Suite 800
Sacramento, CA 95814
Contact: Mr. Dan Leavitt
916-324-1541

USDOT Federal Railroad Administration
1200 New Jersey Avenue SE MS-20
Washington, D.C. 20590
Contact: Mr. David Valenstein
202-493-6381

Cooperating Agency:

U.S. Army Corps of Engineers
650 Capitol Mall, Suite 5-200
Sacramento, CA 95814
Contact: Mr. Zachary Simmons
916-557-6746

August 2011

California High-Speed Rail Authority and Federal Railroad Administration.
2011. *Merced to Fresno Section California High-Speed Train (HST) Draft
Project Environmental Impact Report/Environmental Impact Statement
(EIR/EIS) and Draft Section 4(f) Statement*. Volume I: Report.
Sacramento, CA, and Washington, DC. August 2011.

California High-Speed Train: Merced to Fresno Section

Draft Environmental Impact Report/Environmental Impact Statement and Draft Section 4(f) Statement

Pursuant to:

California Environmental Quality Act, P.R.C. 21000 et seq.; State of California CEQA Guidelines, California Administrative Code, 15000 et seq.; and National Environmental Policy Act (42 U.S.C. 4332 et seq.) 40 C.F.R. Part 1500 and 64 Fed. Reg. 28545

Prepared by the
California High-Speed Rail Authority
and the
Federal Railroad Administration

With Cooperating Agency:
U.S. Army Corps of Engineers

Roelof van Ark, Chief Executive Officer
California High-Speed Rail Authority

Joseph C. Szabo, Administrator
Federal Railroad Administration
U.S. Department of Transportation

Date: _____

Date: _____

The following individuals may be contacted for additional information concerning this document:

Mr. Dan Leavitt
California High-Speed Rail Authority
770 L Street, Suite 800
Sacramento, CA 95814

Mr. David Valenstein
Federal Railroad Administration
MS-20, W38-303
1200 New Jersey Avenue, SE
Washington, DC 20590

Abstract: This document considers, describes and summarizes the environmental impacts of the Merced to Fresno Section High-Speed Train (HST) Project, an approximately 80-mile portion of a larger HST system which is intended to connect to sections traveling west to San Francisco, south to Los Angeles and later, north to Sacramento. The project is designed as a steel-wheel-on-steel-railway completely grade separated from other modes. The need for this project is directly related to the population growth and increased intercity travel demand over the next 20 years and beyond and the increased travel delays and congestion that would result on California's highways and airports. Additionally, the Merced, Madera, and Fresno Counties have limited connectivity with the state's larger urban metropolitan areas. Four alternatives are considered in this Draft EIR/EIS, the No Project Alternative and the three HST alternatives: the UPRR/SR 99, BNSF, and the Hybrid alternatives. Each contains one station in Merced and one in Fresno. The HST in this section has the ability to travel up to 220 mph along the alignment. Potential environmental impacts of the alternatives include displacement of commercial, residential and agricultural properties; community and neighborhood disruption; increase in noise; increase in traffic at each of the stations; impacts on historic and archaeological sites; impacts on parks and recreational resources; visual impacts; impacts on sensitive biological resources and wetlands; and use of energy. Mitigation measures are described to address impacts identified in the Draft EIR/EIS.

This California High-Speed Train (HST) Project Environmental Impact Report/Environmental Impact Statement (EIR/EIS) is being made available to the public in accordance with the California Environmental Quality Act and the National Environmental Policy Act.

Visit the California High-Speed Rail Authority Web Site (www.cahighspeedrail.ca.gov), where you can:

- View and download the Draft EIR/EIS.
- Request a CD-ROM of the Draft EIR/EIS.
- Locate a library near you to review a hardcopy of the Draft EIR/EIS.

Printed copies have been placed in the main public libraries in the following cities and communities: Merced, Chowchilla, Madera, Fresno, Atwater, Fairmead, Le Grand, and Los Banos.

Fact Sheet

Project Name

California High-Speed Train Project, Merced to Fresno Section

Project Description

The California High-Speed Train Project, Merced to Fresno Section, proposes to build and operate an 80-mile portion of a larger high-speed train (HST) system which is intended to connect to sections traveling west to San Francisco, south to Los Angeles, and later north to Sacramento. The project is designed as a steel-wheel-on-steel-railway completely grade-separated from other modes. The need for this project is directly related to the population growth and increased intercity travel demand projected over the next 20 years and beyond and the increased travel delays and congestion that would result on California's highways and at airports. Additionally, Merced, Madera, and Fresno counties currently have limited connectivity with the state's larger urban metropolitan areas.

This Draft Project Environmental Impact Report/Environmental Impact Statement (EIR/EIS) considers four alternatives, including the No Project Alternative and the three HST alternatives: the UPRR/SR 99, BNSF, and the Hybrid alternatives. Each contains one HST station in Merced and one in Fresno. The HST in this section would have the ability to travel up to 220 miles per hour along the alignment. Potential environmental impacts of the alternatives include displacement of commercial, residential, and agricultural properties; community and neighborhood disruption; increase in noise; increase in traffic at each of the stations; impacts on historic and archaeological sites; impacts on parks and recreational resources; visual impacts; impacts on sensitive biological resources and wetlands; and use of energy. Mitigation measures are described to address impacts identified in the Draft Project EIR/EIS.

Joint Lead Agencies

Federal Railroad Administration
1200 New Jersey Avenue SE MS-20
Washington, D.C. 20590

California High-Speed Rail Authority
770 L Street, Suite 800
Sacramento, CA 95814

National Environmental Policy Act (NEPA) Lead Agency

The Federal Railroad Administration is the lead agency for NEPA.

Responsible NEPA Official

David Valenstein, Chief
Environmental and Systems Planning Division
Federal Railroad Administration
1200 New Jersey Avenue, SE, MS-20, W38-303
Washington, DC 20590

California Environmental Quality Act (CEQA) Lead Agency

The California High-Speed Rail Authority is the lead agency for CEQA.

Responsible CEQA Official

Roelof van Ark, Chief Executive Officer
California High-Speed Rail Authority
770 L Street, Suite 800
Sacramento, CA 95814

Document Availability

The Draft EIR/EIS is available online at:
<http://www.cahighspeedrail.ca.gov/>

Printed copies of the Draft EIR/EIS, as well as related appendices and technical reports, are available at the California High-Speed Rail Authority, public libraries, and community centers (see List of Recipients beginning on page 8-1).

Contact Information

To obtain a copy of the environmental documents, contact:

Jeff Hardoin
California High-Speed Rail Authority
770 L Street, Suite 800
Sacramento, CA 95814
(916) 324-1541
E-mail: jhardoin@hsr.ca.gov

Permits, Approvals, and Consultations

Federal

- **U.S. Army Corps of Engineers** – Section 404 Permit for Discharge of Dredge or Fill Materials into Waters of the U.S., including wetlands. Also, Section 10 Permit for construction of any structure in or over any Navigable Water of the U.S.
- **U.S. Environmental Protection Agency** – review of Environmental Justice conclusions; General Conformity Determination.
- **National Marine Fisheries Service and US. Fish and Wildlife Service** – Section 7 Endangered Species Act (ESA) Consultation and Marine Mammal Protection Act Consultation.
- **Federal Railroad Administration, in consultation with the California Office of Historic Preservation and the Advisory Council on Historic Preservation** – National Historic Preservation Act, Section 106 Consultation.
- **U.S. Department of Transportation** – Section 4(f) Evaluation.

State

- **California Department of Fish and Game – California Endangered Species Act (CESA)** permits; Section 1602 Lake and Streambed Alteration Agreement; use of Title 14 lands along the San Joaquin River (Camp Pashayan).

- **California Department of Transportation** – Encroachment permits.
- **California Public Utilities Commission** – approval for construction and operation of railroad crossing of public roads and for construction of new transmission lines and substations.
- **California State Lands Commission** – lease for crossing state sovereign lands.

Regional

- **San Joaquin Valley Air Pollution Control District** – Permits under Rule 201, General Permit Requirements; Rule 403, Fugitive Dust; Rule 442 Architectural Coatings; Rule 902 Asbestos.
- **Regional Water Quality Control Board – Permits** under Clean Water Act Section 401 Water Quality Certification; Section 402 National Pollutant Discharge Elimination System (NPDES) Water Discharge Permit; Dewatering Permit (Order No. 98-67); Spill Prevention, Control, and Countermeasures (SPCC) Plan (part of Section 402 process); Stormwater Construction and Operation Permit.
- **Central Valley Flood Protection Board – Section 408** (flood protection facilities).

Authors and Principal Contributors

Please see List of Preparers in Chapter 9 of the Draft EIR/EIS.

Date Issued

August 2011

Subsequent Environmental Review

After circulation of the Draft EIR/EIS and consideration of comments received, the California High-Speed Rail Authority Board will identify a preferred alternative. Following this action, the Authority and FRA will prepare the Final EIR/EIS. The Final EIR/EIS will document and address comments received on the Draft

EIR/EIS. Following completion of the Final EIR/EIS, the Board will consider certifying the Final EIR/EIS for compliance with CEQA and making a final decision on the project. FRA's decision under NEPA is not final until it certifies the ROD on the Final EIR/EIS. Certification of the ROD is expected in spring 2012.

Preface

What Is This Document?

The California High-Speed Rail Authority (Authority) proposes to construct, operate, and maintain an electric-powered high-speed train (HST) system in California. When completed, the nearly 800-mile HST system will provide new passenger rail service to California's major metropolitan areas and through the counties that are home to more than 90% of the state's population. The Merced to Fresno Section of the California HST System is a critical link connecting the Bay Area HST sections north and south to the rest of the system.

This Project Environmental Impact Report/Environmental Impact Statement (EIR/EIS) is the next step in the environmental process after the development and certification of the *2005 Final Program Environmental Impact Report/Environmental Impact Statement for the Proposed California High-Speed Train System* (referred to hereafter as the Statewide Program EIR/EIS) and the *2008 Bay Area to Central Valley High-Speed Train Final Program Environmental Impact Report/Environmental Impact Statement* (referred to hereafter as the Bay Area to Central Valley Program EIR/EIS) and the *2010 Bay Area to Central Valley Revised Final Program Environmental Impact Report*. The Authority and the Federal Railroad Administration (FRA) have prepared this Project EIR/EIS for the Merced to Fresno Section of the California HST System in compliance with the National Environmental Policy Act (NEPA) and California Environmental Quality Act (CEQA). Because of the highly technical and complex nature of the proposed Merced to Fresno Section of the HST project, this EIR/EIS contains more information than is mandated by either the federal or state statutory and regulatory requirements.

This Project EIR/EIS does the following:

- Describes the HST alternatives and their potential impacts.
- Provides environmental information to assist decision-makers in selecting the project to be built.
- Identifies measures to avoid and minimize impacts, and, when necessary, compensate for adverse impacts.
- Considers cumulative impacts as part of the environmental review process.

How Do I Use This Document?

The purpose of environmental documents prepared under NEPA and CEQA is to disclose information to decision makers and the public. While the science and analysis that supports this Project EIR/EIS is complex, this document is intended for the general public. Every attempt has been made to limit technical terms and the use of acronyms. Where this cannot be avoided, the terms and acronyms are defined the first time they are used.

Volume I of this Project EIR/EIS is organized into 13 chapters and a Summary. Volume II contains technical appendices, and Volume III provides plans and other relevant engineering drawings. For a reader with a limited time to devote to this document, the **Summary** is the place to start. It provides an overview of all of the substantive chapters in this document and includes a table listing the potential environmental impacts at the project level for each environmental resource topic. If the reader begins here but wants more information, the Summary directs the reader where to get details elsewhere in the document.

