CALIFORNIA HIGH-SPEED TRAIN

Project Environmental Impact Report / Environmental Impact Statement

Wetlands Delineation Report

Merced to Fresno Section Project EIR/EIS

April 2012

CALIFORNIA
High-Speed Rail Authority

U.S. Department of Transportation
Federal Railroad Administration

CALIFORNIA HIGH-SPEED TRAIN PROJECT EIR/EIS

TECHNICAL REPORT

Merced to Fresno Section
Wetlands Delineation Report

Prepared by:

AECOM
CH2M HILL

April 2012

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Acronyms and Abbreviations

°F	degrees Fahrenheit
bgs	below ground surface
BIOS	Biogeographic Information and Observation System
CWA	Clean Water Act
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EPA	United States Environmental Protection Agency
ESA	Endangered Species Act
FAC	facultative species
FACW	facultative wetland species
FRA	Federal Railroad Administration
GIS	Geographic Information System
HMF	Heavy Maintenance Facility
HST	High-Speed Train
HUC	Hydrologic Unit Code
JD	Jurisdictional Determination
mph	miles per hour
NA	No agreement (Regional panel was not able to reach a unanimous indicator category decision for this species.)
NWI	National Wetlands Inventory
NRCS	Natural Resource Conservation Service
OBL	obligate wetland species
RGL	Regulatory Guidance Letter
RPW	Relatively permanent water
SR	State Route
SWRCB	State Water Resources Control Board
TNW	traditional navigable waters
UPL	upland species
USACE	United States Army Corps of Engineers
USFWS	United States Fish and Wildlife Service
WRCC	Western Regional Climate Center

1.0 Introduction

The California High-Speed Train (HST) System, as shown in Figure 1-1, is planned to provide intercity, high-speed service on more than 800 miles of tracks throughout California, connecting the major population centers of Sacramento, the San Francisco Bay Area, the Central Valley, Los Angeles, the Inland Empire, Orange County, and San Diego. The HST System is envisioned as a state-of-the-art, electrically powered, high-speed, steel-wheel-on-steel-rail technology, which will include contemporary safety, signaling, and automated train-control systems. The trains will be capable of operating at speeds of up to 220 miles per hour (mph) over a fully grade-separated, dedicated track alignment.

Two phases of the California HST System are planned. Phase 1 will connect San Francisco to Los Angeles via the Pacheco Pass and the Central Valley. An expected express trip time between San Francisco and Los Angeles is mandated to be 2 hours and 40 minutes or less. Phase 2 will connect the Central Valley to the state's capital, Sacramento, and will extend the system from Los Angeles to San Diego.

The California HST System will be planned, designed, constructed, and operated under the direction of the California High-Speed Rail Authority (Authority), a state governing board formed in 1996. The Authority's statutory mandate is to develop a high-speed rail system that is coordinated with the state's existing transportation network, which includes intercity rail and bus lines, regional commuter rail lines, urban rail and bus transit lines, highways, and airports.

Definition of HST System

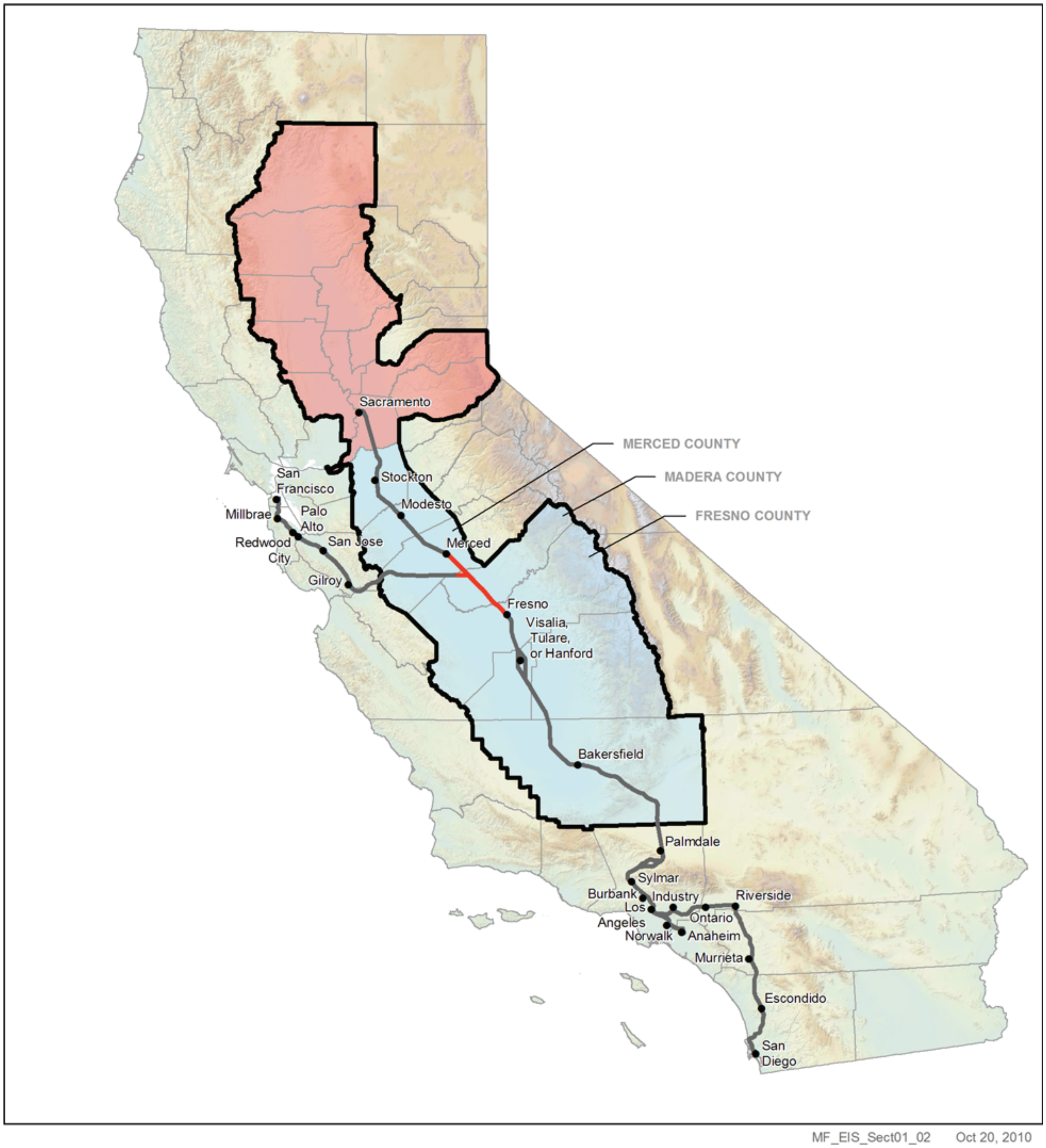
The system that includes the HST tracks, structures, stations, traction powered substations, and maintenance facilities and train vehicles able to travel 220 mph.

The Merced to Fresno HST Section is a critical Phase 1 link connecting the Bay Area HST sections to the Fresno to Bakersfield, Bakersfield to Palmdale, and Palmdale to Los Angeles HST sections. The Merced to Fresno Section alternatives originated in two program Environmental Impact Report/Environmental Impact Statement (EIR/EIS) documents. The Authority and the Federal Railroad Administration (FRA) prepared the 2005 *Final Program EIR/EIS for the Proposed California High-Speed Train System EIR/EIS* (Statewide Program EIR/EIS) and the 2008 *Bay Area to Central Valley HST Final Program EIR/EIS* (Bay Area to Central Valley Program EIR/EIS) to evaluate the ability of an HST system to meet the existing and future capacity demands on California's intercity transportation system and to identify a preferred alignment for the San Francisco Bay Area (Bay Area) to Central Valley sections of the HST System, respectively.

For each of the environmental resources evaluated for this project, analysts defined the study areas to be surveyed for existing conditions and to be analyzed for impacts**.** These study areas are defined with the following basic parameters:

- The potential area of disturbance or construction footprint, encompassing the required right-of-way, and areas required for construction including staging areas and temporary construction easements. The construction footprint is common to all resource areas.
- A resource-specific buffer for evaluation of indirect impacts. The buffer varies by resource area.

This Wetland Delineation Report has been prepared in support of the EIR/EIS prepared for the Merced to Fresno Section of the proposed California HST System. The HST system would provide additional capacity and predictable, consistent travel times to meet increasing intercity travel demands in a manner that is protective of California's natural resources. The Merced to Fresno Section is a nexus in the California HST System, connecting the San Jose to Merced Section to the west, the Merced to Sacramento Section to the north, and the Fresno to Bakersfield Section to the south (Figure 1-1).



Merced to Fresno Section
Statewide HST System
Potential Station
Counties Commonly Associated with the Central Valley
Sacramento Valley
San Joaquin Valley

Figure 1-1
HST System in California

This Wetland Delineation Report provides descriptions of the environmental setting, methods, and results of a survey of wetlands and other water features for the Merced to Fresno Section of the California High Speed Rail Authority's HST System. This document provides information required for preparation of the Merced to Fresno Section EIR/EIS. The analysis presented here is based upon an approximate 15% design completed for the project alternatives. Further design may reduce or change impacts described in this report.

1.1 Project Description

The purpose of the Merced to Fresno Section of the HST project is to implement the California HST System between Merced and Fresno, providing the public with electric-powered high-speed rail service that provides predictable and consistent travel times between major urban centers and connectivity to airports, mass transit systems, and the highway network in the south San Joaquin Valley, and to connect the northern and southern portions of the HST System. The approximately 65-mile-long corridor between Merced and Fresno is an essential part of the statewide HST System. The Merced to Fresno Section is the location where the HST would intersect and connect with the Bay Area and Sacramento branches of the HST System; it would provide a potential location for the heavy maintenance facility (HMF) where the HSTs would be assembled and maintained, as well as a test track for the trains; it would also provide Merced and Fresno access to a new transportation mode and would contribute to increased mobility throughout California.

1.1.1 No Project Alternative

The No Project Alternative refers to the projected growth planned for the region through the 2035 time horizon without the HST project and serves as a basis of comparison for environmental analysis of the HST build alternatives. The No Project Alternative includes planned improvements to the highway, aviation, conventional passenger rail, and freight rail systems in the Merced to Fresno project area. There are many environmental impacts that would result under the No Project Alternative.

1.1.2 High-Speed Train Alternatives

As shown in Figure 1-2, there are three HST alignment alternatives proposed for the Merced to Fresno Section of the HST System: the UPRR/SR 99 Alternative, which would primarily parallel the UPRR railway; the BNSF Alternative, which would parallel the BNSF railway for a portion of the distance between Merced and Fresno; and the Hybrid Alternative, which combines features of the UPRR/SR 99 and BNSF alternatives. In addition, there is an HST station proposed for both the City of Merced and the City of Fresno, there is a wye connection west to the Bay Area, and there are five potential sites for a proposed HMF.

The Authority and FRA have identified the Hybrid Alternative as their preferred alternative for the north-south alignment between Merced and Fresno. The Hybrid Alternative would connect to San Jose to the west along one of three wye design options. The San Jose to Merced Section Project EIR/EIS will fully evaluate the east-west alignment alternatives and wye configurations, including the Ave 24 Wye, the Ave 21 Wye, and another wye design option, the SR 152 Wye, which has not been reviewed in this document. A decision regarding the preferred east-west alignment, including the preferred wye design option, will take place after circulation of the San Jose to Merced Section Project EIR/EIS; that decision will finalize the alignment and profile of the Hybrid Alternative. In addition, the Authority and FRA have identified the Mariposa Street Station Alternative as their preferred alternative for an HST station in Downtown Fresno.

1.1.2.1 UPRR/SR 99 Alternative

This section describes the UPRR/SR 99 Alternative, including the Chowchilla design options, wyes, and HST stations.

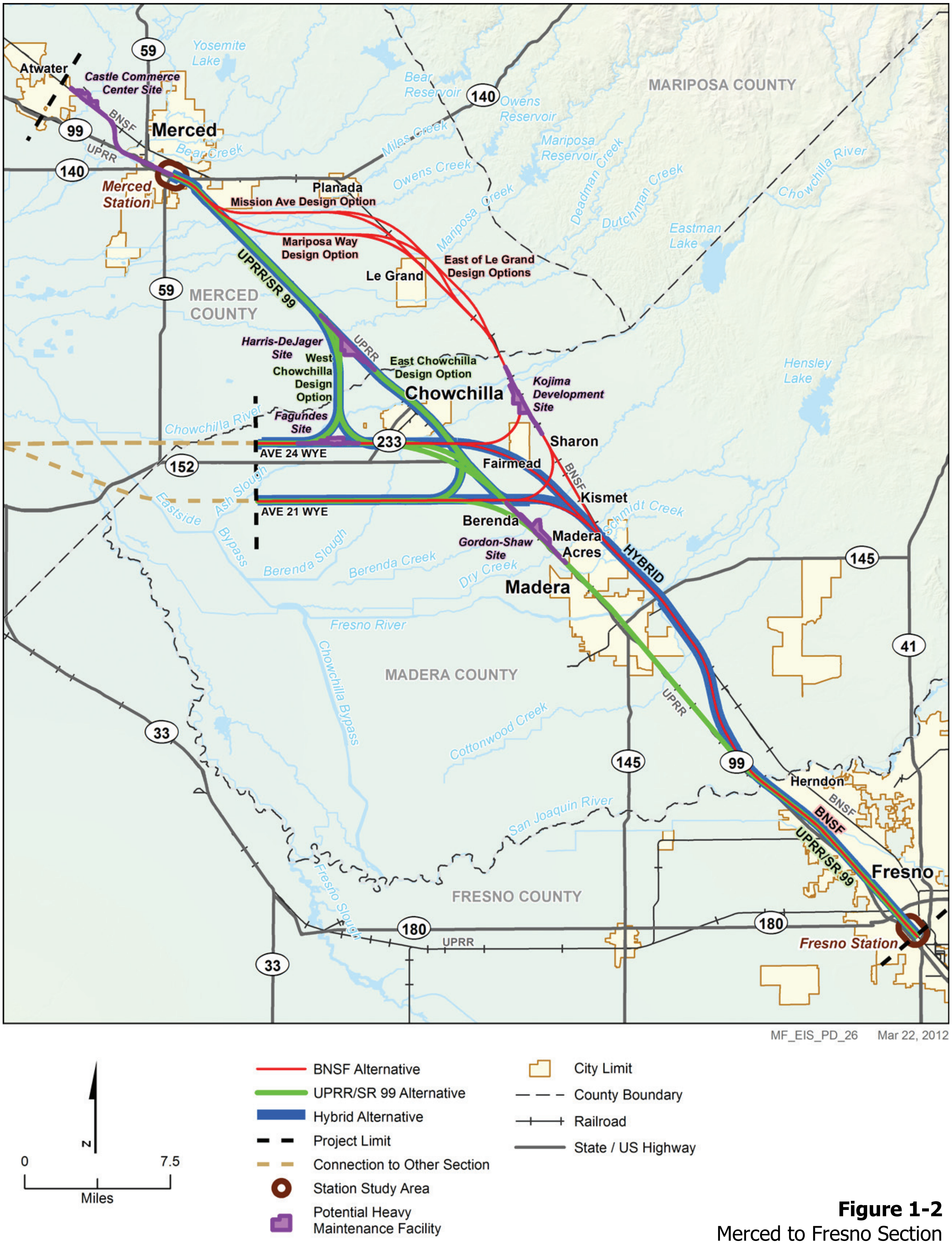


Figure 1-2
Merced to Fresno Section
HST Alternatives

North-South Alignment

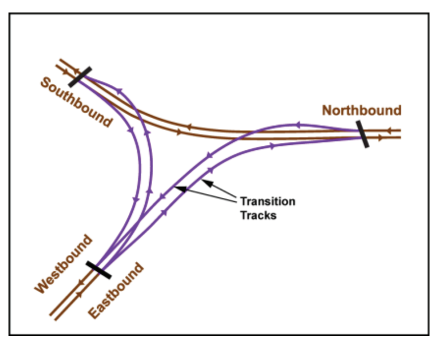
The north-south alignment of the UPRR/SR 99 Alternative would begin at the HST station in Downtown Merced, located on the west side of the UPRR right-of-way. South of the station and leaving Downtown Merced, the alternative would be at-grade and cross under SR 99. Approaching the City of Chowchilla, the UPRR/SR 99 Alternative has two design options: the East Chowchilla design option, which would pass Chowchilla on the east side of town, and the West Chowchilla design option, which would pass Chowchilla 3 to 4 miles west of the city before turning back to rejoin the UPRR/SR 99 transportation corridor. These design options would take the following routes:

- **East Chowchilla design option:** This design option would transition from the west side of the UPRR/SR 99 corridor to an elevated structure as it crosses the UPRR railway and N Chowchilla Boulevard just north of Avenue 27, continuing on an elevated structure away from the UPRR corridor along the west side of and parallel to SR 99 to cross Berenda Slough. Toward the south side of Chowchilla, this design option would cross over SR 99 north of the SR 99/SR 152 interchange near Avenue 23½ south of Chowchilla. Continuing south on the east side of SR 99 and the UPRR corridor, this design option would remain elevated for 7.1 miles through the communities of Fairmead and Berenda until reaching the Dry Creek Crossing. The East Chowchilla design option connects to the HST sections to the west via either the Ave 24 or Ave 21 wyes (described below).
- **West Chowchilla design option:** This design option would travel due south from Sandy Mush Road north of Chowchilla, following the west side of Road 11¾. The alignment would turn southeast toward the UPRR/SR 99 corridor south of Chowchilla. The West Chowchilla design option would cross over the UPRR and SR 99 east of the Fairmead city limits to again parallel the UPRR/SR 99 corridor. The West Chowchilla design option would result in a net decrease of approximately 13 miles of track for the HST System compared to the East Chowchilla design option and would remain outside the limits of the City of Chowchilla. The West Chowchilla design option connects to the HST sections to the west via the Ave 24 Wye, but not the Ave 21 Wye.

The UPRR/SR 99 Alternative would continue toward Madera along the east side of the UPRR south of Dry Creek and remain on an elevated profile for 8.9 miles through Madera. After crossing over Cottonwood Creek and Avenue 12, the HST alignment would transition to an at-grade profile and continue to be at-grade until north of the San Joaquin River. After the San Joaquin River crossing, the HST alignment would require realignment (a mostly westward shift) of Golden State Boulevard and of a portion of SR 99 to create right-of-way adjacent to the UPRR railroad that would not preclude future expansion of these roadways. After crossing the San Joaquin River, the alternative would rise over the UPRR railway on an elevated guideway, supported by straddle bents, before crossing over the existing Herndon Avenue and again descending into an at-grade profile and continuing west of and parallel to the UPRR right-of-way. After elevating to cross the UPRR railway on the southern bank of the San Joaquin River, south of Herndon Avenue, the alternative would transition from an elevated to an at-grade profile. Traveling south from Golden State Boulevard at-grade, the alternative would cross under the reconstructed Ashlan Avenue and Clinton Avenue overhead structures. Advancing south from Clinton Avenue between Clinton Avenue and Belmont Avenue, the HST guideway would run at-grade adjacent to the western boundary of the UPRR right-of-way and then enter the HST station in Downtown Fresno. The HST guideway would descend in a retained-cut to pass under the San Joaquin Valley Railroad spur line and SR 180, transition back to at-grade before Stanislaus Street and continue to be at-grade into

What is a "Wye"?