Chapter 1.0, Project Purpose, Need, and Objectives, explains why the project is proposed and provides a history of the planning process. **Chapter 2.0, Alternatives**, describes the proposed Merced to Fresno Section HST alignment alternatives and design options, HST station alternatives, connections to the Bay Area sections, and heavy maintenance facility alternatives, as well as the No Project Alternative used for purposes of comparison. It contains illustrations and maps and provides a review of construction

activities. These first two chapters help the reader understand what is being analyzed in the remainder of the document.

Chapter 3.0, Affected Environment, Environmental Consequences, and Mitigation Measures is where the reader can find information about the existing transportation, environmental, and social conditions in the area of the proposed project. This chapter provides the findings of the analysis of potential environmental impacts, along with methods to reduce these impacts (called mitigation strategies). Chapter 3 is divided into subsections discussing various environmental resource topics:

- Transportation
- Air Quality and Global Climate Change
- Noise and Vibration
- Electromagnetic Fields and Electromagnetic Interference
- Public Utilities and Energy
- Biological Resources and Wetlands
- Hydrology and Water Resources
- Geology, Soils, and Seismicity
- Hazardous Materials and Waste
- Safety and Security
- Socioeconomics, Communities, and Environmental Justice
- Station Planning, Land Use, and Development
- Agricultural Lands
- Parks, Recreation, and Open Space
- Aesthetics and Visual Quality
- Cultural Resources and Paleontological Resources
- Regional Growth
- Cumulative Impacts

Chapter 4.0, Section 4(f)/Section 6(f) Evaluation summarizes parks, wildlife refuges, and historic properties in accordance with Section 4(f) of the Department of Transportation Act of 1966 and Section 6(f) of the Land and Water Conservation Funds Act. It describes avoidance alternatives and measures to minimize harm to these resources.

Chapter 5.0, Project Costs and Operations, summarizes the estimated capital and operations and maintenance costs for each Merced to Fresno Section alternative evaluated in this Project EIR/EIS, including funding and financial risk.

Chapter 6.0, CEQA/NEPA Decision Process and Other Considerations, summarizes the project's significant adverse environmental effects, the significant adverse environmental effects that cannot be avoided if the project is implemented, and the significant irreversible environmental changes that would occur as a result of the project or irretrievable commitments of resources or foreclosure of future options. Chapter 6 also provides information about identification of the preferred alternative and the least environmentally damaging practicable alternative.

Chapter 7.0, Public and Agency Involvement, contains summaries of coordination and outreach activities with agencies and the general public. **Chapter 8.0, EIR/EIS Distribution**, identifies individuals and organizations informed of the availability of the Project EIR/EIS. **Chapter 9.0, List of Preparers**, provides the names and responsibilities of the authors of the Project EIR/EIS. **Chapter 10.0, References/Sources Used in Document Preparation**, cites the references and contacts used in writing this document. **Chapter 11.0, Glossary of Terms**, provides a definition of certain terms used in the Project EIR/EIS. **Chapter 12.0, Index**, provides a tool to cross-reference major topics used in the Project EIR/EIS. Finally, **Chapter 13.0, Acronyms and Abbreviations**, defines the acronyms and abbreviations used in this document.

Appendices and Technical Reports provide additional details on the project and Draft EIR/EIS process. Technical appendices, included in Volume II, are related to the affected environment and

environmental consequences analyses. These appendices are numbered to match their corresponding environmental elements in Chapter 3, as well as Chapter 2, of the Project EIR/EIS. Detailed technical reports prepared for transportation; air quality and global climate change; noise and vibration; biological resources and wetlands; hydrology and water resources; geology, soils, and seismicity; hazardous wastes/materials; acquisitions and relocations; socioeconomics; aesthetics and visual quality; cultural resources; and paleontological resources; as well as other sections as identified in the Draft EIR/EIS, are available on DVD. Volume III, Alignments and Other Plans, also available on DVD, presents the design drawings, including trackway and roadway crossing design. These documents are also available at www.cahighspeedrail.ca.gov and at locations identified on Chapter 8, EIR/EIS Distribution.

What Happens Next?

Public Review of the Draft EIR/EIS

The Authority and FRA are widely circulating the Draft EIR/EIS to affected local jurisdictions, state and federal agencies, tribes, community organizations, other interest groups, and interested individuals. The document is also available at Authority offices, public libraries, and community centers. Those who wish to review and/or comment are provided a formal public comment period following the date of issuance of the document. In addition, public hearings will be held during the comment period to receive oral testimony.

Identification of Preferred Alternative

It is anticipated that the California High-Speed Rail Authority Board will identify a preferred alternative after the Board considers the information in the Project EIR/EIS, public and agency comments on the Draft EIR/EIS, and other relevant information. The board will not make a final decision on the project alternative to be implemented until after the Final Project EIR/EIS is issued. The preferred alternative is called a "preferred alternative" by FRA to make clear that the federal government has not made a decision until it issues a Record of Decision (ROD) after completion of the Final EIR/EIS.

Final EIR/EIS and Project Decision

After circulation of the Draft EIR/EIS and consideration of comments received, the Authority and FRA will prepare the Final EIR/EIS. The Final EIR/EIS will document and address comments received on the Draft EIR/EIS. It will also describe the preferred alternative and proposed mitigation commitments associated with the Merced to Fresno Section. Following completion of the Final EIR/EIS, the Board will consider certifying the Final EIR/EIS for compliance with CEQA and making a final decision on the project. If the Board certifies the Final EIR/EIS and makes a project decision, it will file a notice of determination with the State Clearinghouse. FRA's decision under NEPA is not final until it certifies the ROD on the Final EIR/EIS.

Federal Approval

FRA will issue a decision document referred to as the federal ROD. The ROD states FRA's decision on the project, identifies the alternatives considered by the FRA in reaching its decision, and itemizes the Authority's commitments to mitigate project impacts. Issuance of the ROD is a prerequisite for any federal funding or approvals.

Merced to Fresno HST Milestone Schedule

August 2011	Public release of Draft EIR/EIS
February 2012	Final EIR/EIS published
March 2012	Notice of Determination and Record of Decision
2011 through 2013	Final design/permitting

December 2012	Property acquisition begins
Spring 2013	Construction begins
2019	Operation begins

The schedule for final design, construction, and operation will be refined as the project moves closer to the end of the environmental review and preliminary design phase. The Authority envisions that service would be provided between Merced and Fresno by 2020.

Table of Contents

Fact Sheet	v
Preface	ix
List of Tables	xxi
List of Figures.....	xxviii
Summary	S-1
S.1 Introduction and Background.....	S-1
S.2 Tiered Environmental Review: Final Statewide Program EIR/EIS and Merced to Fresno Section Project EIR/EIS.....	S-1
S.3 Issues Raised During the Scoping Process	S-4
S.4 Purpose of and Need for the HST System and the Merced to Fresno HST Section	S-4
S.4.1 Purpose of the HST System	S-4
S.4.2 Purpose of the Merced to Fresno Section	S-4
S.4.3 Objectives and Policies for the HST System in California and within the Central Part of the San Joaquin Valley Region	S-5
S.4.4 Need for the HST System Statewide and within the Central San Joaquin Valley Region	S-5
S.5 Alternatives	S-6
S.5.1 No Project Alternative	S-6
S.5.2 Merced to Fresno Section High-Speed Train Alternatives	S-7
S.5.3 Station Area Development	S-8
S.5.4 Heavy Maintenance Facility.....	S-8
S.6 Measures to Avoid and Minimize Impacts	S-9
S.7 No Project Alternative Impacts.....	S-9
S.8 HST Alternatives Evaluation	S-12
S.8.1 HST Benefits.....	S-13
S.8.2 Adverse Effects Common to All HST Alternatives	S-14
S.8.3 Comparison of HST Alternatives	S-17
S.8.4 Capital Cost	S-22
S.8.5 Section 4(f) Resources	S-24
S.8.6 Section 6(f) Resource	S-25
S.9 Areas of Controversy	S-25
S.10 Next Steps in the Environmental Process	S-26
S.10.1 Public and Agency Comment.....	S-26
S.10.2 Identification of Preferred Alternative	S-26
1.0 Project Purpose, Need, and Objectives	1-1
1.1 Introduction.....	1-1
1.2 Purpose of and Need for the HST System and the Merced to Fresno HST Section.....	1-3
1.2.1 Purpose of HST System	1-3
1.2.2 Purpose of the Merced to Fresno HST Section.....	1-4
1.2.3 CEQA Project Objectives for the HST System in California and in the Central Part of the San Joaquin Valley Region.....	1-4
1.2.4 Statewide and Regional Need for the HST System within the Merced to Fresno Section	1-5
1.3 Relationship to Other Agency Plans and Policies.....	1-20
1.4 Relationship to Other Transportation Projects and Plans in the Study Area	1-23

2.0 Alternatives	2-1
2.1 Background	2-1
2.1.1 California HST Project Background	2-1
2.1.2 Merced to Fresno Section EIR/EIS Background	2-2
2.2 HST System Infrastructure	2-2
2.2.1 System Design Performance, Safety, and Security.....	2-2
2.2.2 Vehicles.....	2-5
2.2.3 Stations.....	2-6
2.2.4 Infrastructure Components.....	2-8
2.2.5 Grade Separations.....	2-9
2.2.6 Railroad Wye	2-10
2.2.7 Traction Power Distribution.....	2-13
2.2.8 Track Structure.....	2-15
2.2.9 Maintenance Facilities	2-15
2.3 Potential Alternatives Considered during Alternatives Screening Process	2-17
2.3.1 HST Project-Level Alternatives Development Process.....	2-18
2.3.2 Range of Potential Alternatives Considered and Findings	2-18
2.3.3 Summary of Design Features for Alternatives Being Carried Forward.....	2-23
2.4 Alignment, Station, and Heavy Maintenance Facility Alternatives Evaluated in this Project EIR/EIS	2-26
2.4.1 No Project Alternative—Existing and Planned Improvements.....	2-26
2.4.2 UPRR/SR 99 Alternative.....	2-40
2.4.3 BNSF Alternative	2-58
2.4.4 Hybrid Alternative	2-68
2.4.5 Modification of Caltrans/State Facilities.....	2-76
2.4.6 Proposed Heavy Maintenance Facility Locations	2-82
2.5 Travel Demand and Ridership Forecasts	2-89
2.5.1 Ridership and HST System Design.....	2-89
2.5.2 Ridership and Environmental Impact Analysis	2-90
2.5.3 Ridership and Station Area Parking	2-90
2.6 Operations and Service Plan	2-91
2.6.1 HST Service	2-91
2.6.2 Maintenance Activities	2-93
2.7 Additional High-Speed Train Development Considerations	2-94
2.7.1 High-Speed Train, Land Use Patterns, and Development around High-Speed Train Stations	2-94
2.8 Construction Plan.....	2-96
2.8.1 General Approach	2-96
2.8.2 Major Construction Activities	2-98
2.9 Permits.....	2-101
3.0 Affected Environment, Environmental Consequences, and Mitigation Measures.....	3.1-1
3.1 Introduction.....	3.1-1
3.1.1 Chapter 3 Purpose and Content	3.1-2
3.1.2 Organization of This Chapter	3.1-2
3.1.3 Approach to the Analysis	3.1-3
3.1.4 Legal Authority to Implement Off-Site Mitigation.....	3.1-7
3.2 Transportation	3.2-1
3.2.1 Introduction.....	3.2-1
3.2.2 Laws, Regulations, and Orders.....	3.2-1
3.2.3 Methods for Evaluating Impacts	3.2-3
3.2.4 Affected Environment	3.2-9

3.2.5	Environmental Consequences	3.2-25
3.2.6	Project Design Features.....	3.2-106
3.2.7	Mitigation Measures	3.2-107
3.2.8	NEPA Impacts Summary.....	3.2-126
3.2.9	CEQA Significance Conclusions.....	3.2-127
3.2.10	Potential Future Option for Improved Transportation Connectivity in Merced	3.2-129
3.3	Air Quality and Global Climate Change	3.3-1
3.3.1	Introduction.....	3.3-1
3.3.2	Laws, Regulations, and Orders.....	3.3-1
3.3.3	Methods for Evaluating Impacts	3.3-9
3.3.4	Affected Environment.....	3.3-26
3.3.5	Environmental Consequences	3.3-35
3.3.6	Mitigation Measures	3.3-71
3.3.7	NEPA Impacts Summary.....	3.3-76
3.3.8	CEQA Significance Conclusions.....	3.3-77
3.4	Noise and Vibration.....	3.4-1
3.4.1	Introduction.....	3.4-1
3.4.2	Laws, Regulations and Orders.....	3.4-1
3.4.3	Methods for Evaluating Impacts	3.4-2
3.4.4	Affected Environment.....	3.4-17
3.4.5	Environmental Consequences	3.4-28
3.4.6	Project Design Features.....	3.4-44
3.4.7	Mitigation Measures	3.4-44
3.4.8	NEPA Impacts Summary.....	3.4-58
3.4.9	CEQA Significance Conclusions.....	3.4-58
3.5	Electromagnetic Fields and Electromagnetic Interference.....	3.5-1
3.5.1	Introduction.....	3.5-1
3.5.2	Laws, Regulations, and Orders.....	3.5-2
3.5.3	Methods for Evaluating Impacts	3.5-3
3.5.4	Affected Environment.....	3.5-5
3.5.5	Environmental Consequences	3.5-12
3.5.6	Project Design Features.....	3.5-18
3.5.7	Mitigation Measures	3.5-18
3.5.8	NEPA Impacts Summary.....	3.5-18
3.5.9	CEQA Significance Conclusions.....	3.5-18
3.6	Public Utilities and Energy	3.6-1
3.6.1	Introduction.....	3.6-1
3.6.2	Laws, Regulations, and Orders.....	3.6-1
3.6.3	Methods for Evaluating Impacts	3.6-5
3.6.4	Affected Environment.....	3.6-9
3.6.5	Environmental Consequences	3.6-21
3.6.6	Project Design Features.....	3.6-46
3.6.7	Mitigation Measures	3.6-46
3.6.8	NEPA Impacts Summary.....	3.6-46
3.6.9	CEQA Significance Conclusions.....	3.6-48
3.7	Biological Resources and Wetlands.....	3.7-1
3.7.1	Introduction.....	3.7-1
3.7.2	Laws, Regulations, and Orders.....	3.7-2
3.7.3	Methods for Evaluating Impacts	3.7-5

3.7.4	Affected Environment.....	3.7-9
3.7.5	Environmental Consequences	3.7-43
3.7.6	Mitigation Measures	3.7-105
3.7.7	NEPA Impacts Summary.....	3.7-130
3.7.8	CEQA Significance Conclusions.....	3.7-131
3.8	Hydrology and Water Resources	3.8-1
3.8.1	Introduction.....	3.8-1
3.8.2	Laws, Regulations, and Orders.....	3.8-1
3.8.3	Methods for Evaluating Impacts	3.8-6
3.8.4	Affected Environment.....	3.8-10
3.8.5	Environmental Consequences	3.8-24
3.8.6	Project Design Features.....	3.8-36
3.8.7	NEPA Impacts Summary.....	3.8-39
3.8.8	CEQA Significance Conclusions.....	3.8-39
3.9	Geology, Soils, and Seismicity.....	3.9-1
3.9.1	Introduction.....	3.9-1
3.9.2	Laws, Regulations, and Orders.....	3.9-2
3.9.3	Methods for Evaluating Impacts	3.9-6
3.9.4	Affected Environment.....	3.9-8
3.9.5	Environmental Consequences	3.9-22
3.9.6	Project Design Features.....	3.9-31
3.9.7	NEPA Impacts Summary.....	3.9-33
3.9.8	CEQA Significance Conclusions.....	3.9-34
3.10	Hazardous Materials and Wastes.....	3.10-1
3.10.1	Introduction.....	3.10-1
3.10.2	Laws, Regulations, and Orders.....	3.10-1
3.10.3	Methods for Evaluating Impacts	3.10-5
3.10.4	Affected Environment.....	3.10-7
3.10.5	Environmental Consequences	3.10-17
3.10.6	Project Design Features.....	3.10-25
3.10.7	Mitigation Measures	3.10-25
3.10.8	NEPA Impacts Summary.....	3.10-26
3.10.9	CEQA Significance Conclusions.....	3.10-26
3.11	Safety and Security	3.11-1
3.11.1	Introduction.....	3.11-1
3.11.2	Laws, Regulations, and Orders.....	3.11-2
3.11.3	Methods for Evaluating Impacts	3.11-5
3.11.4	Affected Environment.....	3.11-7
3.11.5	Environmental Consequences	3.11-19
3.11.6	Project Design Features.....	3.11-29
3.11.7	Mitigation Measures	3.11-30
3.11.8	NEPA Impacts Summary.....	3.11-32
3.11.9	CEQA Significance Conclusions.....	3.11-33
3.12	Socioeconomics, Communities, and Environmental Justice.....	3.12-1
3.12.1	Introduction.....	3.12-1
3.12.2	Laws, Regulations, and Orders.....	3.12-1
3.12.3	Methods for Evaluating Impacts	3.12-3
3.12.4	Affected Environment.....	3.12-9
3.12.5	Environmental Consequences	3.12-30
3.12.6	Project Design Features.....	3.12-59

3.12.7	Mitigation Measures	3.12-60
3.12.8	NEPA Impacts Summary.....	3.12-62
3.12.9	CEQA Significance Conclusions.....	3.12-64
3.13	Station Planning, Land Use, and Development	3.13-1
3.13.1	Introduction.....	3.13-1
3.13.2	Laws, Regulations, and Orders.....	3.13-1
3.13.3	Methods for Evaluating Impacts	3.13-7
3.13.4	Affected Environment.....	3.13-8
3.13.5	Environmental Consequences	3.13-15
3.13.6	Project Design Features.....	3.13-27
3.13.7	NEPA Impacts Summary.....	3.13-27
3.13.8	CEQA Significance Conclusion	3.13-28
3.14	Agricultural Lands	3.14-1
3.14.1	Introduction.....	3.14-1
3.14.2	Laws, Regulations, and Orders.....	3.14-1
3.14.3	Methods for Evaluating Impacts	3.14-6
3.14.4	Affected Environment.....	3.14-8
3.14.5	Environmental Consequences	3.14-22
3.14.6	Mitigation Measures	3.14-37
3.14.7	NEPA Impacts Summary.....	3.14-38
3.14.8	CEQA Significance Conclusions.....	3.14-38
3.15	Parks, Recreation, and Open Space	3.15-1
3.15.1	Introduction.....	3.15-1
3.15.2	Laws, Regulations, and Orders.....	3.15-1
3.15.3	Methods for Evaluating Impacts	3.15-4
3.15.4	Affected Environment.....	3.15-5
3.15.5	Environmental Consequences	3.15-15
3.15.6	Mitigation Measures	3.15-40
3.15.7	NEPA Impacts Summary.....	3.15-42
3.15.8	CEQA Significance Conclusion	3.15-43
3.16	Aesthetics and Visual Resources.....	3.16-1
3.16.1	Introduction.....	3.16-1
3.16.2	Laws, Regulations, and Orders.....	3.16-1
3.16.3	Methods for Evaluating Impacts	3.16-4
3.16.4	Affected Environment.....	3.16-8
3.16.5	Environmental Consequences	3.16-23
3.16.6	Mitigation Measures	3.16-56
3.16.7	NEPA Impacts Summary.....	3.16-58
3.16.8	CEQA Significance Conclusions.....	3.16-60
3.17	Cultural and Paleontological Resources	3.17-1
3.17.1	Introduction.....	3.17-1
3.17.2	Laws, Regulations, and Orders.....	3.17-1
3.17.3	Methods for Evaluating Impacts	3.17-8
3.17.4	Affected Environment.....	3.17-22
3.17.5	Environmental Consequences	3.17-58
3.17.6	Mitigation Measures	3.17-72
3.17.7	NEPA Impact Summary	3.17-77
3.17.8	CEQA Significance Conclusions.....	3.17-78

3.18	Regional Growth	3.18-1
3.18.1	Introduction.....	3.18-1
3.18.2	Laws, Regulations, and Orders.....	3.18-1
3.18.3	Methods for Evaluating Impacts	3.18-5
3.18.4	Affected Environment.....	3.18-7
3.18.5	Environmental Consequences	3.18-13
3.18.6	Summary.....	3.18-23
3.19	Cumulative Impacts	3.19-1
3.19.1	Introduction.....	3.19-1
3.19.2	Cumulative Projects and Growth Forecasts	3.19-2
3.19.3	Analysis of Cumulative Impacts.....	3.19-9
4.0	Draft Section 4(f)/6(f) Evaluation.....	4-1
4.1	Introduction.....	4-1
4.1.1	Study Area	4-1
4.1.2	Laws, Regulations, and Orders.....	4-3
4.1.3	Section 4(f) Use Definition.....	4-5
4.2	Coordination	4-7
4.3	Purpose and Need.....	4-9
4.3.1	Project Objectives for the HST System in California and in the Central Part of the San Joaquin Valley Region.....	4-9
4.3.2	Need for the HST System Statewide and within the Central San Joaquin Valley Region.....	4-10
4.4	Alternatives	4-11
4.4.1	No Project Alternative	4-11
4.4.2	UPRR/SR 99 Alternative.....	4-11
4.4.3	BNSF Alternative	4-14
4.4.4	Hybrid Alternative	4-15
4.4.5	Heavy Maintenance Facility Alternatives	4-16
4.5	Section 4(f)/6(f) Properties (Parks, Wildlife Refuges, and Historic Sites)	4-17
4.5.1	Parks, Recreation, and Open Space.....	4-17
4.5.2	Cultural Resources	4-26
4.6	Preliminary Section 4(f) Use Assessment and Draft Determination	4-32
4.6.1	Park/Recreation Resources	4-32
4.6.2	Cultural Resources	4-41
4.7	Preliminary Section 4(f) de minimis Findings.....	4-45
4.8	Avoidance Alternatives	4-45
4.8.1	Individual Resource Avoidance Assessments	4-46
4.9	Measures to Minimize Harm.....	4-48
4.10	Preliminary Section 4(f) Least Harm Analysis	4-54
4.11	Section 6(f)	4-57
5.0	Project Costs and Operations	5-1
5.1	Introduction.....	5-1
5.2	Capital Costs.....	5-1
5.2.1	High-Speed Train Alternatives.....	5-2
5.2.2	Heavy Maintenance Facilities	5-4
5.3	Operation and Maintenance Costs	5-5
5.3.1	Operating Speeds	5-5
5.3.2	Travel Times.....	5-5
5.3.3	Development of Operation and Maintenance Costs.....	5-6