The word "wye" refers to the "Y"-like formation that is created where train tracks branch off the mainline to continue in different directions. The transition to a wye requires splitting two tracks into four tracks that cross over one another before the wye "legs" can diverge in opposite directions to allow bidirectional travel. For the Merced to Fresno Section of the HST System, the two tracks traveling east-west from the San Jose to Merced Section must become four tracks—a set of two tracks branching to the north and a set of two tracks branching to the south.



the station. As part of a station design option, Tulare Street would become either an overpass or undercrossing at the station.

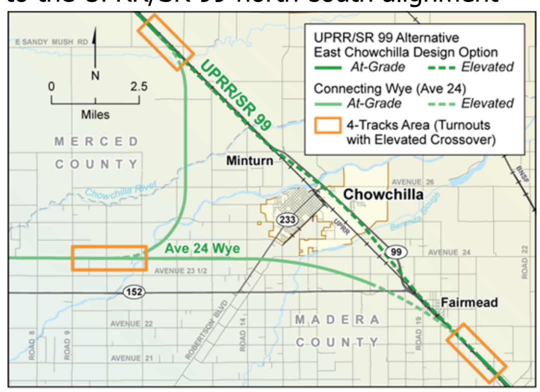
Wye Design Options

The following text describes the wye connection from the San Jose to Merced Section to the Merced to Fresno Section. There are two variations of the Ave 24 Wye for the UPRR/SR 99 Alternative because of the West Chowchilla design option. The Ave 21 Wye does not connect to the West Chowchilla design option and therefore does not have a variation.

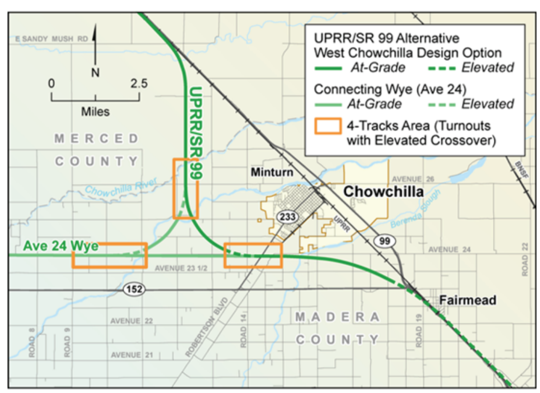
Ave 24 Wye

The Ave 24 Wye design option would travel along the south side of eastbound Avenue 24 toward the UPRR/SR 99 Alternative and would begin diverging onto two sets of tracks west of Road 11 and west of the City of Chowchilla. Under the East Chowchilla design option, the northbound set of tracks would travel northeast across Road 12, joining the UPRR/SR 99 north-south alignment on the west side of the UPRR right-of-way just north of Sandy Mush Road. Under the West Chowchilla design option, the northbound set of tracks would travel northeast across Road 12 and would join the UPRR/SR 99 north-south alignment just south of Avenue 26. The southbound HST guideway would continue east along Avenue 24, turning south near SR 233 southeast of Chowchilla, crossing SR 99 and the UPRR railway to connect to the UPRR/SR 99 Alternative north-south alignment on the east side of the UPRR near Avenue 21½. Under the West Chowchilla design option, the southbound tracks would turn south near Road 16 south of Chowchilla, crossing SR 99 and the UPRR to connect to the UPRR/SR 99 north-south alignment on the east side of the UPRR adjacent to the city limits of Fairmead.

Figure 1-3a shows the wye alignment for the East Chowchilla design option and Figure 1-3b shows the alignment for the West Chowchilla design option. Together, the figures illustrate the difference in the wye triangle formation for each design option connection. The north-south alignment of the West Chowchilla design option between Merced and Fresno diverges along Avenue 24 onto Road 12, on the north branch of the wye, allowing the HST alternative to avoid traveling through Chowchilla and to avoid constraining the city within the wye triangle.



(a) Ave 24 Wye with the East Chowchilla Design Option



(b) Ave 24 Wye with the West Chowchilla Design Option

Figure 1-3a and b
Ave 24 Wye and Chowchilla Design Options

Ave 21 Wye

The Ave 21 Wye would travel along the north side of Avenue 21. Just west of Road 16, the HST tracks would diverge north and south to connect to the UPRR/SR 99 Alternative, with the north leg of the wye joining the north-south alignment at Avenue 23½ and the south leg at Avenue 19½.

HST Stations

The Downtown Merced and Downtown Fresno station areas would each occupy several blocks, to include station plazas, drop-offs, a multimodal transit center, and parking structures. The areas would include the station platform and associated building and access structure, as well as lengths of platform tracks to accommodate local and express service at the stations. As currently proposed, both the Downtown Merced and Downtown Fresno stations would be at-grade, including all trackway and platforms, passenger services and concessions, and back-of-house functions.

Downtown Merced Station

The Downtown Merced Station would be between Martin Luther King Jr. Way to the northwest and G Street to the southeast. The station would be accessible from both sides of the UPRR, but the primary station house would front 16th Street. The major access points from SR 99 include V Street, R Street, Martin Luther King Jr. Way, and G Street. Primary access to the parking facility would be from West 15th Street and West 14th Street, just one block east of SR 99. The closest access to the parking facility from the SR 99 freeway would be R Street, which has a full interchange with the freeway. The site proposal includes a parking structure that would have the potential for up to 6 levels with a capacity of approximately 2,250 cars and an approximate height of 50 feet.

Downtown Fresno Station Alternatives

There are two station alternatives under consideration in Fresno: the Mariposa Street Station Alternative and the Kern Street Station Alternative. The Authority and FRA have identified Mariposa Street Station as their preferred alternative.

Mariposa Street Station Alternative (Preferred Alternative)

The Mariposa Street Station Alternative is located in Downtown Fresno, less than 0.5 mile east of SR 99. The station would be centered on Mariposa Street and bordered by Fresno Street on the north, Tulare Street on the south, H Street on the east, and G Street on the west. The station building would be approximately 75,000 square feet, with a maximum height of approximately 60 feet. The two-level station would be at-grade, with passenger access provided both east and west of the HST guideway and the UPRR tracks, which would run parallel with one another adjacent to the station. Entrances would be located at both G and H Streets. The eastern entrance would be at the intersection of H Street and Mariposa Street, with platform access provided via the pedestrian overcrossing. The main western entrance would be located at G Street and Mariposa Street.

The majority of station facilities would be located east of the UPRR tracks. The station and associated facilities would occupy approximately 18.5 acres, including 13 acres dedicated to the station, bus transit center, surface parking lots, and kiss-and-ride accommodations. A new intermodal facility would be included in the station footprint on the parcel bordered by Fresno Street to the north, Mariposa Street to the south, Broadway Street to the east, and H Street to the west. The site proposal includes the potential for up to 3 parking structures occupying a total of 5.5 acres. Two of the three potential parking structures would each sit on 2 acres, and each would have a capacity of approximately 1,500 cars. The third parking structure would have a slightly smaller footprint (1.5 acres), with 5 levels and a capacity of approximately 1,100 cars. Surface parking lots would provide approximately 300 additional parking spaces.

Kern Street Station Alternative

The Kern Street Station Alternative for the HST station would also be in Downtown Fresno and would be centered on Kern Street between Tulare Street and Inyo Street. This station would include the same components and acreage as the Mariposa Street Station Alternative, but the station would not encroach on the historic Southern Pacific Railroad depot just north of Tulare Street and would not require relocation of existing Greyhound facilities. Two of the 3 potential parking structures would each sit on 2 acres and each would have a capacity of approximately 1,500 cars. The third structure would have a slightly smaller footprint (1.5 acres) and a capacity of approximately 1,100 cars. Surface Like the Mariposa Street Station Alternative, the majority of station facilities under the Kern Street Station Alternative would be east of the HST tracks.

1.1.2.2 BNSF Alternative

This section describes the BNSF Alternative, including the Le Grand design options and wyes. It does not include a discussion of the HST stations, because the station descriptions are identical for each of the three HST alignment alternatives.

North-South Alignment

The north-south alignment of the BNSF Alternative would begin at the proposed Downtown Merced HST Station. This alternative would remain at-grade through Merced and would cross under SR 99 at the south end of the city. Just south of the interchange at SR 99 and E Childs Avenue, the BNSF Alternative would cross over SR 99 and UPRR as it begins to curve to the east, crossing over the E Mission Avenue interchange. It would then travel east to the vicinity of Le Grand, where it would turn south and travel adjacent to the BNSF tracks.

To minimize impacts on the natural environment and the community of Le Grand, the project design includes four design options:

- **Mission Ave design option:** This design option would turn east to travel along the north side of Mission Avenue at Le Grand and then would elevate through Le Grand adjacent to and along the west side of the BNSF corridor.
- **Mission Ave East of Le Grand design option:** This design option would vary from the Mission Ave design option by traveling approximately 1 mile farther east before turning southeast to cross Santa Fe Avenue and the BNSF tracks south of Mission Avenue. The HST alignment would parallel the BNSF for a half-mile to the east, avoiding the urban limits of Le Grand. This design option would cross Santa Fe Avenue and the BNSF railroad again approximately one-half mile north of Marguerite Road and would continue adjacent to the west side of the BNSF corridor.
- **Mariposa Way design option:** This design option would travel 1 mile farther than the Mission Ave design option before crossing SR 99 near Vassar Road and turning east toward Le Grand along the south side of Mariposa Way. East of Simonson Road, the HST alignment would turn to the southeast. Just prior to Savana Road in Le Grand, the HST alignment would transition from at-grade to elevated to pass through Le Grand on a 1.7-mile-long guideway adjacent to and along the west side of the BNSF corridor.
- **Mariposa Way East of Le Grand design option:** This design option would vary from the Mariposa Way design option by traveling approximately 1 mile farther east before turning southeast to cross Santa Fe Avenue and the BNSF tracks less than one-half mile south of Mariposa Way. The HST alignment would parallel the BNSF to the east of the railway for a half-mile, avoiding the urban limits of Le Grand. This design option would cross Santa Fe Avenue and the BNSF again approximately a half-mile north of Marguerite Road and would continue adjacent to the west side of the BNSF corridor.

Continuing southeast along the west side of BNSF, the BNSF alternative would begin to curve just before Plainsburg Road through a predominantly rural and agricultural area. One mile south of Le Grand, the HST alignment would cross Deadman and Dutchman creeks. The alignment would deviate from the BNSF corridor just southeast of S White Rock Road, where it would remain at-grade for another 7 miles, except at the bridge crossings, and would continue on the west side of the BNSF corridor through the community of Sharon. The HST alignment would continue at-grade through the community of Kismet until crossing at Dry Creek. The BNSF Alternative would then continue at-grade through agricultural areas along the west side of the BNSF corridor through the community of Madera Acres north of the City of Madera; in the vicinity of Madera Acres, the HST Project would provide a grade separation of Road 26 and Road 28, which would cross over both the existing BNSF tracks and the new HST guideway. South of Avenue 15 east of Madera, the alignment would transition toward the UPRR corridor, following the east side of the UPRR corridor near Avenue 9 south of Madera, then continuing along nearly the same route as the UPRR/SR 99 Alternative over the San Joaquin River to enter the community of Herndon. After crossing the San Joaquin River, the alignment would be the same as for the UPRR/SR 99 Alternative

Wye Design Options

The Ave 24 Wye and the Ave 21 Wye would be the same as described for the UPRR/SR 99 Alternative (East Chowchilla design option), except as noted below.

Ave 24 Wye

As with the UPRR/SR 99 Alternative, the Ave 24 Wye would follow along the south side of Avenue 24 and would begin diverging into two sets of tracks (i.e., four tracks) beginning west of Road 17. Two tracks would travel north near Road 20½, where they would join the north-south alignment of the BNSF Alternative on the west side of the BNSF corridor near Avenue 26½. The two southbound tracks would join the BNSF Alternative on the west side of the BNSF corridor south of Avenue 21.

Ave 21 Wye

As with the UPRR/SR 99 Alternative, the Ave 21 Wye would travel along the north side of Avenue 21. Two tracks would diverge, turning north and south to connect to the north-south alignment of the BNSF Alternative just west of Road 21. The north leg of the wye would join the north-south alignment just south of Avenue 24 and the south leg would join the north-south alignment just east of Frontage Road/Road 26 north of the community of Madera Acres.

1.1.2.3 Hybrid Alternative (Preferred Alternative)

This section describes the Hybrid Alternative, which generally follows the alignment of the UPRR/SR 99 Alternative in the north and the BNSF Alternative in the south. It does not include a discussion of the HST stations, because the station descriptions are identical for each of the three HST alternatives. The Authority and FRA have identified the Hybrid Alternative as their preferred alternative.

North-South Alignment

From north to south, generally, the Hybrid Alternative would follow the UPRR/SR 99 alignment with either the West Chowchilla design option with the Ave 24 Wye or the East Chowchilla design option with the Ave 21 Wye.

Approaching the Chowchilla city limits, the Hybrid Alternative would follow one of two options:

- In conjunction with the Ave 24 Wye, the HST alignment would veer due south from Sandy Mush Road along a curve and would continue at-grade for 4 miles parallel to and on the west side of Road 11¾. The Hybrid Alternative would then curve to a corridor on the south side of Avenue 24 and would travel parallel for the next 4.3 miles. Along this curve, the southbound HST track would become an elevated structure for approximately 9,000 feet to cross over the Ave 24 Wye connection tracks and Ash Slough, while the northbound HST track would remain at-grade. Continuing east on the south side of Avenue 24, the HST alignment would become identical to the Ave 24 Wye connection for the BNSF Alternative and would follow the alignment of the BNSF Alternative until Madera.

- In conjunction with the Ave 21 Wye connection, the HST alignment would transition from the west side of UPRR and SR 99 to an elevated structure as it crosses the UPRR and N Chowchilla Boulevard just north of Avenue 27, continuing on an elevated structure along the west side of and parallel to SR 99 away from the UPRR corridor while it crosses Berenda Slough. Toward the south side of Chowchilla, the alignment (with the Ave 21 Wye) would cross over SR 99 north of the SR 99/SR 152 interchange near Avenue 23½ south of Chowchilla. It would continue to follow along the east side of SR 99 until reaching Avenue 21, where it would curve east and run parallel to Avenue 21, briefly. The alignment would then follow a path similar to the Ave 21 Wye connection for the BNSF Alternative, but with a tighter 220 mph curve. The alternative would then follow the BNSF Alternative alignment until Madera.

Through Madera and until reaching the San Joaquin River, the Hybrid Alternative is the same as the BNSF Alternative. Once crossing the San Joaquin River, the alignment of the Hybrid Alternative becomes the same as for the UPRR/SR 99 Alternative, including the westward realignments of Golden State Boulevard and SR 99.

Wye Design Options

The wye connections for the Hybrid Alternative follow Avenue 24 and Avenue 21, similar to those of the UPRR/SR 99 and BNSF alternatives.

Ave 24 Wye

The Ave 24 Wye is the same as the combination of the UPRR/SR 99 Alternative with the West Chowchilla design option, and the Ave 24 Wye for the BNSF Alternative.

Ave 21 Wye

The Ave 21 Wye is similar to the combination of the UPRR/SR 99 Alternative with the Ave 21 Wye on the northbound leg and the BNSF Alternative with the Ave 21 Wye on the southbound leg. However, the south leg under the Hybrid Alternative would follow a tighter, 220 mph curve than the BNSF Alternative, which follows a 250 mph curve.

1.1.2.4 Heavy Maintenance Facility Alternatives

The Authority is studying five HMF sites (see Figure 1-2) within the Merced to Fresno Section, one of which may be selected. (The sponsor of the Harris-DeJager site withdrew its proposal from the Authority's consideration of potential HMF sites [Kopshever 2011]. However, to remain consistent with previous analysis and provide a basis of comparison among the HMFs, evaluation of the site continues in this document.)

- **Castle Commerce Center HMF site** – A 370-acre site located 6 miles northwest of Merced, at the former Castle Air Force Base in northern unincorporated Merced County. It is adjacent to and on the east side of the BNSF mainline, 1.75 miles south of the UPRR mainline, off of Santa Fe Drive and Shuttle Road, 2.75 miles from the existing SR 99 interchange. The Castle Commerce Center HMF would be accessible by all HST alternatives.
- **Harris-DeJager HMF site (withdrawn from consideration)** – A 401-acre site located north of Chowchilla adjacent to and on the west side of the UPRR corridor, along S Vista Road and near the SR 99 interchange under construction. The Harris-DeJager HMF would be accessible by the UPRR/SR 99 and Hybrid alternatives if coming from the Ave 21 Wye and the UPRR/SR 99 Alternative with the East Chowchilla design option and the Ave 24 Wye.
- **Fagundes HMF site** – A 231-acre site, located 3 miles southwest of Chowchilla on the north side of SR 152, between Road 11 and Road 12. This HMF would be accessible by all HST alternatives with the Ave 24 Wye.
- **Gordon-Shaw HMF site** – A 364-acre site adjacent to and on the east side of the UPRR corridor, extending from north of Berenda Boulevard to Avenue 19. The Gordon-Shaw HMF would be accessible from the UPRR/SR 99 Alternative with the Ave 24 Wye.
- **Kojima Development HMF site** – A 392-acre site on the west side of the BNSF corridor east of Chowchilla, located along Santa Fe Drive and Robertson Boulevard (Avenue 26). The Kojima Development HMF would be accessible by the BNSF Alternative with the Ave 21 Wye.

1.2 Purpose of the Assessment

The purpose of this technical report is to describe the existing conditions of the wetlands and other water features along the proposed Merced to Fresno Section of the HST system (Figure 1-2). The information presented in this report is based on the best available information, aerial mapping, and field surveys conducted in November and December 2009, April and May 2010, and January and February 2011.

1.3 Summary of Wetland Regulations

The following federal and state laws, regulations, and agency jurisdictions and management guidances apply to this resource:

1.3.1 Federal

1.3.1.1 Protection of Wetlands [Executive Order 11990]

This executive order aims to avoid direct or indirect impact of new construction in wetlands when a practicable alternative is available. If wetland effects cannot be avoided, all practicable measures to minimize impacts must be included.

1.3.1.2 Section 404 of the Clean Water Act [33 U.S.C. Sections 1251 to 1376]

The Clean Water Act (CWA) serves as the primary federal law protecting the quality of the nation's wetlands and surface waters (other Waters). Under Section 404, the United States Army Corps of Engineers (USACE) and the Environmental Protection Agency (EPA) regulate the discharge of dredged and fill materials into the waters of the U.S. Waters are primarily defined as navigable waterways or water features (including wetlands) that have a significant nexus to navigable waters. Project sponsors must obtain authorization from USACE for all discharges of dredged or fill materials into wetlands and other waters of the U.S. before proceeding with a proposed activity. Section 404 permits may only be issued for a least environmentally damaging practicable alternative (commonly referred to as the LEDPA standard). Compliance with CWA Section 404 requires compliance with several other environmental laws and regulations. The USACE cannot issue an individual permit or verify the use of a general permit until the requirements of the National Environmental Policy Act (NEPA), the Endangered Species Act (ESA), the Coastal Zone Management Act, and the National Historic Preservation Act have been met. Additionally, no permit can be issued or verified until a water quality certification, or waiver of certification, has been issued pursuant to CWA Section 401.

The CWA defines waters of the U.S. as follows:

- All waters which are currently used, or were used in the past, or may be susceptible to use in interstate or foreign commerce, including all waters which are subject to the ebb and flow of the tide.
- All interstate waters including interstate wetlands.
- All other waters such as intrastate lakes, rivers, streams (including intermittent streams), mudflats, sandflats, wetlands, sloughs, prairie potholes, wet meadows, playa lakes, or natural ponds, the use, degradation or destruction of which could affect interstate or foreign commerce(33 CFR 328.3[a]).

The CWA defines wetlands as a subset of waters of the U.S. Wetlands are those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas (33 CFR 328.3[b]; 40 CFR 230.3[t]).

The definition of waters of the U.S. has been revised based on subsequent rulings by the U.S. Supreme Court. These rulings have concluded that isolated waters and some headwaters are not waters of the U.S. The USACE and EPA (2007) have developed specific criteria for determining whether features are waters of the U.S. based on these Court rulings, as described below.

Solid Waste Agency of Northern Cook County v. United States Army Corps of Engineers

On January 9, 2001, the U.S. Supreme Court issued a decision in Solid Waste Agency of Northern Cook County v. USACE. The case involved the filling of hydrologically isolated waters that had formed in an abandoned sand and gravel pit. In the 5 to 4 decision, the Court held that the USACE had exceeded its statutory authority by asserting jurisdiction of an isolated wetland based solely on the use of the wetland by migratory birds. The USACE had previously regulated isolated wetlands using the "Migratory Bird Rule" established in 1986. The Court defined isolated waters as any body of water that is non-navigable, intrastate, and lacking any significant nexus to navigable bodies of water (Pooley 2002).

Isolated, intrastate wetlands (i.e., wetlands that are not hydrologically connected with other jurisdictional wetlands or non-wetland waters of the U.S.) are generally considered non-jurisdictional under the CWA. However, under the Preliminary Jurisdictional Determination approach that will be sought for the Merced to Fresno Section of the HST System, vernal pools and seasonal wetlands that may otherwise not fall within USACE jurisdiction will be assumed jurisdictional features (see Section 4.3).

Rapanos v. United States and Carabell v. United States Army Corps of Engineers

Two cases recently brought before the U.S. Supreme Court, Rapanos v. United States (No. 04 1034) and Carabell v. Army Corps of Engineers (No. 04-1384), challenged USACE interpretation of waters of the U.S. (USACE and EPA 2007). The USACE had interpreted CWA 33 USC 1362(7) to regulate wetland areas that are separated from a tributary of a navigable water by a narrow, constructed berm, where evidence of an occasional hydrologic connection existed between the wetland and the tributary. Also, the case questioned Congress's authority under the Commerce Clause to apply the CWA to the wetlands at issue.

On June 19, 2006, the Court held 5 to 4 in favor of tightening the definition of "waters of the United States." According to the opinion, a water or wetland constitutes "navigable waters" under the CWA if it possesses a "significant nexus" to waters that are currently navigable or could feasibly be made navigable.

The USACE and EPA issued a joint memorandum on June 5, 2007, issuing new guidelines for establishing whether or not wetlands or other waters of the U.S. fall within USACE jurisdiction (USACE and EPA 2007). Under these guidelines, the agencies assert jurisdiction over traditional navigable waters (TNWs), wetlands adjacent to TNWs, non-navigable tributaries to TNWs that are relatively permanent waters (RPWs), and wetlands that abut RPWs. The agencies may take jurisdiction over non-navigable tributaries that are not RPWs, wetlands that are adjacent to non-RPWs, and wetlands adjacent to but not directly abutting a relatively permanent, non-navigable tributary. The agencies will generally not assert jurisdiction over swales, erosional features, or ditches excavated wholly in and draining only uplands and that do not carry a relatively permanent flow of water.

1.3.2 State

The State Water Resources Control Board (SWRCB) takes jurisdiction of all waters of the State, including, as a subset, all waters of the U.S. under Section 401 of the CWA. Waters of the State are broadly defined by the Porter-Cologne Water Quality Control Act (§ 1305(e)) as "any surface water or groundwater, including saline waters, within the boundaries of the state." Under this definition, isolated wetlands that may not be subject to regulations under federal law are waters of the State. However, the SWRCB has not yet adopted a wetland definition. As required by State Water Board Resolution No. 2008-0026, a wetland definition will be developed as part of the Wetland and Riparian Area Protection Policy. On October 6, 2009, the Technical Advisory Team for the Wetland and Riparian Area Protection Policy presented a definition to the SWRCB that "would reliably define the diverse array of California wetlands based on the USACE wetland delineation methods to the extent feasible." The proposed definition is as follows:

An area is a wetland if, under normal circumstances, it (1) is saturated by groundwater or inundated by shallow surface water for a duration sufficient to cause anaerobic conditions within the upper substrate; (2) exhibits hydric substrate conditions indicative of such hydrology; and (3) either lacks vegetation or the vegetation is dominated by hydrophytes (San Francisco Estuary Institute 2009).

Some Regional Water Quality Control Boards have adopted a wetland definition in their basin plans. The Central Valley Regional Water Quality Control Board, which has jurisdiction over all the drainage basins potentially affected by the project, has not yet adopted a wetland definition within its basin plans. Therefore the definition in the USACE manuals (USACE 1987 and 2008a) was followed in conducting this wetland delineation.

2.0 Project Setting

The Merced to Fresno Section of the HST system is located in the Great Valley Ecological Subregion of California, and further in the Granitic Alluvial Fans and Terraces Ecological Subsection, which includes the alluvial fans and terraces on the eastern side of San Joaquin Valley (Miles and Goudey 1998). The fans and terraces in this area were derived predominantly from granitic alluvium originating in the Sierra Nevada. The topography is generally flat with slopes ranging between 0 and 2% and elevations ranging from 160 to 300 feet above mean sea level. The regional drainage is generally to the west and southwest. The following sections provide a general overview of the land use and terrestrial vegetation communities, climate, hydrology, and soils in the project vicinity.

2.1 Vegetation Communities

Historically, the Central Valley was characterized by California prairie, marshlands, valley oak savanna, and extensive riparian woodlands (Hickman 1993). Today, more than 80% of the land is covered by farms and ranches (Natural Resource Conservation Service [NRCS] 2006). Urban areas along the Merced to Fresno Section include the communities of Atwater, Merced, Chowchilla, Madera, and Fresno. Natural and semi-natural vegetation communities are uncommon and are limited to uncultivated areas supporting California annual grassland, narrow bands of riparian habitat along watercourses, and wetland communities located on floodplain terraces or adjacent to water courses. The following descriptions of prevalent vegetation communities (agricultural, developed land, natural and semi-natural habitats, and wetland and water resources) present in the study area are based on *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer 1988) and field verification of existing vegetation communities.

2.1.1 Agricultural Lands

Agriculture is the predominant land use in the project vicinity. Common crops include orchards, vineyards, and irrigated hay/alfalfa fields. Almonds (*Prunus dulcis*) are the most common orchard crop along the Merced to Fresno Section. Other orchard crops include walnuts (*Juglans regia*), pistachios (*Pistacia vera*), and pomegranates (*Punica* sp.). Vineyard crops include cultivated wine, table, and raisin grapes (*Vitis* sp.). Irrigated hay and alfalfa crops, including timothy (*Phleum pratense*), common cultivated oat (*Avena sativa*), orchard grass (*Dactylis glomerata*), millet (*Panicum miliaceum*), red clover (*Trifolium pratense*), and alfalfa (*Medicago sativa*), are most often grown as silage for dairy farms. Other common agricultural land uses include field crops such as tomatoes (*Solanum lycopersicum*), lettuce (*Lactuca* sp.), and beans (*Phaseolus vulgaris*), and irrigated pasture lands. Depending on the time of year and various other factors, fields may be idled (short resting periods between planting cycles) or may be fallowed (extended periods of idling, commonly market-driven).

2.1.2 Developed Lands

Various types of urban and rural development, including residential areas, commercial and industrial buildings, parks, roadways, and barren areas where vegetation has been removed comprise extensive areas along the Merced to Fresno Section. Residential land uses include both urban neighborhoods and rural homes. In addition to homes, residential areas often include landscaped yards, gardens, and various outbuildings. Commercial and industrial areas include urban shops, businesses, warehouses, railroad facilities, industrial plants, factories, junk yards, equipment storage yards, airports, and various municipal facilities, as well as associated parking lots. Rural commercial areas include landfills, farm equipment yards, and agricultural processing and storage facilities. Parkland commonly includes developed open grassy areas with landscape trees, picnic facilities, and children's playgrounds.

2.1.3 Natural and Semi-Natural Habitats

The terms 'natural' and 'semi-natural' refer to native and introduced terrestrial vegetation communities. The most common semi-natural habitat along the Merced to Fresno Section is California annual grassland. This community is characterized by nonnative annual grasses such as ripgut brome (*Bromus* *diandrus*), soft chess (*Bromus hordeaceus*), Mediterranean barley (*Hordeum marinum*), medusa-head (*Taeniatherum caput-medusae*), and common wild oat (*Avena barbata*). A number of native annual and perennial herbaceous species may also be present within this grassland community.

Common natural habitats include riparian woodlands found along the rivers, creeks, and sloughs. These areas are characterized by native trees and shrubs such as cottonwood (*Populus fremontii*), willow (*Salix lasiolepis, S. gooddingii,* and *S. exigua*), valley oak (*Quercus lobata*), and California walnut (*Juglans californica*). Common semi-natural riparian habitats are also present in some areas, including dense stands of giant reed (*Arundo donax*), eucalyptus (*Eucalyptus globulus*), and Himalayan blackberry (*Rubus armeniacus*).

Natural and semi-natural riparian habitats within the study area include the following associations:

- **Mixed Riparian Forest and Woodland** is characterized as a mixture of various trees including California walnut, valley oak, eucalyptus, willow, and cottonwood. No single tree species is dominant in the canopy layer.
- **Valley Oak Woodland** is dominated by valley oak. Common associated tree species include California sycamore (*Platanus racemosa*), California walnut, and box elder (*Acer negundo*).
- **Valley and Foothill Riparian** contains cottonwood, California sycamore, valley oak, and willows. No single tree species is dominant in the multi-layered canopy with variable understory vegetation.
- **Willow Riparian Forest and Woodland** is a riparian community dominated by various willows. Cottonwood and valley oak may also occur but these species are not a significant component of the canopy.
- **Himalayan Blackberry Scrub** is a dense thicket of Himalayan blackberry.
- **Cottonwood Willow Riparian** is characterized by a mixture of cottonwood and willow trees and may occasionally include valley oak, California walnut, and other trees that are not abundant.
- **California Walnut Riparian is** a riparian community dominated by California walnut.
- **Giant Reed Community** type is dominated by *Arundo donax*.
- **Eucalyptus Community** type is dominated by dense stands of Eucalyptus.

2.1.4 Wetland Communities and Other Waters

Within the study area (250 foot buffer surrounding the construction footprint, see Section 3.1 for further description), aquatic resources include vernal pools, seasonal wetlands, freshwater emergent marshes, forested wetlands, constructed basins, natural watercourses, constructed watercourses, and open water. These resources are grouped into two categories: 1) palustrine wetlands (vernal pools, seasonal wetlands, freshwater emergent marsh, and forested wetlands and 2) other waters (constructed basins, constructed watercourses, natural watercourses, and open waters). Palustrine wetlands are a broad class of non-tidal wetlands that include vegetated wetlands traditionally called by names such as marsh, swamp, bog, fen, and prairie. Other waters (constructed basins, constructed watercourses, natural watercourses, and open waters) include unvegetated open water habitats or channels. A description of wetland and water resources common to the study area is provided below.

2.1.4.1 Vernal Pools

Vernal pools are a subclass of depressional wetlands and are considered palustrine emergent seasonally flooded wetlands (Cowardin et al. 1979). They are characterized by a herbaceous community dominated by native annual herbs and grasses. Vernal pools are features that are inundated during winter precipitation months and are dry or moist during summer months with no standing water. Evaporation, and not runoff, empties the pools in the spring. Vernal pools are associated with a variety of landform types, including low terraces with undulating to slightly hummocky topography with mounds intervening between localized depressions (Holland 1986). These pools are associated with certain types of soils that have a relatively shallow hardpan such as the San Joaquin and Lewis soil series, or other soils with restrictive clay layers in the upper horizon that limit the downward percolation of water. Conditions lending themselves to this type of habitat often occur over continuous areas, rather than in isolated spots, so vernal pools in the Central Valley tend to occur in clusters called "complexes." Within these complexes, pools may be fed or connected by low drainage pathways called "swales." Vernal pools have specific flora and fauna associated with their seasonal water cycle. Vernal pools contain a low, amphibious, herbaceous community dominated by annual and perennial herbs and grasses. Common plant species include short woollyheads (*Psilocarphus brevissimus*), popcorn flower (*Plagiobothrys* spp.), water pigmy-stonecrop (*Crassula aquatica*), annual hairgrass (*Deschampsia danthonioides*), purslane speedwell (*Veronica peregrina*), and toad rush (*Juncus bufonius*). Shallow vernal pools are often characterized by an abundance of nonnative grasses and forbs such as Mediterranean barley and hyssop-loosestrife (*Lythrum hyssopifolium*), but these areas also typically contain relatively high cover of native vernal pool plants such as coyote thistle (*Eryngium* sp.). Deeper pools are often characterized by creeping spikerush (*Eleocharis macrostachya*). Obligate hydrophytes and other facultative wetland plant species typically are dominant in vernal pools in the spring, but upland species (particularly annuals) may become dominant during the drier portion of the growing season in some areas.

The seasonal standing water that collects in vernal pools is ideal breeding habitat for several special-status species such as vernal pool fairy shrimp, Conservancy fairy shrimp, vernal pool tadpole shrimp (*Lepidurus packardi*), California tiger salamander (*Ambystoma californiense*), and western spadefoot toad (*Spea hammondii*).

2.1.4.2 Seasonal Wetlands

Seasonal wetlands are non-tidal, flooded, depressional wetlands that would be classified as palustrine emergent seasonally flooded wetlands by Cowardin et al. (1979). Seasonal wetlands are a broad wetland class characterized by seasonal inundation, of which vernal pools are a subclass. Seasonal wetlands are similar to vernal pools in that they frequently have comparable landscape positions, soil profiles, and hydrologic cycles. The primary distinction between the two is their vegetative composition. Seasonal wetlands or swales can be characterized by a mix of drought-tolerant vernal pool species and nonnative grasses associated with marginal seasonal wetland habitat, such as Italian ryegrass and Mediterranean barley (Vollmar 2002). In the study area, seasonal wetlands have been degraded by past land management actions (cultivation, grading, etc.) that have reduced their flood storage potential and have spread nonnative plant species.

Water that collects in seasonal wetlands provides potential breeding habitat for several special-status species such as vernal pool fairy shrimp, Conservancy fairy shrimp, vernal pool tadpole shrimp, California tiger salamander, and western spadefoot toad.

2.1.4.3 Freshwater Marshes

Freshwater marsh habitats are permanently or semi-permanently flooded areas that typically support perennial emergent vegetation such as cattails (*Typha* spp.), sedges (*Carex* spp.), bulrushes (*Schoenoplectus* spp.), and rushes (*Juncus* spp.). These wetland communities are found on floodplains, backwater areas, and within the channels of rivers and sloughs. Freshwater marshes are non-tidal, flooded, depressional wetlands and would be classified as palustrine emergent semi-permanently flooded wetlands (Cowardin et al. 1979).

Freshwater marshes may include sensitive wetland communities, such as coastal and valley freshwater marsh, as identified by the List of California Terrestrial Natural Communities (California Department of Fish and Game [CDFG] 2010). Freshwater marsh is equivalent to freshwater emergent wetland as defined by *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer 1988).

2.1.4.4 Forested Wetlands

Forested wetlands typically occur on soils intermittently or seasonally flooded or saturated by freshwater systems. Frequently, these community types are found along riparian corridors, floodplains subject to high-intensity flooding, or on low-gradient depositional areas along rivers and streams. Within the study area, the overstory of forested wetlands is typically dominated by cottonwood or willows, but may also include occasional box elder, Oregon ash (*Fraxinus latifolia*), California walnut, or California sycamore. The shrub layer is typically dominated by willow species and California wild grape (*Vitis californica*). The understory may support emergent perennial vegetation such as cattails, sedges, and rushes. Freshwater forested wetlands are non-tidal, flooded, depressional wetlands and would be classified as palustrine forested wetlands (Cowardin et al. 1979).

2.1.4.5 Constructed Basins

This aquatic feature (other waters) includes constructed stormwater retention basins, reservoirs, dairy waste settling ponds, and agricultural tail water ponds. Constructed basins are highly disturbed and may be routinely managed through vegetation removal and dredging. Depending on substrate and management regimes, vegetation type and presence varies, although most constructed basins lack wetland vegetation, and may include upland vegetation. Hydrology also varies based on precipitation events, irrigation inputs/removal, and other management objectives. Constructed basins would be classified as palustrine unconsolidated bottom deepwater habitats by Cowardin et al. (1979). Palustrine wetlands may be associated with constructed basins at their margins and/or in shallow areas where deep water does not preclude vegetation development.

2.1.4.6 Natural Watercourses

Most natural watercourses in the study area have intermittent or ephemeral flow regimes either because of their small watershed size or because they have been impounded or diverted upstream for agricultural purposes. All are low-gradient systems, and most support some emergent vegetation along their margins with bottom substrates dominated by fine sediments (i.e., sand, silt, or clay). Natural watercourses in the study area would be classified as riverine lower perennial, riverine upper perennial, and riverine intermittent systems, depending on the persistence of their surface hydrology and their locations in a watershed. Riverine systems in the study area may include a variety of bottom and bank substrate types. Palustrine wetlands may also be associated with natural watercourses at watercourse margins and as in-channel islands.