6.0	CEQA/NEPA Decision Process and Other Considerations.....	6-1
6.1	Preferred Alternative	6-1
6.2	Environmentally Superior Alternative and Environmentally Preferable Alternative.....	6-2
6.3	Least Environmentally Damaging Practicable Alternative.....	6-2
6.4	Unavoidable Adverse Potentially Significant Impacts.....	6-3
6.5	Relationship between Short-Term Uses of the Environment and the Enhancement of Long-Term Productivity	6-3
6.6	Significant Irreversible Environmental Changes That Would Result from the Proposed Project if Implemented.....	6-4
7.0	Public and Agency Involvement	7-1
7.1	Environmental Justice Outreach.....	7-1
7.2	Public and Agency Scoping	7-2
7.2.1	Notices of Preparation, Notices of Intent, and Public Information Materials	7-2
7.2.2	Scoping Meetings	7-2
7.2.3	Scoping Comments	7-3
7.3	Alternatives Analysis Process	7-3
7.3.1	Public Information Meetings and Materials during the Alternatives Analysis Process.....	7-5
7.3.2	Technical Working Group Meetings during the Alternatives Analysis Process	7-5
7.3.3	Environmental Resource Agency Meetings during the Alternatives Analysis Process.....	7-6
7.4	Development of the EIR/EIS	7-6
7.4.1	Public Information Materials and Meetings.....	7-6
7.4.2	Technical Working Group Meetings	7-6
7.4.3	Agency Meetings and Consultation	7-6
7.5	Notification and Circulation of the EIR/EIS	7-8
8.0	EIR/EIS Distribution.....	8-1
9.0	List of Preparers	9-1
10.0	References/Sources Used in Document Preparation	10-1
11.0	Glossary of Terms	11-1
12.0	Index	12-1
13.0	Acronyms and Abbreviations	13-1

VOLUME II: TECHNICAL APPENDICES (BOUND SEPARATELY)

- 2-A Proposed Roadway Activities Along HST Alternatives
- 3.1-A Project Footprint
- 3.4-A Proposed California High-Speed Train Project Noise and Vibration Mitigation Guidelines
- 3.6-A Energy Usage Comparison
- 3.7-A Special-Status Plant and Wildlife Species and Mapped Biological Communities
- 3.7-B Special Status Plant and Wildlife Species Potentially Affected by the Alternatives
- 3.11-A Safety and Security Data
- 3.11-B Existing Railroad Crossings
- 3.12-A Relocation Assistance Documents (to be provided)
- 3.13-A Land Use Plans, Goals, and Policies
- 3.17-A Programmatic Agreement
- 3.18-A Planning Area Boundaries
- 3.19-A Planned and Potential Projects and Plans
- 3.19-B Planned and Potential Transportation Projects
- 5-A Operations and Service Plan
- 5-B Operating Cost Memorandum

VOLUME III: ALIGNMENTS AND OTHER PLANS (AVAILABLE ON DVD)

LIST OF TABLES

S-1	Design Features of Alternatives Carried Forward	S-12
S-2	Capital Cost of the HST Alternatives (2010 \$Thousands)	S-23
S-3	Potential Uses of Section 4(f) Resources Differentiating Among HST Alternatives	S-24
S-4	Significant Impacts That Differentiate Among North-South HST Alternatives and Design Options	S-28
S-5	Comparison of Potential Adverse Effects of HST Alternatives.....	S-39
S-6	HMF Alternative Differentiating Environmental Impacts	S-62
1-1	Jobs-to-Housing Ratio in the Merced to Fresno HST Section Region, 2010 and 2035	1-10
1-2	Increase in Total Daily Vehicle Miles Traveled	1-11
1-3	Travel Growth for Intercity Highways	1-12
1-4	2009 Intercity Air Travel	1-13
1-5	Commercial Air Traffic and Central Valley Airports.....	1-14
1-6	Estimated Total Travel Times (Door-to-Door in Hours and Minutes) between City Pairs by Auto, Air, and Rail (Peak Conditions).....	1-16
2-1	HST Performance Criteria	2-4
2-2	Design Features of Alternatives Carried Forward	2-25
2-3	Regional Projected Population and Employment.....	2-26
2-4	Planned Residential Development Plans within the Merced to Fresno Area as of October 2010	2-29
2-5	Increase in Total Daily Vehicle Miles Traveled	2-30
2-6	No Project Alternative – Planned Highway Improvements in Merced.....	2-33
2-7	No Project Alternative – Planned Highway Improvements in Madera	2-34
2-8	No Project Alternative – Planned Highway Improvements in Fresno	2-35
2-9	Passenger Boardings for Fresno and Merced Airports	2-37
2-10	Programmed Improvements in 2008 California State Rail Plan	2-38
2-11	Planning and Design Assumptions	2-52
2-12	Impact of HST Alternatives on Caltrans State Facilities	2-78
2-13	Merced to Fresno Section HMF Site Descriptions	2-82

2-14	HST System Ridership Forecasts (in millions per year)	2-89
2-15	Construction Sequence	2-97
2-16	Potential Major Environmental Permits and Approvals	2-101
3.2-1	Regional and Local Plans and Policies	3.2-2
3.2-2	Roadway Segment Level of Service	3.2-4
3.2-3	Level of Service and Average Vehicular Delay Definitions for Signalized Intersections.....	3.2-5
3.2-4	Level of Service and Average Vehicular Delay Definitions for Unsignalized Intersections.....	3.2-5
3.2-5	Year 2035 Forecast Vehicle Trip Generation at HST Stations	3.2-7
3.2-6	Year 2035 Forecast Vehicle Trip Generation at Heavy Maintenance Facility Sites	3.2-8
3.2-7	Intersections Operating at LOS E or F near the Proposed Downtown Merced Station	3.2-18
3.2-8	Merced Bus Routes and Weekday Service Frequency.....	3.2-18
3.2-9	Intersections Operating at LOS E or F near the Proposed Downtown Fresno Station	3.2-24
3.2-10	Fresno Bus Routes and Weekday Service Frequency	3.2-24
3.2-11	Intersections Operating at LOS E or F around the Proposed HMF Locations under Existing Conditions	3.2-25
3.2-12	Vehicle Trip Reductions by SR 99 Screenline.....	3.2-36
3.2-13	Vehicle Miles Traveled (VMT)	3.2-36
3.2-14	Existing Plus Project Roadway Segment Analysis – Between Herndon Avenue and Shaw Avenue	3.2-38
3.2-15	Future (2035) Plus Project Roadway Segment Analysis – Between Herndon Avenue and Shaw Avenue	3.2-38
3.2-16	Existing Plus Project Intersection Analysis – Between Herndon Avenue and Shaw Avenue.....	3.2-39
3.2-17	Future (2035) Plus Project Intersection Analysis – Between Herndon Avenue and Shaw Avenue	3.2-40
3.2-18	Existing Plus Project Roadway Segment Analysis – Between McKinley Avenue and SR 180.....	3.2-41
3.2-19	Future (2035) Plus Project Roadway Segment Analysis – Between McKinley Avenue and SR 180.....	3.2-42
3.2-20	Existing Plus Project Intersection Analysis – SR 99 Relocation.....	3.2-49
3.2-21	Future Year (2035) plus Project Intersection Analysis - SR 99 Relocation.....	3.2-50

3.2-22	Existing Plus Project Roadway Segment Analysis – Downtown Merced Station (Parking Option A)	3.2-52
3.2-23	Existing Plus Project Roadway Segment Analysis – Downtown Merced Station (Parking Option B)	3.2-54
3.2-24	Future (2035) Plus Project Roadway Segment Analysis – Downtown Merced Station (Parking Option A)	3.2-56
3.2-25	Future (2035) Plus Project Roadway Segment Analysis – Downtown Merced Station (Parking Option B)	3.2-58
3.2-26	Existing Plus Project Intersection Operating Conditions Downtown Merced Station – Parking Option A.....	3.2-60
3.2-27	Existing Plus Project Intersection Operating Conditions Downtown Merced Station – Parking Option B.....	3.2-62
3.2-28	Future (2035) Plus Project Intersection Operating Conditions around Proposed Downtown Merced Station – Parking Option A	3.2-64
3.2-29	Future (2035) Plus Project Intersection Operating Conditions around Proposed Merced HST Station – Parking Option B.....	3.2-66
3.2-30	Existing Plus Project Roadway Segment Analysis – Downtown Fresno Station	3.2-71
3.2-31	Future (2035) Plus Project Roadway Segment Analysis – Downtown Fresno Station	3.2-75
3.2-32	Existing Plus Project Intersection Operating Conditions around Proposed Fresno HST Station	3.2-78
3.2-33	Future (2035) plus Project Intersection Operating Conditions around Proposed Fresno HST Station	3.2-82
3.2-34	Existing plus Project Intersection Level of Service Summary near Proposed Castle Commerce HMF Site – Parking Option A	3.2-89
3.2-35	Existing plus Project Intersection Level of Service Summary near Proposed Castle Commerce HMF Site – Parking Option B	3.2-92
3.2-36	Future (2035) Plus Project Intersection Level of Service Summary near Proposed Castle Commerce HMF Site – Parking Option A.....	3.2-95
3.2-37	Future (2035) Intersection Level of Service Summary near Proposed Castle Commerce HMF Site – Parking Option B	3.2-98
3.2-38	Existing Plus Project Intersection Level of Service Summary near Proposed Harris-DeJager HMF Site.....	3.2-101
3.2-39	Future (2035) Plus Project Intersection Level of Service Summary near Proposed Harris-DeJager HMF Site.....	3.2-101
3.2-40	Existing Plus Project Intersection Level of Service Summary near Proposed Fagundes HMF Site	3.2-102
3.2-41	Future (2035) Plus Project Intersection Level of Service Summary near Proposed Fagundes HMF Site	3.2-103

3.2-42	Existing Plus Project Intersection Level of Service Summary near Proposed Gordon-Shaw HMF Site	3.2-103
3.2-43	Future (2035) Plus Project Intersection Level of Service Summary near Proposed Gordon-Shaw HMF Site	3.2-104
3.2-44	Existing Plus Project Intersection Level of Service Summary near Proposed Kojima Development HMF Site	3.2-105
3.2-45	Future (2035) Plus Project Intersection Level of Service Summary near Proposed Kojima Development HMF Site	3.2-105
3.2-46	Existing Plus Project Mitigation Measures – Between Herndon Avenue and Shaw Avenue.....	3.2-108
3.2-47	Future (2035) Plus Project Mitigation Measures – Between Herndon Avenue and Shaw Avenue.....	3.2-109
3.2-48	Existing Plus Project Mitigation Measures – SR 99 Realignment.....	3.2-110
3.2-49	Future (2035) Plus Project Mitigation Measures – SR 99 Realignment.....	3.2-111
3.2-50	Existing Plus Project Mitigation Measures – Merced Station.....	3.2-112
3.2-51	Future (2035) Plus Project Mitigation Measures – Merced Station.....	3.2-113
3.2-52	Existing Plus Project Mitigation Measures – Fresno Station.....	3.2-115
3.2-53	Future (2035) Plus Project Mitigation Measures – Fresno Station.....	3.2-116
3.2-54	Existing Plus Project Mitigation Measures – Castle Commerce Center HMF	3.2-119
3.2-55	Future (2035) Plus Project Mitigation Measures – Castle Commerce Center HMF ...	3.2-120
3.2-56	Existing Plus Project Mitigation Measures – Harris-DeJager HMF	3.2-123
3.2-57	Future (2035) Plus Project Mitigation Measures – Harris-DeJager HMF	3.2-123
3.2-58	Existing Plus Project Mitigation Measures – Fagundes HMF	3.2-123
3.2-59	Future (2035) Plus Project Mitigation Measures – Fagundes HMF	3.2-124
3.2-60	Existing Plus Project Mitigation Measures – Gordon-Shaw HMF	3.2-124
3.2-61	Future (2035) Plus Project Mitigation Measures – Gordon-Shaw HMF	3.2-124
3.2-62	Existing Plus Project Mitigation Measures – Kojima Development HMF	3.2-125
3.2-63	Future (2035) Plus Project Mitigation Measures – Kojima Development HMF.....	3.2-125
3.2-64	Summary of Significant Transportation Resource Impacts and Mitigation Measures.....	3.2-127
3.3-1	State and Federal Ambient Air Quality Standards	3.3-3
3.3-2	General Conformity Thresholds	3.3-23
3.3-3	SJVAPCD CEQA Construction and Operational Thresholds of Significance.....	3.3-24

3.3-4	Ambient Criteria Pollutant Concentrations at Air Quality Monitoring Stations Closest to the Project	3.3-28
3.3-5	Federal and State Attainment Status	3.3-33
3.3-6	Planning Documents Relevant to Proposed Project	3.3-34
3.3-7	UPRR/SR 99 Alternative Programmatic Construction Emissions for Years 2013–2021 (tons/year)	3.3-38
3.3-8	BNSF Alternative Programmatic Construction Emissions for Years 2013–2021 (tons/year)	3.3-40
3.3-9	Hybrid Alternative Programmatic Construction Emissions for Years 2013–2021 (tons/year)	3.3-41
3.3-10	HST Alternatives Amortized GHG Construction Emissions (metric tons/year)	3.3-44
3.3-11	Summary of Estimated 2035 Statewide Emission Burden Changes (Project vs. No Project 2035)	3.3-46
3.3-12	Summary of Estimated 2009 Statewide Emission Burden Changes (Existing plus Project Vs Existing Condition)	3.3-46
3.3-13	Summary of Regional Changes in Operational Emissions (Project vs. No Project 2035) (tons/year)	3.3-47
3.3-14	Summary of Regional Changes in Operational Emissions (Existing Plus Project vs. Existing Condition 2009) (tons/year)	3.3-48
3.3-15	2035 Estimated Statewide GHG Emission Changes (Project vs. No Project) (metric tons/year)	3.3-52
3.3-16	2009 Estimated Statewide GHG Emission Changes (Existing Plus Project vs. Existing Condition) (metric tons/year)	3.3-52
3.3-17	2035 On-Road Vehicles Regional GHG Emissions (Project vs. No Project) (metric tons/year)	3.3-53
3.3-18	2009 On-Road Vehicles Regional GHG Emissions (Existing Plus Project vs. Existing Condition) (metric tons/year)	3.3-53
3.3-19	2035 Project Alternatives Regional GHG Emissions (Project vs. No Project) (metric tons/year)	3.3-54
3.3-20	2009 Project Alternatives Regional GHG Emissions (Existing Plus Project vs. Existing Condition) (metric tons/year)	3.3-55
3.3-21	Maximum Modeled CO Concentrations at Intersections near the Merced HST Stations and Castle Commerce Center HMF Site.....	3.3-58
3.3-22	Maximum Modeled CO Concentrations at Intersections near the Fresno HST Station and Herndon Avenue and Shaw Avenue.....	3.3-59
3.3-23	Maximum Modeled CO Concentrations at Intersections along SR 99	3.3-60
3.3-24	Maximum Modeled 2035 CO Concentrations at Merced HST Station Parking Structures.....	3.3-61

3.3-25	Maximum Modeled 2035 CO Concentrations at Fresno Station Parking Facilities.....	3.3-61
3.3-26	Maximum Modeled 2009 CO Concentrations at Intersections near the Merced HST Station and Castle Commerce Center HMF Site	3.3-64
3.3-27	Maximum Modeled 2009 CO Concentrations at Intersections near the Fresno HST Station and Herndon Ave and Shaw Ave.....	3.3-65
3.3-28	Maximum 2009 Modeled CO Concentrations at Intersections along SR 99.....	3.3-66
3.3-29	UPRR/SR 99 Alternative Mitigated Construction Emissions for Years 2013–2021 (tons/year)	3.3-73
3.3-30	BNSF Alternative Mitigated Construction Emissions for Years 2013–2021 (tons/year)	3.3-74
3.3-31	Hybrid Alternative Mitigated Construction Emissions for Years 2013–2021 (tons/year)	3.3-75
3.3-32	Summary of Significant Air Quality and Global Climate Change Impacts and Mitigation Measures.....	3.3-77
3.4-1	FTA Construction Noise Assessment Criteria	3.4-5
3.4-2	Construction Vibration Damage Criteria	3.4-6
3.4-3	FRA Noise-Sensitive Land Uses	3.4-7
3.4-4	FHWA Traffic Noise Abatement Criteria	3.4-9
3.4-5	Interim Criteria for High-Speed Train Noise Effects on Animals	3.4-9
3.4-6	FRA Ground-Borne Vibration and Ground-Borne Noise Impact Criteria.....	3.4-10
3.4-7	FRA Ground-Borne Vibration and Ground-Borne Noise Impact Criteria for Special Buildings	3.4-11
3.4-8	Screening Distances for High-Speed Rail Speed Regime III.....	3.4-16
3.4-9	FRA Screening Distances for Vibration Assessment.....	3.4-17
3.4-10	Long-Term Existing Noise Measurement Locations	3.4-22
3.4-11	Short-Term Existing Noise Measurement Locations.....	3.4-24
3.4-12	Summary of Noise Impacts by Project Alternative from HST Operations and HMFs..	3.4-29
3.4-13	Typical Equipment Noise for Rail Construction	3.4-30
3.4-14	Approximate Distances to Vibration Criterion-Level Contours	3.4-31
3.4-15	Potential Noise Impacts under the UPRR/SR 99 Alternative without Mitigation for Design Year 2035	3.4-37
3.4-16	Potential Noise Impacts under the BNSF Alternative without Mitigation for Design Year 2035	3.4-37

3.4-17	Potential Noise Impacts under the Hybrid Alternative without Mitigation for Design Year 2035	3.4-39
3.4-18	Potential Noise Impacts at the HMFs without Mitigation for Full Operations Year 2035.....	3.4-40
3.4-19	Screening Distances for Effects on Wildlife and Domestic Animals	3.4-41
3.4-20	Potential Vibration Impacts under the BNSF Alternative without Mitigation for Design Year 2035	3.4-42
3.4-21	Potential UPRR/SR 99 Alternative Sound Barriers	3.4-51
3.4-22	Potential BNSF Alternative Sound Barriers.....	3.4-51
3.4-23	Potential Hybrid Alternative Sound Barriers.....	3.4-51
3.4-24	Potential Castle Commerce Center Sound Barriers.....	3.4-52
3.4-25	Severe Effects Remaining at Locations without Sound Barriers.....	3.4-52
3.4-26	Potential Vibration Mitigation Procedures and Descriptions	3.4-57
3.4-27	Summary of Significant Noise and Vibration Impacts and Mitigation Measures	3.4-58
3.5-1	Summary Comparison of Measured and Calculated 60-Hz Magnetic Fields	3.5-11
3.5-2	Summary of HST EMF Modeling Results.....	3.5-14
3.5-3	Length Adjacent to Existing Rail Lines – HST Alternatives	3.5-17
3.5-4	Length Adjacent to Existing Rail Lines – HMF Alternatives.....	3.5-17
3.5-5	Summary of Significant EMF/EMI Impacts and Mitigation Measures.....	3.5-19
3.6-1	Local Plans and Policies	3.6-3
3.6-2	Construction-Related Energy Consumption Assumptions for the Merced to Fresno Section	3.6-7
3.6-3	Local Utility and Energy Providers	3.6-10
3.6-4	Existing and Projected Urban Water Demand Summary for the Merced to Fresno Section	3.6-12
3.6-5	Wastewater Treatment Plant Capacity Summary for Proposed HST Station and Maintenance Facility Locations in the Merced to Fresno Section	3.6-14
3.6-6	Landfill Facility Summary for the Merced to Fresno Section.....	3.6-17
3.6-7	Solid Waste Volumes and Diversion Summary for the Merced to Fresno Section.....	3.6-18
3.6-8	2009 Electricity Consumption in Merced, Madera, and Fresno Counties	3.6-19
3.6-9	Fuel Sources for Electric Power in California in 2005.....	3.6-20
3.6-10	2035 Estimated Change in Energy Consumption due to the HST System	3.6-27

3.6-11 Construction Phase Water Consumption	3.6-29
3.6-12 UPRR/SR 99 Alternative Impacts – High-Risk Utilities	3.6-31
3.6-13 UPRR/SR 99 Alternative Impacts – Low-Risk Utilities	3.6-32
3.6-14 Utilities Potentially Affected by the BNSF Alternative – High-Risk Utilities	3.6-33
3.6-15 Utilities Potentially Affected by the BNSF Alternative – Low-Risk Utilities.....	3.6-34
3.6-16 Utilities Potentially Affected by Hybrid Alternative – High-Risk Utilities	3.6-35
3.6-17 Utilities Potentially Affected by Hybrid Alternative ^a – Low-Risk Utilities.....	3.6-35
3.6-18 Utilities Potentially Affected by the HMF Alternatives – High-Risk Utilities.....	3.6-36
3.6-19 Utilities Potentially Affected by the HMF Alternatives – Low-Risk Utilities	3.6-36
3.6-20 Existing and Project-Related Water Consumption	3.6-38
3.6-21 Project-Related Wastewater Generated for the HST Stations.....	3.6-40
3.6-22 Project-Related Solid Waste Generated for the HST Stations.....	3.6-41
3.6-23 Daily HST Energy Usage Calculations	3.6-43
3.6-24 On-Road Vehicle Energy Changes in the Merced to Fresno Region	3.6-44
3.6-25 Aircraft Energy Changes Due to HST System	3.6-44
3.6-26 Summary of Potentially Significant Utility Impacts and Mitigation Measures	3.6-48
3.7-1 Federal Laws and Regulations.....	3.7-3
3.7-2 State Laws and Regulations	3.7-4
3.7-3 Special-Status Plant Species Reported to Occur in the Region	3.7-14
3.7-4 Special-Status Wildlife Species Reported to Occur in the Region.....	3.7-17
3.7-5 Terrestrial Communities Potentially Affected during the Construction Period of the UPRR/SR 99 Alternative (acres).....	3.7-47
3.7-6 Aquatic Communities Potentially Affected during the Construction Period of the UPRR/SR 99 Alternative (acres).....	3.7-47
3.7-7 Terrestrial Communities Potentially Affected during the Construction Period of the BNSF Alternative (acres)	3.7-49
3.7-8 Aquatic Communities Potentially Affected during the Construction Period of the BNSF Alternative (acres)	3.7-50
3.7-9 Terrestrial Communities Potentially Affected during the Construction Period of the Hybrid Alternative (acres)	3.7-51
3.7-10 Aquatic Communities Potentially Affected during the Construction Period of the Hybrid Alternative (acres)	3.7-52