2.1.4.7 Constructed Watercourses

Canals and ditches in the study area are linear water features that have been constructed primarily for the conveyance of agricultural irrigation water. Most of these features are excavated U-shaped or trapezoidal channels that are routinely maintained. Constructed watercourses range in size from small, shallow ditches (10 feet wide and 3 to 4 feet deep) to broad channels (50 feet wide and 10 feet deep). Scattered emergent vegetation is present in some areas, but most constructed watercourses are routinely cleared of vegetation and/or sprayed with herbicides. Constructed watercourses would be classified as non-wetland riverine systems similar to natural watercourses using the Cowardin system, and palustrine wetlands may also be associated with these constructed features. However, routine maintenance of constructed watercourses for conveyance function limits the establishment and function of these wetland types.

2.1.4.8 Open Water

This aquatic feature is characterized by shallow roadside depressions such as incidental scrapes, tire ruts, and localized compaction that have an ephemeral or seasonal hydroperiod. The features are typically bare or sparsely vegetated. Inundation is not of a sufficient duration to produce hydric soils and/or defined wetland vegetation under normal hydrological cycles. Inundation may be of sufficient duration to provide marginal breeding habitat for special-status vernal pool species.

2.2 Hydrology and Climate

2.2.1 Hydrology, Regional Conditions

The wetland study area lies in the southern portion of the San Joaquin River Basin. The San Joaquin River Basin extends from the Sacramento - San Joaquin Delta in the north to the northerly boundary of the Tulare Lake Basin in the south, and from the crest of the Sierra Nevada Range in the east to the crest of the Coast Ranges in the west. The river basin encompasses about 13,500 square miles and includes large areas of high elevation along the western slope of the Sierra Nevada. As a result, the San Joaquin River experiences significant snowmelt runoff during the late spring and early summer. Flood flows typically occur between April and June.

The Merced to Fresno Section is located in three watershed subbasins: the Middle San Joaquin–Lower Chowchilla, Fresno River, and Upper Dry (Figure 2-1). Most of the wetland study area is located to the north of the San Joaquin River in the Middle San Joaquin–Lower Chowchilla Watershed (Hydrologic Unit Code [HUC] 18040001). The survey area to the south of the San Joaquin River is located in the Tulare-Buena Vista Lakes Watershed (HUC 18030012). Prominent water features in the study area include Bear Creek, Miles Creek, Owens Creek, Duck Slough, Deadman Creek, Dutchman Creek, the Chowchilla River,

Ash Slough, Berenda Slough, Berenda Creek, Dry Creek, the Fresno River, Cottonwood Creek, and the San Joaquin River. The natural hydrology of the region has been substantially altered by construction of dams, storage reservoirs, diversion dams, canals, and groundwater pumping associated primarily with agricultural irrigation.

2.2.2 Climate and Precipitation Data

California has a Mediterranean-type climate with cool, wet winters and hot, dry summers. Along the Merced to Fresno Section, mean annual temperatures range from a low of 36 degrees Fahrenheit (°F) in December to a high of 98°F in July (Western Regional Climate Center [WRCC] 2009). The growing season (defined as a 50% probability of temperatures at or above 32°F) ranges from 261 days (March 3 to November 19) to 300 days (February 5 to December 1) for Merced and Fresno, respectively (NRCS 2002). Average annual precipitation is approximately 12 inches in Merced and approximately 11 inches in Fresno (WRCC 2009). Most of the annual rainfall (over 80%) occurs between October and March.

Precipitation data were reviewed to identify and compare recorded rainfall preceding and during the 2011 field investigation and in early 2007 when aerial photographs of the study area were taken. Weather data in 2010 and 2011 were reviewed from a Madera County weather station located near the center of the project (UCIPM, 2011), and historic average precipitation ranges were determined from stations in Merced and Fresno (WRCC 2008). Precipitation for the wet season beginning October 1, 2010 through January 31, 2011 was 6.65 inches, 1.24 inches above normal (122% of normal to date; Table 2-1).

Table 2-2 presents the precipitation data for the wet season preceding the aerial photography in February and March 2007. Precipitation during the 2007 wet season totaled 4.59 inches, between 51% and 52% of normal.

Based on the precipitation data presented, total precipitation for the wet season prior to the January and February 2011 fieldwork was 122% of normal, and precipitation in the two-week period preceding the January field event was 87% of normal (Table 2-3). In contrast, precipitation levels preceding aerial photography in 2007 were below average (50% of normal) and less than the recorded amount for the 2011 wetland field event (2.06 inches). As such, 2011 field conditions likely exhibited somewhat wetter conditions than those reflected within the 2007 aerial imagery. Based on wet season total precipitation and precipitation recorded 2 weeks prior to the 2011 winter field event (Tables 2-3 and 2-4), 2011 precipitation levels are not expected to significantly affect the observation and interpretation of wetland hydrological indicators or stream flow duration indicators observed in winter 2011.

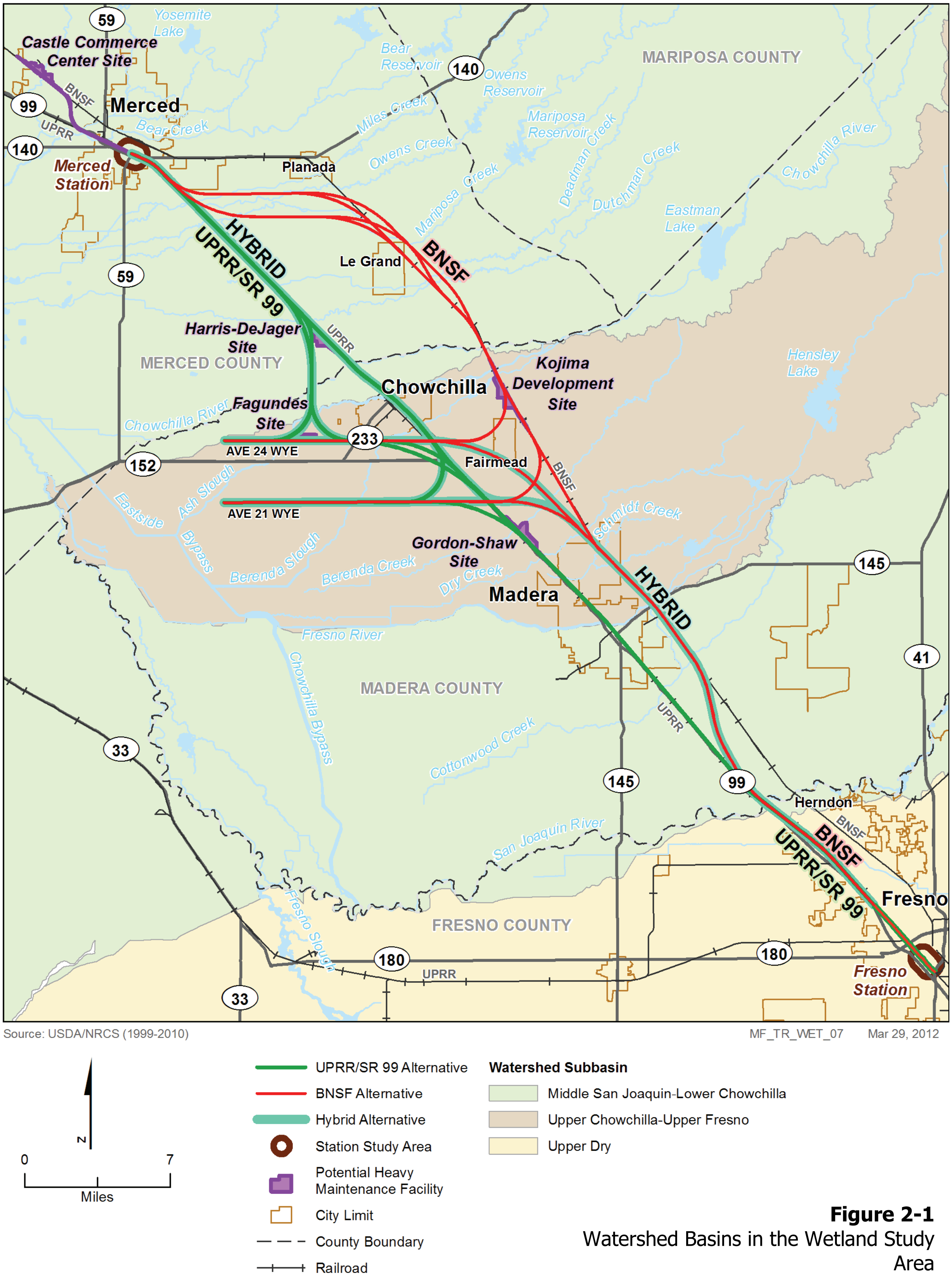


Figure 2-1
Watershed Basins in the Wetland Study Area

Tables 2-3 and 2-4 present the precipitation data for the 2-week period preceding the 2011 field investigation dates of January 24 to 29 and February 7 to 11, 2011. Precipitation totaled 0.04-inch preceding the January event (Table 2-3) and 0.37-inch preceding the February 2011 event (Table 2-4).

Table 2-1
2010-2011 Wet Season Precipitation Data (WRCC, 2008; CIMIS#145, 2011)

	Recorded 2010-2011 Precipitation (in inches)	Historical Average Precipitation (in inches)	Variance (in inches)
October	0.80	0.62 to 0.81	-0.01 to 0.18
November	0.27	0.83 to 0.98	-0.71 to -0.56
December	3.78	1.62 to 1.69	2.09 to 2.16
January*	1.80	2.08 to 2.19	-0.28 to 0.39
February*	Not available	2.08 to 2.28	Not available
March	Not available	1.35 to 1.40	Not available
April	Not available	1.05 to 1.08	Not available
May	Not available	0.42 to 0.48	Not available
Total	**6.65 to date**	**10.36 to 10.60**	**1.24 to date**
*Merced to Fresno 2011 wetland field investigation dates.			

Table 2-2
2006-2007 Wet Season Precipitation Data (WRCC, 2008; CIMIS#145, 2011)

	Recorded 2006-2007 Precipitation (in inches)	Recorded 2010-2011 Precipitation (in inches)	Historical Average Precipitation (in inches)
October	0.4	0.80	0.62 to 0.81
November	0.52	0.27	0.83 to 0.98
December	1.28	3.78	1.62 to 1.69
January	0.47	1.80	2.08 to 2.19
February*	1.48	Not available	2.08 to 2.28
March*	1.44	Not available	1.35 to 1.40
Total	**4.59**	**6.65 to date**	**8.89 to 9.04**

Table 2-3
Daily Precipitation Data-Two Weeks Prior to January 2011 Wetland Field Investigation (CIMIS#145, 2011)

Date	Precipitation (in inches)
January 10, 2011	0
January 11, 2011	0
January 12, 2011	0
January 13, 2011	0
January 14, 2011	0.01
January 15, 2011	0
January 16, 2011	0
January 17, 2011	0
January 18, 2011	0
January 19, 2011	0
January 20, 2011	0
January 21, 2011	0.01
January 22, 2011	0.01
January 23, 2011	0.01
Total:	**0.04**

Table 2-4
Daily Precipitation Data-Two Weeks Prior to February 2011 Wetland Field Investigation (CIMIS#145, 2011)

Date	Precipitation (in inches)
January 24, 2011	0.02
January 25, 2011	0.01
January 26, 2011	0.01
January 27, 2011	0
January 28, 2011	0.01
January 29, 2011	0.01
January 30, 2011	0.3
January 31, 2011	0
February 1, 2011	0
February 2, 2011	0.01
February 3, 2011	0
February 4, 2011	0
February 5, 2011	0
February 6, 2011	0
Total:	**0.37**

2.3 Soils

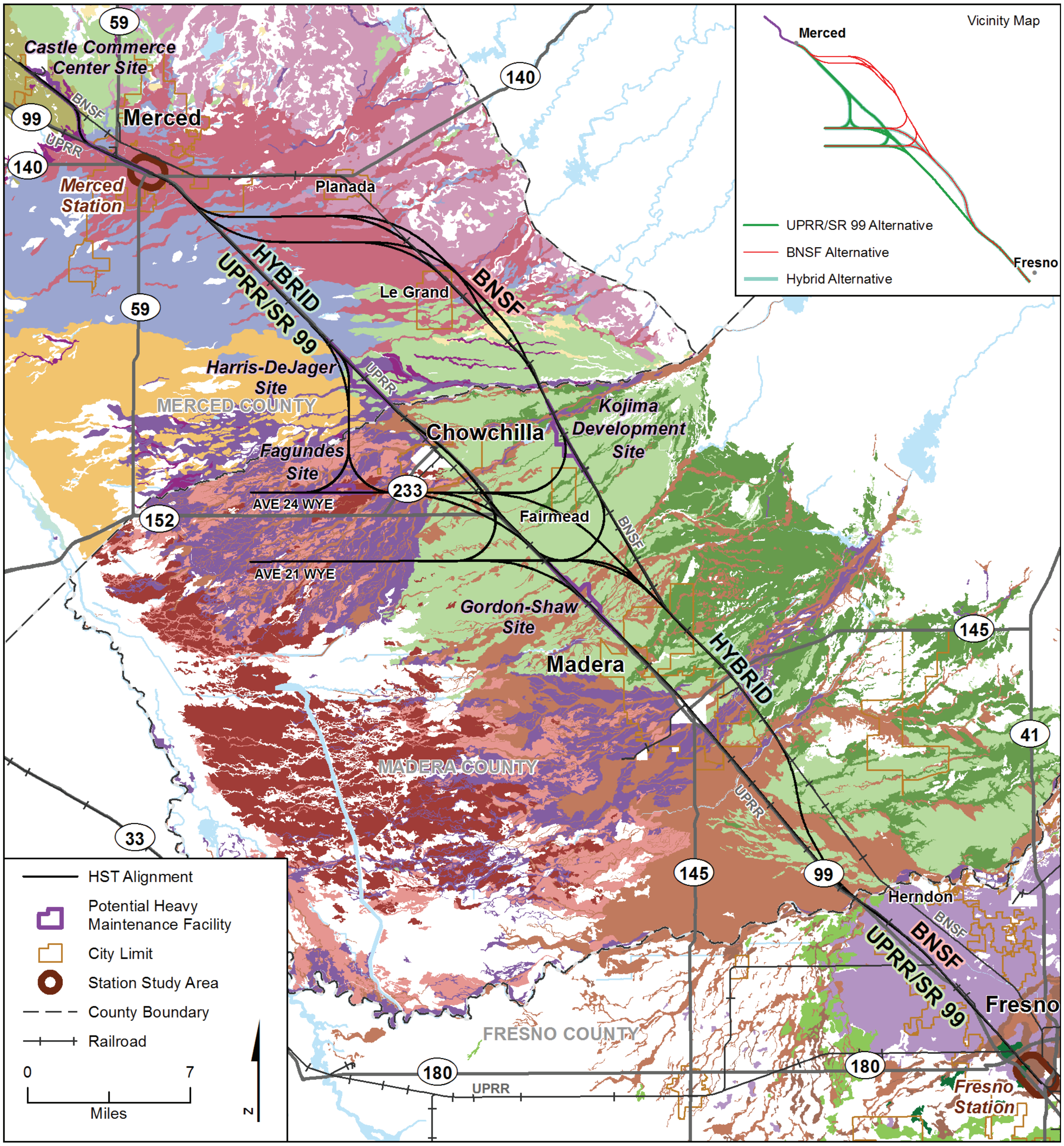
NRCS soil surveys were used to gather general information about soils in the proposed alternatives and HMFs. Soil surveys used for this project included the Eastern Fresno area (NRCS 1971), Madera area (NRCS 1962a), and Merced area (NRCS 1962b). Because of the large area of investigation, soil associations are used to describe soils associated with the wetland study area.

Figure 2-2 shows the soil associations in the wetland study area. Table 2-5 identifies the soil associations grouped by four landform groups identified by NRCS in the wetland study area (1) recent alluvial fans and floodplains; (2) older, low alluvial terraces; (3) basin areas, including saline-alkali basins; and (4) high terraces) and the counties in which they are located. Table 2-6 identifies mapped hydric soils that coincide with wetland data points.

Table 2-5
Soil Associations in the Merced to Fresno Wetland Study Area
(250-foot buffer surrounding construction footprint)

Soil Association	Counties of Occurrence	Landform Groups[a]
Pachappa-Grangeville association	Merced, Madera	Recent alluvial fans and floodplains
Hanford-Tujunga association	Madera, Fresno	
Hanford-Grangeville association	Merced	
Wyman-Yokohl-Marguerite association	Merced	
Hanford-Hesperia association	Fresno	
Hanford-Delhi-Hesperia association	Fresno	
Greenfield-Atwater association	Fresno	
Delhi-Atwater association	Merced	
San Joaquin-Madera association	Merced, Madera	Older, low alluvial terraces
San Joaquin-Exeter-Ramona association	Fresno	
Cometa-Whitney association	Madera	
Fresno-Traver association	Merced	Basin areas (including saline-alkali basins)
Lewis-Landlow-Burchell association	Merced	
Fresno-El Peco association	Madera	
Traver-Chino association	Madera	
Rossi-Waukena association	Merced	
Whitney-Rocklin-Montpellier association	Merced	High terraces
Redding-Pentz-Peters association	Merced	

[a] As mapped by NRCS, but not necessarily observed in the study area.
Sources: NRCS (1962a, 1962b, 1971 [modified from Authority and FRA 2012a]).



Source: NRCS (1962a,b, 1971). MF_EIS_GS_03 Jun 02, 2011

Merced County Associations
- Delhi-Atwater association
- Fresno-Traver association
- Hanford-Grangeville association
- Lewis-Landlow-Burchell association
- Pachappa-Grangeville association
- Redding-Pentz-Peters association
- Rossi-Waukena association
- San Joaquin-Madera association
- Whitney-Rocklin-Montpellier association
- Wyman-Yokohl-Marguerite association

Madera County Associations
- Cometa-Whitney association
- Fresno-El Peco association
- Hanford-Tujunga association
- Pachappa-Grangeville association
- San Joaquin-Madera association
- Traver-Chino association

Fresno County Associations
- Greenfield-Atwater association
- Hanford-Delhi-Hesperia association
- Hanford-Hesperia association
- Hanford-Tujunga association
- San Joaquin-Exeter-Ramona association

Figure 2-2
Soil Associations in the Wetland Study Area

Soils associated with the Merced to Fresno Section exhibit a range of characteristics determined in part by parent material and landscape position. Coarse textured soils are generally found on recent alluvial fans and floodplains, while medium textured soils with duripans occur on older alluvial terraces. Fine textured soils with duripans and salt and alkali accumulations occur in basin areas. In general, soil textures trend finer to coarser north to south along the Merced to Fresno Section. Soils in Merced County are typically fine textured clays and loamy sands. Soil textures in Madera and Fresno counties are predominantly loams and sands. Drainage and permeability are variable. In general, fine textured soils such as clays and silty clay loams are poorly to somewhat poorly drained, with very- to moderately-slow permeability. More coarsely textured soils, including sandy loams and sand, are typically well drained with moderately rapid permeability.

Landform groups and their associated soils are described below. These landform soil descriptions provide soil groupings and representative landscape positions for soils with common characteristics.

2.3.1 Recent Alluvial Fans and Floodplains Landform Group

Soils associated with Recent Alluvial Fans and Floodplains group developed in nearly level to gently sloping areas along drainage ways, on alluvial fans, and on floodplains. Characteristics often vary greatly within short distances because these soils formed from stratified stream deposits. In the wetland study area, these soils are medium- to coarse-textured (low amount of clay), and are generally well to somewhat excessively drained. Most of these soils are very deep, but some areas may have compacted silt or sand or an iron-silica hardpan at a depth of 2 to 4 feet. Some areas are slightly to moderately saline and alkaline at depth.

2.3.2 Older, Low Alluvial Terraces Landform Group

Soils in the Older, Low Alluvial Terraces group tend to have a greater degree of soil development than soils on recent alluvial fans. Low alluvial terraces typically have undulating to rolling topography, and may have relatively steep slopes in some areas. The soils are medium-textured and typically have a strongly cemented or indurated hardpan in the subsoil (from 12 to 48 inches below the ground surface). The hardpan can be composed of cemented silica or clay; either type creates a layer that is restrictive to roots and water and can create a perched water table.

2.3.3 Basin Areas (including Saline-Alkali Basins) Landform Group

Soils in the Basin Areas group developed from fine-textured, water-transported sediments, water-soluble lime and salts. The topography of these areas is nearly level to gently undulating. Soils are finer-textured (have more clay) than the alluvial and high terrace soils, and nearly all have accumulations of salts and alkali as a result of poor drainage. Most of these soils have cemented lime-silica hardpans in the subsoil and are shallow to moderately deep.

2.3.4 High Terraces Landform Group

Soils associated with the High Terraces group are older than the soils of the other associations and tend to be strongly weathered. Many of these soils occur on dissected low hills with an undulating landscape dominated by mound relief. High terrace soils are coarser than alluvial terrace and basin soils, with textures ranging from fine sandy loam to gravelly loam. Some of the high terrace soils are underlain by an iron-silica hardpan or claypan, both of which may restrict drainage.

2.3.5 Hydric Soils

Several mapped hydric soil series are present within the wetland study area (NRCS 2009). Table 2-6 summarizes mapped hydric soil series identified at wetland delineation data point locations and the respective counties in which these soils occur. Soil descriptions are provided below for each identified hydric soil.

Table 2-6
Mapped Hydric Soils in the Merced to Fresno Wetland Study Area

Mapped Hydric Soil Series	Counties of Occurrence within Wetland Study Area	Hydric Soil Criteria[b]
Cometa sandy loams, 3 to 8% slopes	Madera	3
Landlow silty clay loam, 0 to 1% slopes[a]	Merced	4
Riverwash	Merced and Fresno	4
San Joaquin loam 0 to 3% slopes	Merced	3
San Joaquin sandy loams 0 to 3 % slopes	Madera	3
San Joaquin-Alamo complex, 0 to 3% slopes	Madera	2B3
Tujunga loamy sand, moderately deep and deep over hardpan, 0 to 3% slopes	Madera	4

[a] Also identified as Lewis loam slightly saline-alkaline, 0 to 1 % slope by Madera County.

[b] Hydric Soil NASIS Database Selection Criteria (http://soils.usda.gov/use/hydric/criteria.html).

2.4 National Wetlands Inventory and Central Valley Vernal Pool Habitat dataset (CDFG 2009) Mapped Wetlands

A review of the National Wetlands Inventory (NWI) maps (United States Fish and Wildlife Service [USFWS] 2009) identified 91 palustrine emergent marsh wetlands (36.87 acres), and 5 palustrine forested/palustrine scrub-shrub wetlands (16.00 acres), excluding natural drainages within the wetland study area. A review of the Central Valley Vernal Pool Habitat dataset from the Biogeographic Information and Observation System (BIOS; CDFG 2009) identified 912 acres of mapped vernal pool communities within the wetland study area. BIOS-mapped wetland features within the study area are concentrated along the UPRR/SR 99 Alternative between Deadman Creek and Dutchman Creek and on the BNSF alignment between Deadman Creek and Ash Slough. NWI- and Holland-mapped wetlands are provided in Appendix A, which contains NWI and Holland maps for the Merced, Chowchilla, Madera, and Fresno vicinities. Many of the mapped NWI features are constructed water features, including stormwater retention basins and waste settling ponds associated with dairy farms. Many of the NWI/BIOS-mapped locations no longer support wetlands. In many cases, these areas have been developed or converted to orchards, inactive farmland, or row cultivation.

3.0 Methods

Wetland delineation methods were developed for the Merced to Fresno, San Jose to Merced, and Fresno to Bakersfield sections, as described in the *Central Valley Biological Resources and Wetlands Survey Plan* (Survey Plan) provided as Appendix B (URS Corporation, CH2M HILL and ICF Jones and Stokes 2009). Because access to private properties along the Merced to Fresno Section is limited, the following methods incorporated in the Survey Plan were not completed in preparing this wetland delineation report.

- No pedestrian transects were included in the preliminary surveys; however, the methodology described for inaccessible areas was followed as described in the sections below.
- Detailed wetland delineation methods, including paired data points and mapping of wetland boundaries with a global positioning system, were included as part of the spring 2010 and winter 2011 wetland delineations only in accessible areas in the study area that were likely to support wetland habitats.

The following sections describe the wetland study area, the pre-survey investigation, and the field survey methods.

3.1 Wetland Study Area

The wetland study area encompasses a total of 24,048 acres. The wetland study area includes a 250-foot buffer surrounding the construction footprint. The construction footprint includes all proposed project elements (i.e., proposed alternative rights-of-way, station locations, construction staging, laydown areas, borrow sites, and HMF sites). The 250-foot buffer is anticipated to include areas subject to direct and indirect impacts on wetlands and other waters that may result from the proposed project. Wetland delineations were conducted in the wetland study area as shown in Appendix C, Delineated Wetlands and Other Waters of the U.S. Study Area Maps.

3.2 Pre-field Survey Investigations

The following resources were reviewed prior to field investigations to obtain information on wetlands and other water features that may occur in the wetland study area:

- United States Geological Survey 7.5-minute topographic quadrangles.
- NWI maps (USFWS 2009a).
- National Hydrography Dataset; BIOS Central Valley Vernal Pool Habitat dataset (CDFG 2009).
- Color aerial photographs at a scale of 1:2,400 from February and March, 2007 (Mapcon Mapping, Ltd. 2007).
- Mapped soil units (NRCS 2008).
- Aerial photographs from 1976, 1987, 1998 to 1999, 2007 and 2009.
- Climate and Precipitation Data (WRCC 2009) (WRCC 2008; CIMIS#145 2011).
- Hydraulics and Floodplain Technical Report. California High-Speed Train Project EIR/EIS Merced to Fresno Section (Authority and FRA 2012b).

3.3 Field Survey Methods

CH2M HILL conducted numerous field activities to identify and map wetlands and waters in the 21,562-acre wetland study area. The field survey occurred during the following periods:

- Wetland reconnaissance surveys in November 2009.
- Natural drainage features surveys in December 2009 and May 2010.
- Wetland delineation field surveys in April and May 2010 (spring 2010) and in January and February 2011 (winter 2011).

3.3.1 Reconnaissance-Level Field Surveys

CH2M HILL conducted wetland reconnaissance surveys for the Merced to Fresno Section from November 16 through 20, 2009, between 7 a.m. and 5 p.m. Weather conditions throughout the survey period were overcast to partly cloudy with temperatures ranging from 36°F to 66°F. Michael Clary and Corinna Lu surveyed wetlands along the proposed alignments for the UPRR/SR 99 Alternative as well as the Ave 24 Wye. During the survey, wetlands and waters—such as agricultural canals, stormwater basins, retention basins, and agricultural tailwater ponds—were noted on 1:2,400 scale aerial photographs. Reconnaissance-level field surveys were conducted to determine the presence or absence of wetlands and waters, and to document the location of any wetland resources that warrant additional or more focused surveys. All wetland characterization and mapping were conducted from publically accessible roads along or near the alignments. The reconnaissance field mark-ups on the color aerial photographs were used to digitize potential wetlands and waters into a Geographic Information System (GIS) database.

3.3.2 Natural Drainage Features Field Surveys

Field surveys of natural drainage waters at the Merced to Fresno Section along the UPRR/SR 99 Alternative's alignment were conducted by CH2M HILL biologists Russell Huddleston, Michael Clary, and Craig Williams from December 7 through 10, 2009. Temperatures ranged from approximately 27 to 50°F with occasional light winds, moderate precipitation on December 7, and locally heavy morning fog on December 8. Surveys for the natural drainages along the BNSF Alternative's alignment were conducted by Craig Williams and Neil Nikirk in May 2010. The objective of the December surveys was to characterize and map each of the locations proposed for crossing rivers, creeks, and sloughs (referred to in this report as natural drainages). To the extent possible, these surveys were conducted by walking along the portion of the drainage channel in the wetland study area. In areas where access was limited or not possible, the natural drainage waters were evaluated from the nearest public road or other accessible locations upstream and/or downstream of the proposed crossing location.

Specific information on the channel geomorphology and hydrology was collected at each crossing location. Data included information on the channel type and dimensions, substrate, and apparent flow regime (perennial, intermittent, or ephemeral). The width and depth of the active flow channel was determined based on defined bed and bank features and/or observations of field indicators of the ordinary high water mark such as shelving, destruction of terrestrial vegetation, scour, presence of litter and debris, water staining, and other indicators included in the USACE Regulatory Guidance Letter (RGL) RGL-05-5 (USACE 2005). The ordinary high water mark (OHWM) was determined using concepts presented in *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States* (Lichvar and McColley 2008). Characteristic vegetation within the channel and along the edges of the channel was also recorded at each accessible crossing location. Representative photographs were also taken.

3.3.3 Wetland Delineation Methods

Wetlands and other Waters were delineated by aerial imagery interpretation (Mapcon Mapping, Ltd. 2007 and Google Earth 2011) and field surveys in spring 2010 and winter 2011 (where property access had been granted) offsite. To the extent possible wetland and water features identified via aerial mapping were verified in the field either through onsite delineation or offsite observations from public access locations. Offsite observations of wetland and water features identified presence or absence of wetland hydrology (standing water), general location and extent of ponded features and, where possible, the characteristic vegetation.

3.3.3.1 Aerial Imagery Mapping

Aerial imagery (Mapcon Mapping, Ltd. 2007 and Google Earth 2011) was used to identify wetland and other Waters present in the study area. Wetland and other Waters were initially identified based on landscape signatures viewable on imagery overlayed with National Wetlands Inventory (NWI) and Central Valley Vernal Pool Habitat dataset (CDFG 2009). Two aerial imagery sources (Mapcon Mapping, Ltd. 2007 and Google Earth 2011) were used to identify landscape signatures of palustrine wetlands and other Waters early and late in the growing season. Mapcon aerial imagery was collected (flown) in early in the growing season (February and March; 30cm aerial photography, Mapcon Mapping, Ltd. 2007) and prepared in September. Google Earth imagery (2011) was dated from June and September 2009 and 2010 (late growing season).

The Mapcon 2007 imagery dataset was selected for project use based on adequate project area coverage, higher quality resolution, and imagery collection during the wet season (February and March). Wet season imagery is preferred in identifying the maximum extent of wetlands and waters signatures on the landscape. Precipitation preceding February fly dates (2007) was 51% of normal. However imagery reviewed from other vintages were not considered to contain better representation of wetland signatures as these images were collected during the drier portions of the growing season, contained lower quality resolution, or had insufficient coverage of the project area. Aerial imagery sources reviewed prior to selection of the 2007 imagery (Mapcon Mapping, Ltd.) include:

- 2007 50cm aerial photography – Collected in June and July of 2007.
- 2009 1m aerial photography – Collected in June of 2009.
- 2009 30cm aerial photography – Collected from March to June of 2009.

Further information on precipitation conditions during 2007 imagery collection and 2011 field work is presented in *Section 2.2.2 Climate and Precipitation Data*. High resolution Google Earth imagery was collected later in the growing season (June through September 2010) under drier seasonal conditions as compared to the 2007 imagery dates. The 2011 imagery was also referenced to support field efforts and 2007 wet season imagery interpretation.

Forested wetland signatures are not easily distinguished from upland riparian communities based on aerial imagery signatures. To improve accuracy, NWI and riparian habitat mapping polygons (CH2M HILL habitat field data, unpublished) were used to better inform the locations of potential forested wetlands within non-accessible parcels in the study area. A description of riparian habitat types is provided in *Section 2.1.3 Natural and Semi-Natural Habitats*. Riparian habitats identified within the study area include:

- Mixed riparian forest and woodland
- Valley oak woodland
- Valley and foothill riparian
- Willow riparian forest and woodland
- Himalayan blackberry scrub
- Cottonwood willow riparian
- Black walnut riparian
- Giant reed community
- Eucalyptus community

To better identify forested wetlands on aerial imagery, mapped riparian habitats were grouped into upland dominant or wetland dominant communities based on the species composition of each mapped habitat type. Of all the riparian communities mapped, Willow riparian forest and woodlands and Cottonwood willow riparian are considered to have to greatest potential to support forested wetlands as these riparian types are described to contain a predominance of facultative and facultative wetland species. Each mapped location of Willow riparian forest and woodlands and Cottonwood willow riparian habitat was reviewed on imagery to determine if it was likely to support forested wetlands based on vegetation signature, stream entrenchment, adjacent barriers to stream migration (levees/roads), general topographic gradient of banks, and knowledge of site conditions. In addition to the NWI and riparian habitat data overlays, each named natural water crossing location was reviewed for potential forested wetland signature based on vegetation signature, stream entrenchment, adjacent barriers to stream migration, general topographic gradient, and site conditions. All wetland and water features identified on aerial images and on Google Earth were digitized using GIS.

3.3.3.2 Field Delineations

Field delineations were conducted in April and May of 2010 (spring 2010) and in January and February 2011 (winter 2011) on parcels where property access had been granted in the wetland study area. Access was granted to a total of 99 parcels within the wetland study area in 2010 and 2011. Parcel access requests for wetland and water surveys were prioritized to include those parcels that were identified as having potential wetland resources based on reconnaissance surveys, aerial photograph mapping, NWI, and Central Valley Vernal Pool Habitat dataset. Offsite observations of imagery-identified wetland and water features were conducted on non-accessible parcels in winter 2011.

Wetland and waters field surveys were conducted by CH2M HILL biologists Russell Huddleston, Michael Clary, Deborah Waller, and Gretchen Herron from April 26 through 29, 2010, generally between 7 a.m. and 5 p.m. Temperatures ranged from approximately 44°F to 86°F with occasional light winds and trace precipitation on April 28, 2010. Additional wetlands and waters field surveys were conducted on May 24 through 26, 2010, by CH2M HILL biologists Deborah Waller and Russell Huddleston. Temperatures ranged from approximately 60°F to 88°F with no precipitation. The primary objective of the April and May surveys was to characterize and delineate wetlands and waters on accessible parcels.

Wetland and waters winter field surveys were conducted by CH2M HILL biologists Russell Huddleston, Michael Clary, Steve Long, Gretchen Herron, Yolanda Molette, and Victor Leighton from January 25 through 28, 2011, generally between 8 a.m. and 5 p.m. Temperatures ranged from approximately 44°F to 55°F with foggy morning conditions, occasional light winds, and no precipitation. Additional wetland and waters winter field surveys were conducted by CH2M HILL biologists Morgan King, Michael Clary, Steve Long, Gretchen Herron, Yolanda Molette, and Victor Leighton from February 7 through 10, 2011, generally between 8 a.m. and 5 p.m. Temperatures ranged from approximately 44°F to 55°F with foggy morning conditions, occasional afternoon 40 mph wind speeds, and no precipitation.

Data Collection. Wetland delineations were completed following the *Corps of Engineers Wetlands Delineation Manual* (USACE 1987) and the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Arid West Region* (Version 2.0) (USACE 2008a). Wetland types were generally classified according to the *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979). Information from the wetland delineation was used to obtain a Preliminary Jurisdictional Determination (JD) issued by the USACE on November 3, 2011. A Preliminary JD assumes all water features are jurisdictional (under Section 404 of the CWA). A recipient of a Preliminary JD can later request and obtain an approved JD from the USACE if that becomes necessary or appropriate during the permitting process or during an administrative appeal process (USACE 2008b). A permittee can identify impacts, compensatory mitigation requirements, and other resource protection measures with a Preliminary JD, because the USACE treats all waters and wetlands that would be affected by the permitted activity as if they are jurisdictional waters of the U.S. (USACE 2008b).

Characterization of non-wetland water features included information on channel type and dimensions, substrate, and apparent flow regime (perennial, intermittent, or ephemeral). The location of the OHWM was determined based on indicators of scour, shelving, destruction of terrestrial vegetation, presence of litter and debris, water staining, and other indicators included in the USACE RGL-05-5 (USACE 2005) and concepts presented in *A Field Guide to the Identification of the Ordinary High Water Mark (OHWM) in the Arid West Region of the Western United States* (Lichvar and McColley 2008), although a specific waterway assessment form was designed for use on this project.

Wetland surveys conducted in April and May in 2010 included prioritized private property access to parcels containing NWI or Central Valley Vernal Pool Habitat mapped wetlands, other Waters, and areas that had been identified though wetland and water reconnaissance field work in 2009. Where access was granted wetland teams entered private properties and collected wetland delineation data points and boundaries, OHWM information (if other Waters were present), and characterized plant communities.

Wetland surveys conducted in January and February 2011 (winter 2011) prioritized accessing private properties where potential wetlands and other water resources were evident on aerial images. Where access was granted, wetland field teams entered private properties and collected wetland delineation data points at image-verified wetland and water locations. Any additional wetland or water resources present on accessible parcels were also delineated. OHWM indicators and widths were collected at water features on accessible parcels. At accessible water crossing locations, GIS line information was collected at the OHWM and range finder measurements were used to measure the width to the OHWM on the adjacent bank.

Where wetlands and waters were identified on non-accessible private properties, mapped features were observed from publically accessible locations. Wetland survey teams in winter 2011 reviewed all non-accessible parcels for wetland and water resources from the public roadways (where viewable from roadways). Information collected from public access vantage points included observation of natural or constructed watercourses and observation of wetland hydrology (standing water) corresponding to mapped or newly identified wetland features. OHWM indicators were also in some cases observed from publicly accessible locations. This information was used in conjunction with image-verified OHWM width to estimate the OHWM widths for water features within the wetland study area.

3.4 Impact Calculations

Potential impacts on wetlands and other waters of the U.S. were quantified by overlaying the current construction footprint and wetland study area boundary over delineated jurisdictional features. All aquatic surface water features are assumed jurisdictional under Section 404 of the Clean Water Act using the Preliminary Jurisdictional Determination approach.