3.7-11	Terrestrial Communities Potentially Affected during the Construction Period of the HMF Alternatives (acres)	3.7-53
3.7-12	Aquatic Communities Potentially Affected during the Construction Period of the HMF Alternatives (acres)	3.7-54
3.7-13	Special-Status Wildlife Species Potentially Affected during the Construction Period of the HMF Alternatives.....	3.7-64
3.7-14	Critical Habitat Potentially Affected during the Construction Period of the BNSF Alternative (acres)	3.7-67
3.7-15	Habitats of Concern Potentially Affected during the Construction Period of the HMF Alternatives	3.7-70
3.7-16	Wildlife Movement Corridors Potentially Affected during the Construction Period of the HMF Alternatives.....	3.7-72
3.7-17	Terrestrial Communities Potentially Affected during the Project Period of the UPRR/SR 99 Alternative (acres)	3.7-74
3.7-18	Aquatic Communities Potentially Affected during the Project Period of the UPRR/SR 99 Alternative (acres)	3.7-75
3.7-19	Terrestrial Communities Potentially Affected during the Project Period of the BNSF Alternative (acres)	3.7-76
3.7-20	Aquatic Communities Potentially Affected during the Project Period of the BNSF Alternative (acres)	3.7-77
3.7-21	Terrestrial Communities Potentially Affected during the Project Period of the Hybrid Alternative (acres)	3.7-78
3.7-22	Aquatic Communities Potentially Affected during the Project Period of the Hybrid Alternative (acres)	3.7-79
3.7-23	Terrestrial Communities Potentially Affected during the Project Period of the HMF Alternatives (acres).....	3.7-81
3.7-24	Aquatic Communities Potentially Affected during the Project Period of the HMF Alternatives (acres).....	3.7-81
3.7-25	Special-Status Wildlife Species Potentially Affected during the Project Period of the HMF Alternatives.....	3.7-91
3.7-26	Critical Habitat Potentially Affected during the Project Period of the BNSF Alternative (acres)	3.7-95
3.7-27	Habitats of Concern Potentially Affected during the Project Period of the HMF Alternatives	3.7-97
3.7-28	Summary of Wildlife Crossings within ECA and Modeled Wildlife Corridors by Alternative	3.7-102
3.7-29	Wildlife Movement Corridors Potentially Affected during the Project Period of the HMF Alternatives.....	3.7-105
3.7-30	Summary of Significant Biological Resource Impacts and Mitigation Measures.....	3.7-131

3.8-1	Local Policies and Plans	3.8-5
3.8-2	Beneficial Uses of Surface Water in the Project Vicinity.....	3.8-11
3.8-3	Section 303(d) List of Impaired Waters in the Project Vicinity	3.8-12
3.8-4	Natural Water Body Crossings.....	3.8-19
3.8-5	FEMA Special Flood Hazard Zone Designations in the Study Area	3.8-22
3.8-6	HST Alternatives Water Body Crossings	3.8-26
3.8-7	Acres Disturbed During Construction by HST Alternatives	3.8-28
3.8-8	HST Alternatives Area in the Special Flood Hazard Area (acres)	3.8-35
3.9-1	Local Plans and Policies	3.9-4
3.9-2	Summary of Mapped Surficial Geologic Units	3.9-11
3.9-3	Predominant Geologic Formation Subunits between City of Merced and the City of Fresno	3.9-12
3.9-4	Summary of General Groundwater Locations	3.9-13
3.9-5	Summary of Soil Associations.....	3.9-15
3.9-6	Predominant Soil Associations between City of Merced and the City of Fresno	3.9-16
3.10-1	Local Plans and Policies	3.10-3
3.10-2	Range of Potentially Affected PEC Sites and Schools	3.10-17
3.10-3	PEC Sites Potentially Affected by UPRR/SR 99 Alternative and Nearby Schools.....	3.10-21
3.10-4	PEC Sites Potentially Affected by BNSF Alternative and Nearby Schools	3.10-21
3.10-5	PEC Sites Potentially Affected by the Hybrid Alternative and Nearby Schools.....	3.10-23
3.10-6	Summary of Significant Hazardous Materials and Wastes Impacts and Mitigation Measures	3.10-26
3.11-1	General Plans and Other Plans Considered.....	3.11-4
3.11-2	Airport Plans Considered	3.11-5
3.11-3	Fire Departments and Equipment.....	3.11-7
3.11-4	Fire, Law Enforcement, and Emergency Medical Service Locations, by HMF Site....	3.11-14
3.11-5	Airports, Airstrips, and Heliports within 2 Miles of Alternative Alignment Footprints.....	3.11-16
3.11-6	Schools Within Approximately 0.25 Mile of Alternative Alignment Footprints	3.11-17

3.11-7	Summary of Significant Safety and Security Impacts and Mitigation Measures	3.11-33
3.12-1	Public Involvement Activities and Outreach to Minority and Low-Income Populations.....	3.12-7
3.12-2	Regional Existing and Projected Populations	3.12-9
3.12-3	Household Income and Poverty Status	3.12-10
3.12-4	County Housing Characteristics	3.12-13
3.12-5	Facilities within Study Area	3.12-16
3.12-6	Communities Affected, by Alternative	3.12-17
3.12-7	Minority and Low-income Population	3.12-25
3.12-8	Elementary Schools – Percent of Minority Students and Percent of Students Receiving Free or Reduced-Price Lunch in 2008–2009	3.12-26
3.12-9	Annual Local Project Expenditures and Sales Tax Revenues during Construction ...	3.12-36
3.12-10	Contribution of Sales Tax Revenues during Construction	3.12-37
3.12-11	Resource Impacts Potentially Affecting Community Character and Cohesion – Impacts Common to All Alternatives	3.12-40
3.12-12	Potential Impacts on Community Cohesion, Neighborhoods, and Community Resources during Operation – Proposed HMF Sites	3.12-45
3.12-13	Range of Residential and Business Displacements	3.12-46
3.12-14	Annual Sales Tax Revenues during Operation.....	3.12-49
3.12-15	Contribution of Sales Tax Revenues during Operation	3.12-49
3.12-16	Property Tax Revenues during Operation	3.12-50
3.12-17	Impacts Common to All Alternatives on Communities of Concern.....	3.12-55
3.12-18	Summary of Significant Physical Changes to Communities and Mitigation Measures	3.12-64
3.13-1	Permanent Land Use Impacts by Alternative (acres).....	3.13-18
3.13-2	Permanent Land Impacts by Potential HMF Site (acres)	3.13-19
3.13-3	Percentage of Existing Land Uses and Current Zoning Opportunities within the HST Station Study Areas.....	3.13-22
3.14-1	Regional and Local Plans and Policies	3.14-3
3.14-2	Important Farmland and Grazing Land in Merced, Madera, and Fresno Counties	3.14-9

3.14-3	Farmland Conversions in Merced, Madera, and Fresno Counties 2000–2008	3.14-18
3.14-4	Protected Farmland in Merced, Madera, and Fresno Counties	3.14-19
3.14-5	Important Farmland Potentially Affected by Each HST Alternative	3.14-23
3.14-6	Protected Farmland Potentially Affected by HST Alternatives.....	3.14-23
3.14-7	Important Farmland Temporarily Used for Project Construction	3.14-25
3.14-8	Farmland Types Potentially Affected by the UPRR/SR 99 Alternative	3.14-28
3.14-9	Farmland Types Potentially Affected by the BNSF Alternative.....	3.14-29
3.14-10	Farmland Types Potentially Affected by the Hybrid Alternative	3.14-30
3.14-11	Farmland Types Potentially Affected by the HMF Alternatives	3.14-31
3.14-12	Protected Farmland Potentially Affected under the UPRR/SR 99 Alternative.....	3.14-33
3.14-13	Protected Farmland Potentially Affected by the BNSF Alternative	3.14-34
3.14-14	Protected Farmland Potentially Affected by the Hybrid Alternative	3.14-34
3.14-15	Protected Farmland Potentially Affected by the Heavy Maintenance Facility.....	3.14-35
3.14-16	Summary of Significant Agricultural Land Impacts and Mitigation Measures.....	3.14-39
3.15-1	Local Jurisdiction Plans and Policies.....	3.15-3
3.15-2	Parks, Recreation, and Open Space Resources within the HST Alternatives Study Area	3.15-10
3.15-3	Parks, Recreation, and Open Space Resources within Castle Commerce Center HMF Study Area	3.15-12
3.15-4	Parks, Recreation, and Open Space Resources in the Downtown Merced Station Study Area – Common to all HST Alternatives	3.15-13
3.15-5	Parks, Recreation, and Open Space Resources in the Downtown Fresno Station Study Area – Common to all HST Alternatives	3.15-14
3.15-6	Parks, Recreation, and Open Space Resources Permanent Acquisition Acreage	3.15-34
3.15-7	Examples of Adverse Effects Provided in 36 CFR 800.5(a)(2)	3.15-38
3.15-8	Summary of Significant Parks, Recreation and Open Space Impacts and Mitigation Measures	3.15-43
3.16-1	Local Plans and Policies	3.16-2
3.16-2	Characteristics of Typical HST Components	3.16-25
3.16-3	Generalized Summary of Aesthetics and Visual Resources Impacts on KVPs under NEPA and CEQA by HST Alternative	3.16-27
3.16-4	Summary of Visual Quality Changes and Impacts at Key Viewpoints.....	3.16-30

3.16-5 Summary of Significant Aesthetics and Visual Resources Impacts and Mitigation Measures	3.16-60
3.17-1 Regional and Local Cultural Resource Plans and Ordinances	3.17-5
3.17-2 FRA Coordination with SHPO and ACHP	3.17-15
3.17-3 FRA Tribal Consultation	3.17-17
3.17-4 Prehistoric Cultural Periods	3.17-22
3.17-5 Archaeological Resources and Sensitive Areas within or adjacent to the APE.....	3.17-25
3.17-6 Significant Historic Architectural Resources by Alternative.....	3.17-37
3.17-7 Paleontological Sensitivity Ratings Employed for This Analysis	3.17-55
3.17-8 Relative Paleontological Sensitivity of Geologic Units Potentially Affected by the Merced to Fresno Section HST Alternatives and Components	3.17-57
3.17-9 Effects on Historic Architectural Resources by Component of the HST Project	3.17-63
3.17-10 Summary of Significant Cultural and Paleontological Impacts and Mitigation Measures	3.17-79
3.18-1 Population Growth, 2000 – 2010	3.18-8
3.18-2 Population Projections, 2010 - 2035	3.18-8
3.18-3 Merced, Madera, and Fresno County Employment by Industry	3.18-10
3.18-4 Employment Projections, 2010 and 2035	3.18-11
3.18-5 Labor Force Characteristics – Merced, Madera, Fresno Counties.....	3.18-11
3.18-6 Labor Force Characteristics – Cities of Merced, Chowchilla, Madera, and Fresno ...	3.18-12
3.18-7 Existing Housing Units and Projected Housing Unit Demand	3.18-12
3.18-8 HST Alternative Costs (2010 \$M)	3.18-15
3.18-9 UPRR/SR 99 Alternative Employment Impacts during Construction.....	3.18-15
3.18-10 BNSF Alternative Employment Impacts during Construction	3.18-16
3.18-11 Hybrid Alternative Employment Impacts during Construction.....	3.18-17
3.18-12 Merced-Fresno Section Stations and HMF Costs (2010\$)	3.18-17
3.18-13 Employment Impacts during Construction of the Merced and Fresno Stations	3.18-18
3.18-14 Employment Impacts during Construction of the HMF – Castle Commerce Center	3.18-18
3.18-15 Employment Impacts during Construction of the HMF – Generic.....	3.18-19
3.18-16 Regional Projected and Induced Population and Employment.....	3.18-20

3.19-1	Merced County Major Foreseeable Projects.....	3.19-3
3.19-2	City of Merced Major Foreseeable Projects.....	3.19-4
3.19-3	Madera County Major Foreseeable Projects.....	3.19-5
3.19-4	City of Chowchilla Major Foreseeable Projects.....	3.19-6
3.19-5	City of Madera Major Foreseeable Projects	3.19-7
3.19-6	City of Fresno Major Foreseeable Projects	3.19-7
3.19-7	SR 99 Transportation Improvement Projects.....	3.19-8
4-1	Section 4(f) and 6(f) Evaluation Consultation Summary	4-7
4-2	Park and Recreation Areas Evaluated for Section 4(f) Use	4-22
4-3	Archaeological Sites in Project APE Potentially Eligible for the National Register of Historic Places	4-27
4-4	Resources Listed in, or Determined Eligible for, the National Register of Historic Places	4-28
4-5	Resources Recommended Eligible for the National Register of Historic Places	4-29
4-6	Examples of Adverse Effects Provided in 36 CFR 800.5(a)(2)	4-44
4-7	<i>De Minimis</i> Impacts - Measures to Minimize Harm and Mitigation for Section 4(f) Park and Recreation Areas in the Merced to Fresno Section HST Study Area.....	4-46
4-8	Measures to Minimize Harm	4-49
4-9	Preliminary Least Harm Analysis.....	4-55
5-1	Capital Cost of the HST Alternatives (2010 \$Thousands)	5-3
5-2	Cost for Heavy Maintenance Facilities Alternatives (2010 \$Thousands)	5-4
5-3	Optimal Express Travel Times from Merced to Fresno and Other Cities (hours:minutes)	5-5
5-4	Annual Phase 1 System O&M Cost (2010 \$Millions)	5-7
5-5	Annual O&M Costs of the Merced to Fresno Section (2010 \$Millions)	5-7
7-1	Public and Agency Meetings.....	7-9