For purposes of evaluating impacts on jurisdictional waters, the area of potential impact generally consists of the following areas:

- A 100-foot project construction footprint for track segments;
- The construction footprints for any project-related facilities or improvements (e.g., the Merced to Fresno Section HST Project stations, power distribution facilities, and/or maintenance facilities); and
- A 250-foot buffer around all construction footprints.

To determine the maximum direct impact that might result from each HST alternative, all aquatic resources present within the construction footprint (at-grade track or associated facilities) would be considered directly and permanently affected due to construction of such facilities, with notable differences in how impacts are calculated between at-grade and elevated segments of the track alignment, as follows:

- For at grade segments of the track alignment, all aquatic resources present within the construction footprint would be considered directly and permanently affected as a result of the introduction of compacted soil and ballast material and the construction of the track.
- For elevated segments of the track alignment:
  - All aquatic resources within a 60-foot-wide construction footprint would be considered directly and permanently affected due to construction of facilities.

  - All aquatic resources (excluding vernal pools, seasonal wetlands, and open water) within a 20-foot area on each side of the 60-foot-wide construction footprint would be considered directly and temporarily affected due to ground disturbance associated with construction within the 60-foot elevated construction footprint. No fill would be placed within these outboard temporary impact zones, and they would be restored to their original conditions (contour, vegetation, etc.) following disturbance. Impacts on vernal pools, seasonal wetlands, and open water features within these outboard 20-foot areas would be considered direct and permanent.

- All aquatic resources within 250 feet of defined project footprints (at-grade track, elevated track, or project-related facilities) would be considered indirectly and permanently affected.

Potential indirect impacts on jurisdictional waters include water quality degradation due to runoff, erosion, and siltation, hydrologic regime and water quality impairment caused by soil hardpan damage, surface water sedimentation, stream or wetland fragmentation, soil compaction, disruption of the upland micro watershed area, barriers to water flow (e.g., the rail bed), and potential changes in the quantity and quality of wetland and riparian plant communities from disturbance, shading, or introduction or spread of invasive plant species.

4.0 Results

Aerial mapping and field investigations within the wetland study area (24,048 acres) identified a total of 129.07 acres of wetlands (vernal pool, seasonal wetlands, freshwater marsh, and forested wetlands) and 326.20 acres of other waters of the U.S. (natural watercourses, constructed watercourses, constructed basins, and open water). All wetlands and other Waters are considered potentially jurisdictional under the Preliminary Jurisdictional Determination format (USACE 2008b). The following subsections present the aerial mapping/wetland field survey results for wetlands and other Waters in the wetland study area. The presence and quantity of wetlands and other Waters are further described by individual alternative (UPRR/SR 99, BNSF, and Hybrid) and design option combinations.

4.1 Wetlands

Descriptions of wetland types and acreages in the wetland study area are provided in Section 4.1.1. Section 4.1.2 identifies wetlands and acreages by alternative. Mapped wetland locations and wetland delineation data points are provided in Appendix C. Data sheets supporting wetland type descriptions are provided in Appendix D, Wetland Determination Data Sheets. Photographs of wetlands and other waters in the study area are provided in Appendix E, Wetland and Other Waters Photographs. Appendix F, Wetlands Identified in the Study Area, includes a summary table of all wetlands identified in the study area by type and acreage.

4.1.1 Wetlands in the Study Area

Aerial mapping and field investigations identified a total of 129.07 acres of Palustrine wetlands in the wetland study area. Mapped wetlands are presented in Appendix C. Wetland boundaries shown on all exhibits are clipped to the edge of the study area. In many instances, particularly in reference to freshwater marshes, the wetlands may extend outside the area of investigation. Because of limited access to private properties in the study area, many wetlands were mapped using aerial photographs and viewed from public roadways. Significant information on resource location and extent can be identified on imagery for properties that cannot be field verified, however an uncertain degree of error is anticipated based on the nature of this method. Wetland classes (Cowardin et al. 1979) identified in the wetland study area include the following:

- 96.91 acres of palustrine emergent wetlands, including:
  - 84.93 acres of vernal pools
  - 6.96 acres of seasonal wetlands
  - 5.03 acres of freshwater marsh
- 32.15 acres of palustrine forested wetlands

Within a watershed context, the Merced to Fresno Section wetland study area falls into four main watersheds: the Middle San Joaquin-Lower Chowchilla (north), the Middle San Joaquin-Lower Chowchilla (south), the Upper Chowchilla-Upper Fresno (Fresno River), and the Tulare-Buena Vista Lakes/Upper Dry watershed. The greatest total delineated wetland acreage (92.45 total acres) is located within the Middle San Joaquin-Lower Chowchilla (north) watershed. This watershed includes 60.88 acres of delineated vernal pools, 1.46 acres of delineated seasonal wetlands, 0.81 acres of freshwater marsh, and 29.30 acres of palustrine forested wetlands (Appendix G, Acres of Delineated Wetlands and Other Waters in Wetland Study Area by Watershed). The greatest total acreage (116.40 acres) of delineated Other Waters of the U.S. is located within the Upper Chowchilla-Upper Fresno (Fresno River) watershed. This watershed includes 48.26 acres of delineated natural watercourses, 48.16 acres of constructed watercourses, 17.21 acres of constructed basins, and 2.32 acres of delineated open water features (see Appendix G).

The field-verified wetland types identified in the study area (vernal pools, seasonal wetlands, freshwater marsh, and forested wetlands) are described below. Wetland maps, data sheets and site photographs supporting the wetland types described here are provided in Appendixes C, D, and E. A summary table identifying individual wetland resources and acreage in the wetland study area is provided in Appendix F. A wetland plant species list is provided in Appendix H.

4.1.1.1 Vernal Pools and Seasonal Wetlands

Of the 96.91 acres of palustrine emergent wetlands identified in the wetland study area, 84.93 acres were identified as vernal pools and 6.69 acres were identified as seasonal wetlands. Vernal pool systems are characterized as depressional, seasonally saturated wetlands located in hummocky depressions on alluvial terraces. Native floristic composition of these systems is influenced by hydrology and topographic position within the wetland. Vernal pools are not associated with watercourses and capture water from precipitation and limited overland flow from adjacent upland areas.

The distinction between vernal pools and seasonal wetlands is largely based on disturbance level and the presence of a native (vernal pool) or nonnative plant community types (seasonal wetland). Seasonal wetlands may resemble vernal pools (e.g., landscape position, seasonal hydrology, soil profile), but they may lack a predominance of native plant assemblages (characteristic to vernal pools) and may have been disturbed through conversion to agriculture. The description below identifies field conditions of vernal pools and seasonal wetlands observed in spring 2010 and winter 2011. Vernal pools and seasonal wetlands are described together as they exhibit many of the same landscape position, soil, and hydrologic conditions. Notable differences in vegetation assemblages are also described.

Vegetation observed in vernal pool wetlands during spring 2010 surveys included annual rabbitsfoot grass (*Polypogon monspeliensis*), prostrate knotweed (*Polygonum aviculare*), purslane speedwell, tarweed (*Holocarpha* sp.), Fremont's goldfields (*Lasthenia fremontii*), coyote thistle, Mediterranean barley, *popcornflower*, toad rush, and pale spikerush. Seasonal wetland plant assemblages included seaside barley, annual rabbitsfoot grass, European knotweed (*Polygonum arenastrum*), purslane speedwell, rush species, tarweed, and popcorn flower. Within the wetland study area, soils (vernal pool and seasonal wetland) ranged from compacted fill material to cemented gravelly substrate. Primary hydrologic inputs to vernal pools and other seasonal wetlands observed in the study area are precipitation and limited surface water overland flow from adjacent uplands. During field investigations in spring 2010, most vernal pool and seasonal wetland depressions were dry due to normal seasonal conditions. Observed hydrologic indicators included remnants of aquatic invertebrates and biotic crusts (algal matting). Subsequent field investigations during winter 2011 at vernal pools and seasonal wetland locations identified wetland hydrology (standing water or surface soil saturation) in all 2010 observed vernal pools and seasonal wetland locations. Vegetative data collected in winter 2011 reflects vegetative communities early in the growing season. Vegetation identification is based on seedlings and non-flowering plants. As a result many vernal pool and seasonal wetland plant species in winter 2011 could not be positively identified, and the plant species that were identified are likely a subset of a larger wetland community present later in the growing season. Delineations of vernal pools and seasonal wetlands were conducted on accessible parcels, and results are described below. Data sheets are included in Appendix D, and maps are included in Appendix C.

Field-delineated vernal pools and seasonal wetlands are summarized in Table 4-1, and described in the following text.

Table 4-1
Field-delineated Vernal Pools and Seasonal Wetlands
in the HST Merced to Fresno Section Wetland Study Area

Wetland ID	Appendix C, Mapbook Page	Wetland Type	[redacted]	Hydrophytic Vegetation	Hydric Soils	Wetland Hydrology	Wetland?
10756	37	Vernal Pool	[redacted]	Yes	Inferred	Yes	Yes
8534	102	Vernal Pool	[redacted]	Yes	Yes	Yes	Yes
8535	102	Vernal Pool	[redacted]	Yes	Yes	Yes	Yes
8536	102	Vernal Pool	[redacted]	Yes	Yes	Yes	Yes
5166	123	Vernal Pool	[redacted]	Yes	Yes	Yes	Yes
5533 and 5534	134	Seasonal Wetlands	[redacted]	Yes	Yes	Yes	Yes
5529, 5594, 5597-5599, and 5600	263, 291	Vernal Pool	[redacted]	Yes	Yes	Yes	Yes
8818	324	Vernal Pool	[redacted]	Yes	Yes	Yes	Yes
5562 and 5559	340	Vernal Pool	[redacted]	Yes	Yes	Yes	Yes
8582	389	Vernal Pool	[redacted]	Yes	Inferred	Yes	Yes
5158	393	Vernal Pool	[redacted]	Yes	Yes	Yes	Yes
8803 and 8802	614,615	Vernal Pool	[redacted]	Yes	Yes	Yes	Yes
8932, 8933, and 8934	626, 627	Vernal Pool	[redacted]	Yes	Yes	Yes	Yes
8543	383	Vernal Pool	[redacted]	Yes	Yes	Yes	Yes

Wetland 10756

[redacted]

The wetland resource at this location was a vernal pool within and adjacent to a freeway frontage road with a constricted outlet. Wetland delineation data were collected in May 2010 at data points (DP-DW-001-1-WL and DP-DW-001-2-UPL).

Vegetation. The wetland contained one vegetative layer (emergent) dominated by annual rabbitsfoot grass, European knotweed (*Polygonum arenastrum*), and purslane speedwell (obligate wetland species

[OBL]). The wetland vegetation criterion was achieved by a prevalence of wetland vegetation (more than 50% of the dominant plant species are facultative species [FAC] or wetter).

Soils. Soils at data point DW-001-1-WL were uniform and clean and appear to be fill material in origin. Hydric soil conditions were assumed to be present under natural conditions. Soils were sampled from 0 to 14 inches below ground surface (bgs). The soil profile was characterized as a reddish brown (2.5YR 5/3) sandy peat clay loam. No redoximorphic features were observed. Presence of hydric soils was assumed based on disturbed conditions (fill material), wetland hydrology indicators (aquatic invertebrates presence), a predominance of hydrophytic vegetation (facultative wetland species [FACW] and OBL dominant species observed), and landscape feature that concentrates and collects surface water (depression).

Hydrology. Wetland hydrology indicators were satisfied by observation of two primary indicators: biotic crust (B12) and aquatic invertebrates (B13). No standing water or soil saturation was observed. The wetland hydrology criterion was met through identification of at least one primary wetland hydrology indicator.

Wetland 8534

[redacted]

Wetland 8534 was a vernal pool containing car parts, tires, barrels, wood, and treated lumber debris. Wetland delineation data were collected in January 2011 at data points (DP-VL-301-3-UPL and DP-VL-301-2-WL).

Vegetation. Vegetation within 8534 contained one vegetative layer (emergent). The emergent layer provided 22% vegetative cover and was dominated by rush species (FACW assumed), and coyote thistle (FACW). Open water comprised approximately 78% cover of the wetland. Vegetation identification was based on seedlings and non-flowering plants. The hydrophytic vegetation criterion was achieved by a prevalence of wetland vegetation.

Soils. Soils were sampled from 0 to 12 inches bgs. The soil profile was characterized as a dark gray (10YR 4/1) loamy sand. Redoximorphic features (10YR 4/6) were present at 50%. Hydric soil indicator of Redox Depression (F8) was met at the sample location.

Hydrology. Hydrology indicators observed within Wetland 8534 included surface water (1 inch), saturation, and presence of reduced iron. The wetland hydrology criterion was met based on the observation of the above primary indicators.

Wetland 8535

[redacted]

Wetland 8535 was a vernal pool wetland contained within a roadside ditch. Adjacent land management was a disked field. Wetland delineation data were collected in January 2011 at data points (DP-VL-5538-1-UPL and DP-VL-5538-2-WL).

Vegetation. Vegetation within wetland 8535 contained one vegetative layer (emergent). The emergent layer provided 100% vegetative cover and was dominated by popcornflower (FACW assumed).

Soils. Soils were sampled from 0 to 9 inches bgs. The soil profile was characterized as a black (7.5YR 2.5/1) loamy sand. The soil continued as a very dark grayish brown (10YR 3/2) loamy sand with 15% redoximorphic features (5YR 4/4). Hydric soil indicator of Redox Dark Surface (F6) was met at the sample location.

Hydrology. Hydrology indicators observed within Wetland 8535 included surface water (2 inches), high water table (9 inches bgs), saturation (at ground surface), aquatic invertebrates, and presence of reduced iron. The wetland hydrology criterion was met based on the observation of the above primary indicators.

Wetland 8536

[redacted]

Wetland 8536 was a vernal pool contained within a basin. Adjacent land management was a disked field. Wetland delineation data were collected in January 2011 (data point: DP-VL-5539-2-WL).

Vegetation. Wetland 8536 contained one vegetative layer (emergent). The emergent layer provided 70% vegetative cover and was dominated by seaside barley (FAC) and tarweed (FAC).

Soils. Soils were sampled from 0 to 10 inches bgs. The soil profile was characterized as a very dark grayish brown (10YR 3/2) silty clay from 0 to 2.5 inches. Soils continued as a dark gray (2.5YR 4/1) sandy clay with 12% redoximorphic features (10 YR 4/4 and 10YR 6/2). From 5 to 10 inches the sampled soil was dark grayish brown (10YR 4/2) sandy loam. Hydric soil indicator of Depleted Matrix (F3) was met at the sample location.

Hydrology. Hydrology indicators observed within Wetland 8536 included surface soil cracks and water-stained leaves. The wetland hydrology criterion was met based on the observation of the above primary indicators.

Wetland 5166

[redacted]

Wetland 5166 was a shallow weakly expressed vernal pool. Wetland delineation data were collected in January 2011 at data points (DP-RH-5166-1-WL and DP-RH-5166-2-UPL).

Vegetation. Vegetation within Wetland 5166 contained one vegetative layer (emergent). The emergent layer provided 90% vegetative cover and was dominated by popcorn flower (FACW assumed). Ten percent cover of biotic crust was identified within the wetland boundary. Vegetation identification was based on seedlings and non-flowering plants.

Soils. Soils within the wetland are characterized as a brown (10YR 4/3) sandy loam from 0 to 7 inches bgs. Soils continued as a dark yellowish brown (10YR 4/4) very fine sandy loam with 20% redoximorphic features (10YR 5/3 and 10YR 5/8) to 18 inches bgs. Hydric soil indicators were inferred based on vernal pool community, landscape formation (depression), and USDA-NRCS hydric soil definition #3: soils that are ponded for long or very long duration during the growing season.

Hydrology. Hydrology indicators observed within Wetland 5166 included saturation, biotic crust, and alpha alpha-dipyridyl test positive reaction (faint). The wetland hydrology criterion was met based on the presence of saturation and biotic crust.

Wetlands 5533/5534

[redacted]

Wetlands 5533 and 5534 were seasonal wetlands adjacent to Dry Creek. Soil and vegetative conditions within the parcel showed evidence of historic agricultural management, currently the area was fallow. Wetland delineation data were collected in April 2010 at data points (DP-GHSP-2, DP-GHSP-3, DP-RHSP-5, and DP-RHSP-6).

Vegetation. Within the wetland complex the wetland areas contained one vegetative layer (emergent). The emergent layer provided 100% vegetative cover and was dominated by vernal pool popcorn flower (OBL) and woollyheads species (OBL assumed).

Soils. Soils were sampled from 0 to 19 inches bgs at DP-GHSP-2. Soils from 0 to 6 inches were a dark grayish brown (10YR 4/2) very fine sandy clay. Soils continued to 19 inches as a very dark grayish brown (10YR 3/2) fine sandy clay with 20% redoximorphic features (7.5Y 3/3). Soils at this location satisfied the hydric soil indicator Redox Dark Surface (F6).

Soils sampled at DP-RHSP-5 were inferred as hydric. Soils were a brown (10YR 4/3) sandy clay loam from 0 to 7 inches bgs. A hardpan of cemented substrate was encountered at 7 inches bgs. These soils were inferred hydric based on landform that collects and concentrates surface water (depression), vernal pool plant community, algal matting, dead ostrocods (evidence of long duration ponding), and a hardpan that restricts water transport away from the soil surface.

Hydrology. Hydrology indicators observed within the wetland included biotic crust and aquatic invertebrates (DP-RHSP-5). Surface soil saturation was observed at DP-GHSP-2. The wetland hydrology criterion was met based on the observation of the above primary indicators.

Wetlands 5529, 5594, 5597, 5598, 5599, and 5600

[redacted]

Wetlands at this location were a vernal pool wetland complex in a grassland community adjacent to an oxbow stream feature. Wetland delineation data were collected in May 2010 at data points (DP-DW-003-1-WL, DP-DW-003-2-WL, DP-DW-003-3-UPL, DP-DW-003-4-UPL, DP-DW-003-5-WL, DP-DW-003-6-WL, DP-DW-003-7-WL, and DP-DW-003-8-UPL).

Vegetation. Within the wetland complex the wetland areas contained one vegetative layer (emergent). The emergent layer provided 30 to 90% vegetative cover. Dominants included Great Valley button celery (*Eryngium castrense*, FACW), Fremont's goldfields (FACW), Italian ryegrass (*Lolium perenne* ssp*. multiflorum,* FAC), rush (*Juncus* sp., assumed FACW), pale spikerush (OBL), and seaside barley (FAC).

Soils. Soils were sampled within the wetland complex from 0 to 10 inches bgs. Sampled soils were typically a very dark grayish brown (10YR 3/2) throughout the profile with 5%, dark brown (7.5YR 3/3 or 3/4) or dark yellowish brown (10YR 4/6) redoximorphic features. Soils at data point DW-003-5-WL were dark gray (10YR 4/1) from 0-9 inches bgs with a muck layer (1-3 cm) at the ground surface. Wetland soil textures were uniformly clay loams that ranged from sandy to gravelly. All wetland sample points exhibited conditions that met the hydric soil indicator F6 Redox Dark Surface with the exception of data point DW-003-5-WL. Soils at this location are best described as and satisfy the hydric soil indicator of loamy mucky mineral (F1).

Hydrology. Primary wetland hydrology indicators observed within this wetland complex included at least one of the following: biotic crust, surface water, or saturation; or as observed at DP-003-2-WL, two secondary indicators (dry-season water table and saturation visible on aerial imagery). The wetland hydrology criterion was met based on the observation one primary indicator or two secondary wetland hydrology indicators.

Wetland 8818

[redacted]

Wetland 8818 was a vernal pool/vernal swale complex. Wetland delineation data were collected in January 2011 at data points (DP-RH-5564-1-UPL and DP-RH-5564-2-WL).

Vegetation. Vegetation within Wetland 8818 contained one vegetative layer (emergent). The emergent layer provided 10% vegetative cover and was dominated by pale spikerush (OBL), hyssop loosestrife (*Lythrum hyssopifolium,* FACW), and Italian ryegrass (FAC). The basin was mostly bare dirt due to the early season survey timing. Vegetation identification was based on seedlings and non-flowering plants.

Soils. Soils were sampled from 0 to 11 inches bgs. The soil profile was characterized as a gray (10YR 5/1) fine sandy loam. Redoximorphic features (10YR 4/6) were present at 5%. The hydric soil indicator of Depleted Matrix (F3) was met at the sample location.

Hydrology. Hydrology indicators observed within Wetland 8818 included surface water, saturation, aquatic invertebrates, and presence of reduced iron. The wetland hydrology criterion was met based on the observation of the above primary indicators.

Wetlands 5562 and 5559

[redacted]

Wetlands 5562 and 5559 were part of a larger vernal pool complex on this parcel. The parcel was managed under grazing that appeared to have not significantly disturbed the vernal pools. Potential vernal pool fairy shrimp (*Branchinecta lynchi*) and unidentified egg masses were identified in the surface water within the wetlands. Wetland delineation data were collected in January 2011 at data points (GH-5562-1-UPL, GH-5562-2-WL, SL-5559-1-UPL, GH-5559-2-WL).

Vegetation. Vegetation within the wetlands occurred in one layer (emergent) dominated by spikerush (*Eleocharis* sp., FACW assumed), water-starwort (*Callitriche* sp*.,* OBL), coyote thistle (FACW assumed), and/or seaside barley (FAC). The emergent layer provided 100% vegetative cover throughout the wetland. Vegetation identification was based on seedlings and non-flowering plants.

Soils. Soils within the wetlands were characterized as olive gray (5Y 4/2) sandy loams from 0 to 3 inches bgs. Soils continued as an olive gray (5Y 5/2) sandy loam with redoximorphic features (5Y 4/3) to 6 inches bgs. From 6 to 12 inches bgs, soils were olive (5Y 4/3) with 2.5Y 4/4 redoximorphic features (quantity unspecified). Hydric soil indicators were inferred based on vernal pool community, landscape formation (depression), and USDA-NRCS hydric soil definition #3: soils that are ponded for long or very long duration during the growing season.

Hydrology. Hydrology indicators observed within Wetlands 5562 and 5559 included surface water, saturation, inundation visible on aerial imagery, aquatic invertebrates, and presence of reduced iron. The wetland hydrology criterion was met based on several primary wetland hydrology indicators.

Wetland 8582

[redacted]

Wetland 8582 was a vernal pool wetland within a mowed rural residential parcel. Several additional seasonal wetlands were identified in the vicinity of GH300. Wetland delineation data were collected in January 2011 at data points (DP-GH-300-1-WL and DP-GH-300-2-UPL).

Vegetation. Wetland 8582 contained one vegetative layer (emergent) dominated by seaside barley (FAC). Vegetation identification was based on seedlings and non-flowering plants.

Soils. No soils were sampled within this seasonal wetland. Standing water within the wetland limited soil capture. Hydric soils were inferred based on landscape formation that collects and concentrates surface water (closed depression).

Hydrology. Hydrology indicators were satisfied by standing water (>12 inches), saturation (surface saturation), and presence of reduced iron. All hydrology conditions observed corresponded to primary wetland hydrology indicators.

Wetlands 5158

[redacted]

Wetland 5158 was part of a vernal pool complex. The surrounding area was mowed and may have been used for light grazing. Shrimp species were identified within the wetland. Wetland delineation data were collected in January 2011 at data points (GH-5158-1-WL, GH-5158-2-UPL).

Vegetation. Vegetation within the wetland contained one vegetative layer (emergent) dominated by seaside barley (FAC) and coyote thistle species (FACW assumed). The emergent layer provided 55% vegetative cover throughout the wetland.

Soils. Soils within the wetlands was characterized as a gray (2.5Y 5/1) sandy loam. Due to saturated/inundated conditions soil capture was poor and further soil characterization was not possible. Mottles may have been present but were difficult to identify due to saturation. Hydric soils indicators were inferred based on vernal pool community, landscape formation that collects and concentrates surface water (depression), and USDA-NRCS hydric soil definition #3: soils that are ponded for long or very long durations during the growing season.

Hydrology. Hydrology indicators observed within Wetland 5158 included surface water, saturation, inundation visible on aerial imagery, and aquatic invertebrates. The wetland hydrology criterion was met based on several primary wetland hydrology indicators.

Wetlands 8803 and 8802

[redacted]

Wetlands identified within parcel 029-120-006 were vernal pools disturbed by agricultural management. Land management on the parcel included drill seeding, disking, and/or plowing but the area had not been graded and wetland hydrology was maintained by shallow depressional features throughout the parcel. Wetland delineation data were collected in January 2011 (data points: DP-GH-202-1-WL, DP-GH-202-2-UPL, DP-RH-400-1-UPL, and DP-RH-400-2-WL).

Vegetation. Vegetation within the wetlands was variable depending on the intensity of the drill seeding activity in the depression. Several wetlands were entirely seeded and devoid of natural recruits. Other wetland areas were seeded to the wetland margin and contained some native vegetation. Within the parcel, the wetlands contained one vegetative layer (emergent) and were dominated by an unidentified seeded grain crop, tufted hairgrass (*Deschampsia cespitosa*, FACW), and/or winged water star-wort (*Callitriche marginata*, OBL), depending on the intensity of management within the wetland. Percent vegetative cover within the wetland areas ranged from 25 to 75%. Vegetation identification was based on seedlings and non-flowering plants. The hydrophytic vegetation criterion was either met (prevalence of wetland vegetation) or inferred (disturbed seeded vegetation) within all wetlands delineated within the parcel.

Soils. Soils within the wetlands were characterized as a weak red (2.5Y 5/2) fine sandy loam with 2% (2.5Y 4/4) redoximorphic features from 0 to 4 inches bgs. The soil continued to 8 inches bgs as a brown (10YR 5/3) fine sandy loam with 5% (10YR 3/6) redoximorphic features. Soil color between 8 and 18 inches bgs was brown (10YR 4/3) with 5% (10YR 4/6) redoximorphic features and 5% of 10YR 3/1. Hydric soils were inferred based on landscape position that collects surface water (depression), vernal pool plant community, and USDA-NRCS hydric soil definition #3: soils that are ponded for long or very long duration during the growing season.

Hydrology. All wetlands contained standing water or surface soil saturation at the time of investigation. alpha alpha-dipyridyl test on wetland soils yielded a positive reaction for reduced iron Fe++ conditions. The wetland hydrology criterion was met based on saturation, standing water, and presence of reduced iron.

Wetland 8932, 8933, and 8934

[redacted]

Wetlands 8932, 8933, and 8934 were depressional vernal pools that had been somewhat disturbed by agricultural management (disking/plowing). Wetland delineation data were collected in January 2011 at data points (DP-VL-5170-1-WL, VL-5170-2-UPL, VL-5173-1-WL, VL-200-3-WL and VL-200-4-WL).

Vegetation. Vegetation within the wetland complex contained one vegetative layer (emergent). The emergent layer ranged from 10 to 90% vegetative cover and was dominated by popcorn flower species (FACW assumed). Vegetation identification was based on seedlings and non-flowering plants.

Soils. Wetland soils within the features were characterized as a dark grayish brown (10YR 4/2) loamy sand with 10% redoximorphic features (5Y 4/4) from 0 to 20 inches bgs. Hydric soils indicators of Redox Dark Surface (F6) and Redox Depression (F8) were met within the wetland.

Hydrology. Hydrology indicators observed within the wetland complex included saturation, water-stained leaves, biotic crust, and recent iron reduction on tilled soils. The wetland hydrology criterion was met based on the above listed primary indicators.

Wetland 8543

[redacted]

Wetland 8543 was a vernal pool wetland contained within a constructed basin. The wetland condition was disturbed presumably through basin management. Wetland delineation data were collected in January 2011 at data points (DP-VL-5164-1-WL and DP-VL-5164-2-UPL).

Vegetation. Wetland 8543 contained one vegetative layer (emergent) dominated by common sunflower (*Helianthus annuus*, FAC), yellow nutsedge (*Cyperus esculentus*, FACW), and broad leaf plantain (*Plantago lanceloata*, FAC).

Soils. Soils sampled at wetland 8543 were a dark gray (2.5YR 4/1) loamy sand with 1% (5YR 4/6) redoximorphic features. Hydric soil indicator of Redox Dark Surface (F6) was met at the sample location.

Hydrology. Hydrology indicators were satisfied by standing water (more than 1 inch), saturation (soil saturation present at less than 8 inches bgs), oxidized rhizospheres, and presence of reduced iron. All hydrology conditions observed corresponded to primary wetland hydrology indicators.

4.1.1.2 Freshwater Marsh

Of the 96.91 acres of palustrine emergent wetlands identified in the wetland study area, 5.03 acres were freshwater marsh. This wetland type is generally associated with the channel margins and beds of natural watercourses in the study area. Regional irrigation practices and adjacent agriculture management may degrade freshwater marshes by removing riparian vegetation, diverting water, applying herbicides, and adding nutrients. Floristic composition of these wetlands is influenced by these management techniques, hydrologic regimes, and topographic position within the wetland.

Field surveys in spring 2010 showed that study area freshwater marshes were generally characterized by one vegetative layer (emergent) that commonly included hardstem bulrush (*Schoenoplectus acutus*), spreading rush (*Juncus patens*), pointed rush (*J. oxymeris*), common soft rush (*J. effusus*), narrowleaf cattail (*Typha angustifolia*), curly dock (*Rumex crispus*), and spikerush species. Adjacent to the freshwater marshes, riparian communities may be present on channel banks or upper terraces and may include oaks (*Quercus* spp.), northwest sandbar willow (*Salix sessilifolia*), arroyo willow (*S. lasiolepis*), and fig trees (*Ficus* sp.). Hydrology for the wetland data points was inundated or saturated to the surface. Primary hydrologic input for freshwater marshes is surface water from upgradient stream flows with limited contribution from precipitation and overland flow from adjacent upland locations. Soils are typically saturated with an organic component.

Delineations of freshwater marshes were conducted on accessible parcels within the study area (winter 2011) and are described below (see Appendixes C and D).

Field-delineated freshwater marsh wetlands are summarized in Table 4-2, and described in the following text.

Table 4-2
Field-delineated Freshwater Marsh Wetlands
in the Merced to Fresno Section Wetland Study Area

Wetland ID	Appendix C, Mapbook Page	[redacted]	Hydrophytic Vegetation	Hydric Soils	Hydrology	Wetland?
2370	125	[redacted]	Yes	Assumed	Yes	Yes
8538	339	[redacted]	Yes	Yes	Yes	Yes

Wetlands 2370

[redacted]

The freshwater marsh is located in a low-lying area adjacent to Berenda Creek. In general the creek is bound on either side by steep banks and agricultural access roads. The open channel of Berenda Creek is incised and lacks a developed floodplain. Wetland delineation data were collected in January 2011 (data points: DP-GH-200-1-WL and DP-GH-200-2-UPL).

Vegetation. The wetland contained one vegetative layer (emergent) dominated by cattail (100% cover, OBL).

Soils. Steep cut banks prohibited soil sampling within the channel. Hydric soil was inferred based on 100% cover of obligate plant species and landscape formation that collects and concentrates surface water (watercourse).

Hydrology. The wetland hydrology criterion was satisfied by standing water (>12 inches) and saturation (surface saturation), both of which are primary wetland hydrology indicators.

Wetland 8538

[redacted]

Wetland 8538 was a freshwater marsh adjacent to Berenda Reservoir. The wetland contained two vegetative layers (shrub and emergent). Wetland delineation data were collected in January 2011 at data points (DP-RH-3697-1-UPL and DP-RH-3697-2-WL).

Vegetation. The shrub layer in Wetland 8538 provided less than 5% cover (mule fat, *Baccharis salicifolia*, FACW). The emergent layer provided 100% vegetative cover and was dominated by rush species (FACW assumed). Vegetation identification was based on seedlings and non-flowering plants. The wetland data point was collected at the upper edge of the wetland community. Dominant vegetation transitioned to OBL species (cattail) closer to the reservoir edge.

Soils. Soils were sampled from 0 to 18 inches bgs. The soil profile was characterized as a very dark grayish brown (10YR 3/2) sandy loam from 0 to 3 inches. Soils continued as an olive brown (2.5YR 4/3) loamy fine sand to 15 inches and as a light olive brown (2.5Y 5/3) coarse medium sand to 18 inches.

Hydric soil was inferred based on the highly mixed and graded soil condition from reservoir construction (circa 1964), adjacency to Berenda Reservoir which likely deposited new sediment through alluvial transport, and high sand content in the soil profile influencing the matrix color and available iron in parent material.

Hydrology. Hydrology indicators were inferred within Wetland 8538 as the water level and managed drawdowns of the reservoir significantly influences the hydrology of this wetland. At the time of investigation, reservoir water levels were under drawdown conditions; however, during high reservoir water levels during the growing season it is likely that soils are saturated to the surface for greater than 2 weeks during the growing season and would satisfy the wetland hydrology criterion.

4.1.1.3 Forested Wetlands

Of the 129.07 acres of palustrine wetlands identified in the wetland study area, 32.15 acres were palustrine forested wetlands. This wetland type is generally associated with the edges and channels of natural watercourses in the study area. Delineations of forested wetlands were conducted on accessible parcels within the study area (spring 2010 and winter 2011). Data sheets and maps are presented in Appendixes D and C, respectively.

Field-delineated forested wetlands are summarized in Table 4-3, and described in the following text.

Table 4-3
Field-delineated Forested Wetlands
in the Merced to Fresno Section Wetland Study Area

Wetland ID	Appendix C, Delineated Mapbook Page	[redacted]	Hydrophytic Vegetation	Hydric Soils	Hydrology	Wetland?
8306	41	[redacted]	Yes	Assumed	Yes	Yes
8871 and 3006	43, 44	[redacted]	Yes	Yes	Yes	Yes

Wetland 8306

[redacted]

Wetland 8306 was a cottonwood dominated forested wetland located on a low terrace adjacent to Owens Creek. Wetland delineation data were collected in January 2011 at data points (DP-RH-200-1-UPL, DP-RH-200-2-WL, and DP-RH-200-3-WL).

Vegetation. Wetland 8306 contained two vegetative layers (tree and emergent). The tree layer contained approximately 25% cover from Fremont cottonwood (FACW) and arroyo willow (FACW). The emergent layer provided 7% vegetative cover and was dominated by cattail (OBL) and wire rush (*Juncus balticus, OBL*). The understory of the wetland was predominantly bare soil with scattered obligate vegetation. No upland plant species were identified within the wetland area.

Soils. Soils were not sampled at this location. Hydric soil was assumed present based on absence of upland vegetation, presence of FACW and OBL vegetation, evidence of flooding, and landscape position adjacent to Owens Creek.

Hydrology. Hydrology indicators observed at wetland 8306 included secondary indicators of water marks, sediment deposits, and drift deposits. The wetland hydrology criterion was met based on three secondary indicators observed at the wetland data point location.

Wetland 8871 and 3006

[redacted]

Wetland polygons 8871 and 3006 comprise a depressional, seasonally saturated, cottonwood-dominated forested wetland. The wetland is contained [redacted] Vegetation composition throughout the system varies, largely based on hydrology with fish ponds adjacent to Duck Slough having deeper excavation and seasonal saturation compared to those ponds located further from Duck Slough. At the time of the investigation (spring 2010), surface water was not observed. Primary hydrologic inputs for wetland 1983 are precipitation with limited overland flow from adjacent upland locations. Soils at the wetland data points indicate a depleted matrix. Delineation datasheets were collected in spring 2010 (data points: GHSP-1, RHSP-1, RHSP-2, RHSP-3, and RHSP-4).

Vegetation. Features 8871 and 3006 comprise a forested wetland with three vegetative layers (tree, shrub, and emergent). The wetland community is characterized by a diffuse overstory of Fremont cottonwood (FACW) in the tree layer, disperse Gooddings willow (OBL) and arroyo willow (FACW) in the shrub layer, and patches of narrow leaf cattail (OBL), spreading rush (FAC), annual rabbitsfoot grass (FACW), and spotted ladysthumb (*Polygonum persicaria,* FACW) in the emergent layer. Tree cover is estimated at 20% throughout the system, albeit variable. Shrub vegetative cover throughout the community is 10 to 20% with emergent vegetative cover ranging from 15 to greater than 65%.

Soils. Soils within the wetlands meet the hydric soils indicator of Depleted Matrix (F3). Soil colors range from dark gray (10YR 4/1) clay or clay loam with 2% dark yellowish brown (10YR 4/6) or very dark gray (7.5YR 3/1) redoximorphic features from 0 to 12 inches bgs. The soil continues to 26 inches bgs as a dark gray (2.5Y 4/1) silty clay with greater than 5% yellowish red (5YR 5/8) redoximorphic features.

Hydrology. Wetland hydrology indicators observed within the wetlands include inundation visible on aerial imagery and other indicators. The property owner confirmed that standing water is present (2 to 3 feet deep) during the winter months. Soils saturation was not observed within 0 to 26 inches bgs. Aerial imagery inundation and anecdotal confirmation of standing water in winter months (other indicators) achieves the minimum wetland hydrology requirement at this location. USACE representative observed standing water in northern depressions in May 2011.

4.1.2 Wetlands Identified by Alternative

Table 4-4a summarizes the extent of wetlands (in acres) identified in the wetland study area for three proposed alternatives and their design option combinations. Table 4-4b summarizes the extent of wetlands and other waters of the U.S. associated with each of five alternative HMF sites. The acreages of wetland and water resources associated with each alternative and specific design options are presented in Appendix I, Acres of Wetlands and Other Waters of the U.S. by Alternative (UPRR/SR 99, BNSF, and Hybrid).