LIST OF FIGURES

S-1	California HST System Initial Study Corridors	S-2
S-2	Merced to Fresno Section Alternatives and Design Options	S-3
S-3	Overview of SR 152 Wye	S-8
S-4	Overview of UPRR/SR 99 Alternative and Design Options	S-18
S-5	Overview of BNSF Alternative and Design Options.....	S-19
S-6	Overview of the Hybrid Alternative.....	S-20
S-7	Next Steps Schedule	S-27
1-1	HST System in California	1-2
1-2	Merced to Fresno HST Project Corridor.....	1-6
1-3	Existing and Future California Population (in millions).....	1-7
1-4	Intercity Trips (in millions).....	1-8
1-5	Major Intercity Travel Routes and Airports.....	1-9
2-1	California HST System Initial Study Corridors	2-3
2-2	Examples of Japanese Shinkansen High-Speed Trains	2-5
2-3	Example of an At-grade Profile Showing Catenary Wire System and Vertical Arms of the Pantograph Power Pickups	2-5
2-4	Examples of Existing Stations	2-6
2-5a and b	Simulated and Plan Views of a Functional Station and Its Various Components	2-7
2-6	At-grade Typical Cross Section.....	2-8
2-7a	Retained Fill Typical Cross Section	2-8
2-7b	Retained Cut Typical Cross Section.....	2-9
2-8	Elevated Structure Typical Cross Sections	2-9
2-9	Straddle Bent Typical Cross Section.....	2-10
2-10a	Replacing Local At-Grade Crossings with New Overcrossings above HST Guideway and Existing Railroad Trackway	2-11
2-10b	Adding Local Roadway Overcrossings above HST Guideway.....	2-11
2-11	Typical Cross Section of Roadway Grade-Separated Beneath HST Guideway.....	2-11
2-12	Diagram of a Wye Formation	2-12
2-13	Photograph Showing Leg of Wye Crossing over Another HST Track.....	2-12

2-14	Elevated Four-track Segment at Wye Turnouts	2-13
2-15	Traction Power Substation.....	2-14
2-16	Switching Station	2-14
2-17	Paralleling Station	2-14
2-18	Typical HMF Layout.....	2-16
2-19	Potential Alternatives Considered During Screening.....	2-19
2-20	SR 152 Wye Connection	2-22
2-21	HST Alternatives and HMF Sites Carried Forward for Further Study	2-24
2-22	HST Alternatives and Project Vicinities.....	2-27
2-23	Existing Intercity Transportation Network	2-31
2-24	No Project Alternative Planned Improvements in Merced	2-32
2-25	No Project Alternative Planned Improvements in Madera	2-32
2-26	No Project Alternative Planned Improvements in Fresno	2-33
2-27a	UPRR/SR 99 Alternative with West Chowchilla Design Option and Ave 24 Wye.....	2-40
2-27b	UPRR/SR 99 Alternative with East Chowchilla Design Option and Ave 24 Wye.....	2-40
2-27c	UPRR/SR 99 Alternative with East Chowchilla Design Option and Ave 21 Wye.....	2-40
2-28	UPRR/SR 99 Alternative Requirements	2-41
2-29	UPRR/SR 99 Alternative – UPRR Right-of-way Cross Section Configurations.....	2-42
2-30	UPRR/SR 99 Alternative in the Merced Project Vicinity.....	2-44
2-31	UPRR/SR 99 Alternative and Design Options in the Chowchilla Project Vicinity	2-45
2-32	UPRR/SR 99 Alternative and Design Options in the Madera Project Vicinity	2-47
2-33	UPRR/SR 99 Alternative in the Fresno Project Vicinity.....	2-48
2-34a	Golden State Boulevard Realignment (Between Veterans Boulevard and W Shaw Avenue)	2-49
2-34b	SR 99 Realignment (Between W Ashlan Avenue and W Clinton Avenue)	2-49
2-35	Typical Cross Section of SR 99 Realignment.....	2-50
2-36a and b	Ave 24 Wye and Chowchilla Design Options.....	2-51
2-37	Ave 21 Wye	2-51
2-38a and b	Artist's Rending and Cross Section of Functional Station Structure in Merced	2-53
2-39	Downtown Merced Station Location	2-54

2-40	Conceptual Design of Mariposa Street Station (left) and Kern Street Station (right) Alternatives for Downtown Fresno	2-55
2-41	Downtown Fresno Station – Mariposa Street Station Alternative.....	2-56
2-42a	South Facing Aerial View of Existing Southern Pacific Railroad Depot Property	2-57
2-42b	South Facing Aerial View of Existing Southern Pacific Railroad Depot Property and Proposed Mariposa Street Station Alternative Area.....	2-57
2-43	Downtown Fresno Station – Kern Street Station Alternative	2-58
2-44a	BNSF Alternative with Mission Ave and Le Grand Design Option and Ave 24 Wye.....	2-59
2-44b	BNSF Alternative with Mission Ave and East of Le Grand Design Option and Ave 24 Wye	2-59
2-44c	BNSF Alternative with Mariposa Way and Le Grand Design Option and Ave 24.....	2-59
2-44d	BNSF Alternative with Mariposa Way and East of Le Grand Design Option and Ave 24 Wye	2-59
2-44e	BNSF Alternative with Mission Ave and Le Grand Design Option and Ave 21 Wye.....	2-60
2-44f	BNSF Alternative with Mission Ave and East of Le Grand Design Option and Ave 21 Wye	2-60
2-44g	BNSF Alternative with Mariposa Way and Le Grand Design Option and Ave 21 Wye	2-60
2-44h	BNSF Alternative with Mariposa Way and East of Le Grand Design Option and Ave 21 Wye	2-60
2-45	BNSF Alternative without Shared Right-of-Way	2-62
2-46	BNSF Alternative Showing Opportunity for Shared Right-of-Way	2-63
2-47	BNSF Alternative in the Merced Project Vicinity	2-64
2-48	Mission Ave and Mariposa Way Design Options in the Merced Project Vicinity	2-65
2-49	BNSF Alternative in the Chowchilla Project Vicinity	2-66
2-50	BNSF Alternative in the Madera Project Vicinity	2-67
2-51	BNSF Alternative in the Fresno Project Vicinity	2-69
2-52a	Hybrid Alternative with Ave 24 Wye	2-70
2-52b	Hybrid Alternative with Ave 21 Wye	2-70
2-53	Hybrid Alternative in the Merced Project Vicinity	2-71
2-54	Hybrid Alternative in the Chowchilla Project Vicinity	2-72
2-55	Hybrid Alternative in the Madera Project Vicinity	2-74
2-56	Hybrid Alternative in the Fresno Project Vicinity	2-75

2-57	Location of State Facilities Affected by HST Alternatives	2-77
2-58	Example of Lengthening an Overcrossing on a Divided Highway	2-80
2-59	Overcrossing Replacement (Example: UPRR/SR 99 at Avenue 11).....	2-80
2-60	Interchange and Road System Replacement (Example: UPRR/SR 99 at Avenue 9)	2-81
2-61	Frontage Road and Highway Access Modification (Example: SR 99 Arboleda Interchange)	2-81
2-62	Locations of Proposed Heavy Maintenance Facility Sites	2-84
2-63	Proposed Castle Commerce Center HMF Site	2-85
2-64	Proposed Harris-DeJager HMF Site	2-87
2-65	Proposed Fagundes HMF Site.....	2-87
2-66	Proposed Gordon-Shaw HMF Site	2-88
2-67	Proposed Kojima Development HMF Site	2-88
2-68	Revenue Service and Ridership Build-Up.....	2-92
3.1-1	Shifts of Roadways and Other Infrastructure	3.1-4
3.1-2	Parcel Affected Beyond Project Right-of-Way	3.1-5
3.2-1	Regionally Significant Roadways in the Merced Project Vicinity.....	3.2-11
3.2-2	Regionally Significant Roadways in the Chowchilla Project Vicinity.....	3.2-12
3.2-3	Regionally Significant Roadways in the Madera Project Vicinity	3.2-13
3.2-4	Regionally Significant Roadways in the Fresno Project Vicinity	3.2-14
3.2-5	Roadway Classifications in Downtown Merced.....	3.2-16
3.2-6	Study Intersections in Downtown Merced	3.2-17
3.2-7	Roadway Classifications in Downtown Fresno	3.2-21
3.2-8	Study Intersections in Northern Portion of Downtown Fresno.....	3.2-22
3.2-9	Study Intersections in Southern Portion of Downtown Fresno	3.2-23
3.2-10	Proposed SR 99 Realignment	3.2-48
3.2-11	Future (2035) Project Intersection LOS with Proposed Downtown Merced Station – Parking Option A	3.2-69
3.2-12	Future (2035) Project Intersection LOS with Proposed Downtown Merced Station – Parking Option B	3.2-70
3.2-13	Future (2035) Project Intersection LOS with Proposed Downtown Fresno Station – Northern Portion of Downtown	3.2-86

3.2-14 Future (2035) Project Intersection LOS with Proposed Fresno Station – South Portion of Downtown.....	3.2-87
3.3-1 National MSAT Emission Trends (1999–2050) for Vehicles Operating on Roadways Using EPA's Mobile6.2 Model.....	3.3-14
3.3-2 San Joaquin Valley Air Basin	3.3-25
3.3-3 Air Quality Ambient Air Monitors	3.3-27
3.3-4 CO Hot-Spot Evaluation Intersections (Project vs. No Project 2035)	3.3-57
3.3-5 CO Hot-Spot Evaluation Intersections (Existing plus Project vs. Existing Conditions 2009)	3.3-63
3.4-1 Typical 24-hour L_{dn} Noise Levels	3.4-4
3.4-2 Typical Levels of Ground-Borne Vibration	3.4-4
3.4-3 FRA Noise Impact Criteria.....	3.4-8
3.4-4 FTA Detailed Ground-Borne Vibration Impact Criteria	3.4-12
3.4-5 Noise and Vibration Measurement Locations in the Merced Project Vicinity	3.4-18
3.4-6 Noise and Vibration Measurement Locations in the Chowchilla Project Vicinity	3.4-19
3.4-7 Noise and Vibration Measurement Locations in the Madera Project Vicinity	3.4-20
3.4-8 Noise and Vibration Measurement Locations in the Fresno Project Vicinity	3.4-21
3.4-9 Noise Impacts in the Merced Project Vicinity.....	3.4-33
3.4-10 Noise Impacts in the Chowchilla Project Vicinity.....	3.4-34
3.4-11 Noise Impacts in the Madera Project Vicinity.....	3.4-35
3.4-12 Noise Impacts in the Fresno Project Vicinity.....	3.4-36
3.4-13 Vibration Impacts in the Le Grand Project Vicinity	3.4-43
3.4-14 Potential Noise Mitigation Locations in the Merced Project Vicinity.....	3.4-46
3.4-15 Potential Noise Mitigation Locations in the Chowchilla Project Vicinity.....	3.4-47
3.4-16 Potential Noise Mitigation Locations in the Madera Project Vicinity	3.4-48
3.4-17 Potential Noise Mitigation Locations in the Fresno Project Vicinity	3.4-49
3.4-18 Examples of Sound Barriers for Rail Corridors	3.4-50
3.4-19 Potential Sound Barrier Locations in the Merced Project Vicinity	3.4-53
3.4-20 Potential Sound Barrier Locations in the Chowchilla Project Vicinity	3.4-54
3.4-21 Potential Sound Barrier Locations in the Madera Project Vicinity	3.4-55

3.4-22 Potential Sound Barrier Locations in the Fresno Project Vicinity.....	3.4-56
3.5-1 EMF/EMI Measurement Locations in the Merced Project Vicinity.....	3.5-7
3.5-2 EMF/EMI Measurement Locations in the Chowchilla Project Vicinity.....	3.5-8
3.5-3 EMF/EMI Measurement Locations in the Madera Project Vicinity.....	3.5-9
3.5-4 EMF/EMI Measurement Locations in the Fresno Project Vicinity.....	3.5-10
3.6-1 California Energy Consumption by Sector, 2008	3.6-18
3.6-2 California Transportation Energy Consumption by Source, 2008.....	3.6-19
3.6-3 High-Risk Utilities in the Merced Project Vicinity	3.6-23
3.6-4 High-Risk Utilities in the Chowchilla Project Vicinity	3.6-24
3.6-5 High-Risk Utilities in the Madera Project Vicinity.....	3.6-25
3.6-6 High-Risk Utilities in the Fresno Project Vicinity.....	3.6-26
3.6-7 Alternatives for Relocating an Existing Substation Affected by the Ave 21 Wye	3.6-47
3.7-1 Regional Habitats of Concern.....	3.7-20
3.7-2 Regional Habitats of Concern (Merced Area).....	3.7-21
3.7-3 Regional Habitats of Concern (Chowchilla Area)	3.7-22
3.7-4 Regional Habitats of Concern (Madera Area).....	3.7-23
3.7-5 Regional Habitats of Concern (Fresno Area).....	3.7-24
3.7-6 Wildlife Corridors	3.7-28
3.7-7 Threatened and Endangered Species Observed and Reported.....	3.7-34
3.8-1 Regional Hydrology	3.8-9
3.8-2 Water Resources in the Merced Project Vicinity.....	3.8-14
3.8-3 Water Resources in the Chowchilla Project Vicinity.....	3.8-15
3.8-4 Water Resources in the Madera Project Vicinity.....	3.8-16
3.8-5 Water Resources in the Fresno Project Vicinity.....	3.8-17
3.8-6 Groundwater Subbasins in the Project Vicinity.....	3.8-18
3.8-7 Flood Zones in the Project Vicinity.....	3.8-23
3.9-1 Location of Rock Quarries.....	3.9-3

3.9-2	Surficial Geology within the Study Area	3.9-10
3.9-3	Soil Associations within the Study Area.....	3.9-14
3.9-4	Active and Potentially Active Faults within about 65 miles of the HST Alternatives ...	3.9-18
3.9-5	Historical Earthquakes and Magnitudes within 100 Miles of Project Area	3.9-20
3.10-1	Locations of Conceivable and Current PECs in the Merced Project Vicinity.....	3.10-11
3.10-2	Locations of Conceivable and Current PECs in the Chowchilla Project Vicinity.....	3.10-12
3.10-3	Locations of Conceivable and Current PECs in the Madera Project Vicinity	3.10-13
3.10-4	Locations of Conceivable and Current PECs in the Fresno Project Vicinity	3.10-14
3.11-1	Fatalities per 100 Million Passenger Miles in 2008	3.11-2
3.11-2	Total Passenger Fatalities in 2008	3.11-2
3.11-3	Safety and Security Existing Conditions in the Merced Project Vicinity	3.11-9
3.11-4	Safety and Security Existing Conditions in the Chowchilla Project Vicinity.....	3.11-10
3.11-5	Safety and Security Existing Conditions in the Madera Project Vicinity	3.11-11
3.11-6	Safety and Security Existing Conditions in the Fresno Project Vicinity	3.11-12
3.11-7	Derailment Wall and Parapet	3.11-24
3.11-8	HST Derailment	3.11-24
3.11-9	Alternate Mitigation Alignment to Avoid Safety Risk to Correctional Facilities.....	3.11-31
3.12-1	Communities in the Study Area	3.12-18
3.12-2	City of Fresno – Community and Specific Plan Areas	3.12-21
3.12-3	Merced Downtown Station – Areas with Zero Population	3.12-28
3.12-4	Fresno Downtown Station – Areas with Zero Population	3.12-29
3.13-1	Existing Land Uses in the Downtown Merced Station Study Area.....	3.13-10
3.13-2	Current Zoning in the Downtown Merced Station Study Area	3.13-11
3.13-3	Existing Land Uses in the Downtown Fresno Station Study Area.....	3.13-12
3.13-4	Current Zoning in the Downtown Fresno Station Study Area	3.13-13
3.14-1	Important Farmland and Grazing Land in the Merced Project Vicinity	3.14-10
3.14-2	Important Farmland and Grazing Land in the Chowchilla Project Vicinity	3.14-11

3.14-3	Important Farmland and Grazing Land in the Madera Project Vicinity	3.14-12
3.14-4	Important Farmland and Grazing Land in the Fresno Project Vicinity	3.14-13
3.14-5	Distribution of Crop Cover in the Merced Project Vicinity.....	3.14-14
3.14-6	Distribution of Crop Cover in the Chowchilla Project Vicinity.....	3.14-15
3.14-7	Distribution of Crop Cover in the Madera Project Vicinity	3.14-16
3.14-8	Distribution of Crop Cover in the Fresno Project Vicinity	3.14-17
3.14-9	Protected Lands in the Project Vicinity.....	3.14-20
3.15-1	Parks, Recreation, and Open Space in the Merced Project Vicinity	3.15-6
3.15-2	Parks, Recreation, and Open Space in the Chowchilla Project Vicinity	3.15-7
3.15-3	Parks, Recreation, and Open Space in the Madera Project Vicinity.....	3.15-8
3.15-4	Parks, Recreation, and Open Space in the Fresno Project Vicinity.....	3.15-9
3.15-5	Sharon Avenue Linear Park, Riverside Park, and Rotary Park, City of Madera.....	3.15-18
3.15-6	Fairmead Toddler Park, Madera County	3.15-19
3.15-7	Courthouse Park, City of Madera.....	3.15-20
3.15-8	County Road 27¾ Linear Park, City of Madera.....	3.15-21
3.15-9	Camp Pashayan and San Joaquin River Parkway, City of Fresno.....	3.15-22
3.15-10	Roeding Park, City of Fresno	3.15-23
3.15-11	Highway City Neighborhood Community Center, City of Fresno	3.15-24
3.15-12	Basin AH1 Dog Park, City of Fresno	3.15-25
3.15-13	Bob Hart Square and Courthouse Square Park, City of Merced	3.15-26
3.15-14	Chukchansi Park Stadium and Fresno County Plaza, City of Fresno	3.15-27
3.15-15	Stephen Gray Park, City of Merced	3.15-28
3.15-16	Le Grand Park, Merced County	3.15-29
3.15-17	Veterans Park, City of Atwater.....	3.15-30
3.15-18	Joe Stefani Elementary School, Merced County.....	3.15-31
3.15-19	KVP 16 Existing and Simulated Views.....	3.15-42
3.16-1	Landscape Units.....	3.16-12
3.16-2	Key Viewpoints in the Merced Station Area	3.16-13
3.16-3	Key Viewpoints in the Merced Project Vicinity	3.16-14

3.16-4 Key Viewpoints in the Chowchilla Project Vicinity	3.16-15
3.16-5 Key Viewpoints in the Madera Project Vicinity	3.16-16
3.16-6 Key Viewpoints in the Fresno Project Vicinity	3.16-17
3.16-7 KVP 4 Existing and Simulated View and Rendering	3.16-34
3.16-8 KVP 5 Existing and Simulated Views.....	3.16-34
3.16-9 KVP 6 Existing and Simulated Views.....	3.16-35
3.16-10 KVP 8 Existing and Simulated Views	3.16-36
3.16-11 KVP 9 Existing and Simulated Views	3.16-37
3.16-12 KVP 10 Existing View	3.16-38
3.16-13 KVP 11 Existing and Simulated Views.....	3.16-39
3.16-14 KVP 13 Existing and Simulated Views.....	3.16-40
3.16-15 KVP 15 Existing and Simulated Views.....	3.16-41
3.16-16 KVP 16 Existing and Simulated Views.....	3.16-41
3.16-17 KVPs 18 and 19, Existing and Simulated Views	3.16-42
3.16-18 KVP 20 Existing and Simulated Views.....	3.16-44
3.16-19 KVP 24 Existing and Simulated Views.....	3.16-45
3.16-20 KVP 25 Existing and Simulated Views.....	3.16-46
3.16-21 KVP 26 Existing and Simulated Views.....	3.16-47
3.16-22 KVP 27 Existing and Simulated Views.....	3.16-48
3.16-23 KVP 28 Existing and Simulated Views.....	3.16-49
3.16-24 KVP 30 Existing and Simulated Views.....	3.16-50
3.16-25 Typical HMF Layout	3.16-51
3.16-26 KVP 2 Existing and Simulated Views	3.16-53
3.16-27 KVP 3 Existing and Simulated Views	3.16-54
3.16-28 KVP 4A Existing and Simulated Views	3.16-55
3.17-1 Cultural Resources in the Merced Project Vicinity	3.17-33
3.17-2 Cultural Resources in the Chowchilla Project Vicinity	3.17-34
3.17-3 Cultural Resources in the Madera Project Vicinity	3.17-35
3.17-4 Cultural Resources in the Fresno Project Vicinity	3.17-36
3.17-5 Cultural Resources in the Western Portion of the Downtown Merced Station APE ..	3.17-42

3.17-6 Cultural Resources in the Eastern Portion of the Downtown Merced HST Station APE.....	3.17-43
3.17-7 Cultural Resources in the APE – South of Merced	3.17-45
3.17-8 Cultural Resources in the APE – Chowchilla Vicinity	3.17-46
3.17-9 Cultural Resources in APE – North of Downtown Fresno	3.17-47
3.17-10 Cultural Resources in the APE – North of Fresno.....	3.17-49
3.17-11 Cultural Resources along the Downtown Fresno Station Alternatives and Alignment	3.17-50
3.17-12 Cultural Resources in the APE – Downtown Madera	3.17-54
4-1 Project Location Map.....	4-2
4-2 Park Properties in the Merced Project Vicinity	4-18
4-3 Park Properties in the Chowchilla Project Vicinity	4-19
4-4 Park Properties in the Madera Project Vicinity	4-20
4-5 Park Properties in the Fresno Project Vicinity	4-21
4-6 Historic and Archaeological Resources Listed or Eligible for Listing on the NRHP	4-31
4-7 Rotary Park, Sharon Avenue Linear Park, and Riverside Park, City of Madera.....	4-33
4-8 County Road 27¾ Linear Park, City of Madera.....	4-36
4-9 Camp Pashayan and San Joaquin River Parkway, City of Fresno.....	4-37
4-10 Roeding Park, City of Fresno.....	4-38
4-11 Joe Stefani Elementary School, Merced County	4-40
5-1 HST Speeds Along the UPRR/SR 99, BNSF, and Hybrid Alternatives.....	5-6