4.2 Other Waters of the U.S.

Non-wetland waters investigated in the wetland study area include natural and constructed watercourses, constructed basins, and open water (collectively, “other waters of the U.S.”). These resources are located in the Middle San Joaquin-Lower Chowchilla, Fresno River, and Upper Dry subbasin watersheds. All natural and constructed watercourses, constructed basins, and open water are considered potentially jurisdictional under the Preliminary Jurisdictional Determination format (USACE 2008b). Natural watercourses, constructed watercourses, constructed basins, and open water are described in the wetland study area (Section 4.2.1) and by alternative (Section 4.2.2) below.

Table 4-4a
Total Wetlands (in acres [a]) by Alternative within the Wetland Study Area
(Construction Footprint Plus 250-foot Buffer)

North-South Alignment Isolated and with Wye Design Option	UPRR/SR 99 Alternative			Hybrid Alternative		BNSF Alternative								Station Alternative	
						Mariposa Way Design Options				Mission Ave Design Options					
	East Chowchilla Design Option	East Chowchilla Design Option	West Chowchilla Design Option	East Chowchilla Design Option	West Chowchilla Design Option	Le Grand	East of Le Grand	Le Grand	East of Le Grand	Le Grand	East of Le Grand	Le Grand	East of Le Grand	Kern Street Design Option	Mariposa Station Design
	Ave 21	Ave 24	Ave 24	Ave 21	Ave 24	Ave 21		Ave 24		Ave 21		Ave 24		Ave 21	Ave 24
Vernal Pools	4.08	2.48	2.23	12.50	10.34	53.96	53.27	52.20	51.52	51.95	58.41	50.19	56.65	0	0
Seasonal Wetlands	1.42	1.37	1.37	2.86	2.86	3.92	3.87	3.78	3.74	3.92	4.06	3.78	3.93	0	0
Freshwater Marsh	0	0	0	0.26	0	1.89	1.89	1.95	1.95	2.39	1.85	2.45	1.91	0	0
Palustrine Forested Wetland	9.75	10.82	9.64	8.30	8.51	9.88	11.42	9.89	11.42	2.60	5.03	2.61	5.03	0	0
Total Acres by Alternative and Design Option Combination	**15.25**	**14.67**	**13.24**	**23.92**	**21.71**	**69.65**	**70.45**	**67.82**	**68.63**	**60.85**	**69.35**	**59.03**	**67.52**	**0**	**0**

[a] All non-zero measurements are rounded to the nearest one-hundredth acre.

Table 4-4b
Wetlands and Other Waters (in acres [a]) within the Heavy Maintenance Facilities
(Construction Footprint Plus 250-foot Buffer)

Heavy Maintenance Facility	Vernal Pools	Seasonal Wetlands	Freshwater Marsh	Forested Wetlands	Natural Watercourse	Constructed Watercourse	Constructed Basin	Open Water
Castle Commerce Center	0.24	0.99	0.00	1.28	9.44	7.27	4.34	0.57
Harris-DeJager	0.00	0.00	0.00	0.44	0.19	0.91	0.00	0.42
Fagundes	0.00	0.00	0.00	0.00	0.61	0.95	1.17	0.00
Gordon-Shaw	0.00	0.34	0.16	0.38	3.53	0.37	0.00	1.76
Kojima Development	1.27	0.59	2.70	0.00	6.82	0.34	0.84	0.32

[a] All non-zero measurements are rounded to the nearest one-hundredth acre.

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4.2.1 Other Waters of the U.S. Identified in the Wetland Study Area

Aerial mapping, best available information, and field surveys (December 2009; April and May 2010; January and February 2011) identified 17 potentially jurisdictional named and unnamed natural watercourses (125.80 acres), 119.24 acres of potentially jurisdictional constructed watercourses (named and unnamed canals and drains), 69.88 acres of potentially jurisdictional constructed basins, and 11.27 acres of potentially jurisdictional open water features in the wetland study area as shown in Appendix C; Appendix J, Water Crossings Maps; and Appendix K, Other Waters Identified in the Study Area. A description of natural and constructed watercourses, constructed basins, and open water follows in Sections 4.2.1.1 through 4.2.1.4.

4.2.1.1 Natural Watercourses in the Wetland Study Area

In the wetland study area, 17 natural watercourses (125.80 acres; Table 4-5 and Appendix K) have been identified. Natural watercourses with perennial flow include the San Joaquin River and Bear Creek. The majority of the natural watercourses in the study area have intermittent or ephemeral flow regimes either because of their small watershed size or because they have been impounded or diverted for agricultural purposes. All are low-gradient systems, and most support some emergent vegetation at their margins or on their beds, with bottom substrates primarily consisting of fine sediments (i.e., sand, silt, or clay). A summary (Table 4-5) and description of named natural watercourses identified in the wetland study area are provided below.

Table 4-5
Named Natural Watercourses in the Wetland Study Area

Water Body Name	Flow Regime[a]
Canal Creek	Intermittent
Black Rascal Bear Creek	Intermittent
Bear Creek	Perennial
Miles Creek	Intermittent
Owens Creek	Ephemeral
Duck Slough	Intermittent
South Slough (also known as Russell Lateral)	Intermittent
Deadman Creek	Ephemeral
Dutchman Creek	Intermittent
Chowchilla River	Intermittent-Ephemeral
Ash Slough	Ephemeral
Berenda Slough	Intermittent-Ephemeral
Berenda Creek	Intermittent
Dry Creek	Intermittent
Fresno River	Ephemeral

Water Body Name	Flow Regime[a]
Cottonwood Creek	Intermittent
San Joaquin River	Perennial

[a] Perennial flow: channel that contains water continuously during a year of normal rainfall, often with the stream bed located below the water table for most of the year. Groundwater supplies the base flow for perennial streams, but stormwater runoff also supplements flow.

Intermittent flow: a channel that contains water for only part of the year, typically during winter and spring when the stream bed may be below the water table and/or when precipitation and runoff from surrounding uplands provides sustained flow.

Ephemeral flow: flow occurs only in direct response to precipitation.

Canal Creek

Canal Creek originates east and northeast of the City of Merced. It has been highly altered by channelization, an impoundment structure, and water diversions. In the wetland study area, immediately to the southwest of North Santa Fe Avenue, the channel is impounded and diverted into the Livingston Canal, which flows northwest and west for approximately 13 miles, where it discharges into the Merced River. On the northeast side of the weir structure, the channel is characterized by a broad, open sandy area that is generally devoid of vegetation both within the channel and along the adjacent banks. Small localized patches of hardstem bulrush, cattails, and sparse scattered herbs such as fireweed, rabbitsfoot grass, cudweed (*Gnaphalium* sp.), and horseweed (*Conyza* sp.) are present around the upper edges. A single large eucalyptus tree was observed on the south side of the channel east of the UPRR railway. In the wetland study area, the channel width ranges from approximately 45 to 60 feet with an average depth of approximately 10 feet. At the time of the survey, a few small, shallow braided flow channels had water present with depths of less than 6 inches.

Southwest of the diversion structure, Canal Creek is a U-shaped earthen channel with sandy substrate that is generally devoid of vegetation. Although shallow (2 to 4 inches deep) areas of standing water were observed, no flow was present at the time of the survey (stream survey, December 2009). The ordinary high-water level is approximately 4.5 feet above the channel bed. The adjacent riparian vegetation is composed of dense eucalyptus woodland with an understory of giant reed, Bermuda grass, field bindweed (*Convolvulus arvensis*), goose grass (*Galium aparine*), and some Himalayan blackberry. This channel continues for approximately 3.5 miles to the south, where it meets Black Rascal Creek. From the confluence, Black Rascal Creek flows southwest for approximately 5.2 miles into Bear Creek, which continues to flow west for approximately 12.5 miles to the San Joaquin River.

Black Rascal Creek

Black Rascal Creek originates east and northeast of the City of Merced. In the wetland study area, Black Rascal Creek has been channelized and comprises a section of the El Capitan Canal. The broad, U-shaped channel has a silty clay and gravel substrate that is devoid of vegetation. At the time of the field survey (stream surveys, December 2009), shallow flowing water (6 to 12 inches deep) was present in the lower part of the channel. The active flow channel is approximately 90 feet wide and 12 feet deep. The adjacent riparian community is limited to a narrow band of common soft rush just above the ordinary high-water mark along the east bank and to Himalayan blackberry with scattered sweet almond trees (*Prunus dulcis*) along the edge of a cultivated field on the upper west bank. From the proposed alignment, Black Rascal Creek flows south for approximately 400 feet, where it intersects Bear Creek. From the confluence, Bear Creek flows west approximately 16 miles and joins the San Joaquin River.

Bear Creek

Bear Creek originates east and northeast of the City of Merced. The study area intersects Bear Creek at two locations, the first at the confluence with Black Rascal Creek and the second between SR 99 and SR 59 in eastern Merced. At the confluence with Black Rascal Creek, the broad open channel has a silty clay and cobble substrate that is devoid of vegetation. Shallow flowing water (less than 18 inches deep) was present in the bottom of the channel at the time of the survey (stream survey, December 2009). The active flow channel is approximately 120 feet wide and 12 feet deep. Limited riparian vegetation in this area consists of patches of giant reed, along with dense Johnsongrass (*Sorghum halepense*), poison hemlock (*Conium maculatum*), and common soft rush.

Bear Creek in eastern Merced is characterized by an open sandy/gravel/cobble channel. Riprap, including large boulders, chunks of cement, and old asphalt, is present along some sections of the creek banks in this area. Numerous homeless camps were observed in the adjacent riparian vegetation and trash and debris were wildly scattered throughout the channel. Shallow flowing water was present in the lower part of the channel at the time of the survey with water depths ranging from approximately 4 inches in the upstream areas to an estimated 3 to 4 feet in the downstream portions of the channel near SR 99. The active flow channel ranges from approximately 75 to 85 feet wide, with an estimated ordinary high-water mark of 10 to 12 feet. The active flow channel is devoid of vegetation. The adjacent riparian community is variable. On the north side of SR 59, the riparian community is limited to a narrow band of mostly large cottonwood and alder (*Alnus* sp.) trees. Moving downstream, the riparian community is characterized by dense giant reed with scattered black locust (*Robinia pseudoacacia*), cottonwood, and eucalyptus trees. From the wetland study area in eastern Merced, Bear Creek flows generally west for approximately 13.3 miles and joins the San Joaquin River.

Miles Creek

In the wetland study area, Miles Creek appears to be a channelized natural tributary to Owens Creek. Shallow flowing water (less than 8 inches deep) was present at the time of the survey (stream survey, December 2009). The active flow channel is approximately 25 feet wide. The substrate is a gravelly silty clay with wetland and emergent vegetation consisting of hardstem bulrush, common soft rush, sprangletop, tall flat sedge, and sparse water smartweed (*Polygonum punctatum*) along the edges of the channel. The narrow band of riparian vegetation along the upper banks is characterized by dense patches of Himalayan blackberry and scattered ruderal herbaceous species such as mustard (*Brassica nigra*), blessed milk thistle (*Silybum marinum*), and poison hemlock. A dead and partially cut black walnut tree is present near the UPRR right-of-way and a few cottonwood trees are present near the western edge of the wetland study area. From this crossing location, Miles Creek flows generally west for 0.6-mile into Owens Creek. From the confluence with Owens Creek, water flows west approximately 19 miles into Deep Slough, where it then flows north through Deep and Bravel sloughs for approximately 3.8 miles into the Bear River. From the confluence of Bravel Slough, the Bear River flows another 1.6 miles northwest before joining the San Joaquin River.

Owens Creek

The section of Owens Creek within the wetland study area appears to have been channelized and is characterized by well defined, steep vertical banks and a flat channel bottom with a silty clay substrate. The channel was completely dry at the time of the survey. The average channel width is 25 feet with an ordinary high-water depth of approximately 3 feet. The channel is largely devoid of vegetation, with the exception of narrow patches of common soft rush and tall flat sedge in some areas along the channel edges. The adjacent slopes are characterized by dense Himalayan blackberry with an overstory of arroyo willow and black willow (*Salix nigra*) trees. A few fig trees are also present. At the time of the survey, the tops of all of the larger willow trees located beneath a power distribution line that parallels the creek in this location had been trimmed. This section of Owens Creek is located approximately 850 feet southeast of the Miles Creek crossing described above. The Miles Creek confluence is located approximately 0.75-mile from this location. Owens Creek flows generally west for 25 miles, ultimately connecting to the San Joaquin River.

Duck Slough

In the wetland study area, Duck Slough is a broad, open channel with a silty clay substrate devoid of vegetation. At the time of the survey, the channel was largely dry with scattered areas of shallow, standing water (less than 6 inches deep). The active flow channel is approximately 65 feet wide with an ordinary high-water depth of 9 feet. A narrow band of common soft rush grows just above the ordinary high-water mark. Riparian vegetation is discontinuous and composed mostly of dense patches of sandbar willow or Himalayan blackberry with scattered cottonwood trees. A weir is located approximately 1,800 feet downstream of the SR 99 overcrossing, just outside of the wetland study area. From this crossing location, Duck Slough flows west for approximately 25 miles, where it joins Owens Creek. Owens Creek flows west-northwest into Bear Creek. Bear Creek then flows northwest, through Deep Slough and Bravel Slough, for approximately 9 miles, where it joins the San Joaquin River.

South Slough (also known as Russell Lateral)

The portion of South Slough in the wetland study area is a channelized, earthen feature with a gravelly clay substrate that was dry at the time of the survey. The active flow channel is 16 feet wide with an ordinary high-water depth of just over 2 feet. No emergent or aquatic vegetation was present within the channel at the time of the survey. The riparian community consists of a narrow band of large valley oaks along the upper edges of the channel with a few large cottonwoods toward the western edge of the wetland study area. A segment of this feature between the UPRR railroad tracks and East Le Grand Road is concrete-lined, with no adjacent riparian vegetation. South Slough flows approximately 2 miles west through a series of constructed canals and then flows into the Nido Canal. Nido Canal continues to flow north for 2 miles into Duck Slough, just west of the wetland study area at this location. As previously noted, Duck Slough is a tributary to Owens Creek.

Deadman Creek

In the wetland study area, Deadman Creek has gravelly silty clay substrate and the creek channel was dry at the time of the survey. The active flow channel width ranges from 14 to 20 feet with an ordinary high-water depth ranging from 18 to 24 inches above the channel bottom. The narrow riparian community along most of the channel consists of cottonwoods, including numerous saplings as well as large mature trees. This section of the channel is devoid of emergent and aquatic vegetation, but does contain some woody debris. The cottonwood riparian vegetation ends abruptly near the southwestern boundary of the wetland study area, and the channel bed becomes mostly filled with dense common soft rush on either side with a 3- to 5-foot-wide open channel. Immediately west of the wetland study area, Deadman Creek has been diverted from its natural channel into a constructed canal that flows south for approximately 0.5 mile and then west for another 3.8 miles before returning to its natural channel. Deadman Creek appears to then flow through its natural channel for approximately 2.5 miles before returning to a channelized ditch, where it then flows south for 1,300 feet into Dutchman Creek. From this point, Dutchman Creek flows west for 13 miles before joining the Eastside Bypass of the San Joaquin River.

Dutchman Creek

The northeastern portion of Dutchman Creek in the wetland study area is highly disturbed with no riparian vegetation. The sandy substrate within the Dutchman Creek floodplain has been disturbed by several unimproved roads. The roads parallel the railroad tracks and also cross under the highway. To the southwest, the channel and adjacent riparian habitat are much less disturbed. In this area, the channel has a silty clay substrate with scattered patches of common soft rush, tall flat sedge, and curly dock scattered throughout. Small patches of cattail are also present in some sections of the channel, toward the southwestern end of the wetland study area. The channel was dry at the time of the survey with an active flow channel width ranging from 20 to 30 feet. The ordinary high-water depth appears to be between 2 and 3.5 feet. The narrow riparian community is composed of large cottonwood and black walnut trees with scattered arroyo willow. Some trash and debris are present within the channel in this area. Dutchman Creek flows generally west for approximately 21 miles, where it enters the Eastside Bypass of the San Joaquin River.

Chowchilla River

The Chowchilla River originates in the Sierra Nevada and drains a basin of approximately 600 square miles. Because of the low elevation of the watershed, most of the flow in the Chowchilla River results from rainfall. Immediately east of the study area, the Chowchilla River forms three separate branches. From north to south, these include the Chowchilla River, Ash Slough, and Berenda Slough. The branches ultimately discharge into the San Joaquin River via the Eastside Bypass. The only regulating dam on the Chowchilla River is Buchanan Dam forming H.V. Eastman Lake, 15 miles northeast of Chowchilla.

In the wetland study area, the Chowchilla River is a low, broad sandy channel that supports a mosaic of emergent vegetation, active flow channels, and riparian woodland. At the time of the surveys, water was not flowing in the channel, but shallow pockets of ponded water (less than 6 inches deep) were present along the channel bottom. Some of these pockets contained mosquito fish (*Gambusia affinis*). The active flow channel in this area appears dynamic, ranging in width from 30 to 60 feet with an estimated ordinary high-water depth of 3 feet. Vegetation within the channel includes patches of cattail and scattered tall flat sedge, cocklebur, dallisgrass (*Paspalum dilatatum*), rabbitsfoot grass, and a number of other herbaceous species. Floating water primrose (*Ludwigia peploides*) was observed in a few areas where standing water was present within the channel. The open riparian woodland adjacent to the river includes a number of large alder trees and several smaller arroyo willows.

Downstream (at Avenue 26), the Chowchilla River lacked a defined active flow channel and was completely filled with vegetation. Species observed within the channel included common soft rush, sprangletop, Johnsongrass, tall flat sedge, and pale spikerush, and creeping wild rye (*Leymus triticoides*). Cattail and smartweed were also present in small localized patches near the Avenue 26 Bridge. The river channel in this area was estimated to be 30 feet wide. The adjacent riparian community included discontinuous areas of large valley oak trees, scattered alder, and a few small cottonwood saplings. The Chowchilla River flows approximately 14.5 miles west into the Eastside Bypass of the San Joaquin River.

Ash Slough

Ash Slough is a broad, open sandy-gravel channel that was dry at the time of the survey. The average active flow channel is 70 feet wide with an ordinary high-water depth of 3 feet. The channel is largely devoid of emergent vegetation with the exception of a few small patches of cattail and hardstem bulrush in scattered locations. Riparian vegetation along the edges of the channel includes a mixture of dense patches of giant reed intermixed with cottonwood and willow trees and open areas characterized by ruderal grassland habitat. Other riparian vegetation includes Himalayan blackberry, Mexican rush (*Juncus mexicanus*), and sandbar willow. In some areas along the slough, giant reed had been cut and treated with herbicides in an apparent effort to manage this highly invasive species.

In the vicinity of the Ave 24 Wye crossing locations, Ash Slough was dry at the time of the survey and much of the channel was vegetated. The active flow channel in this area is approximately 20 feet wide with an ordinary high-water depth of 2 feet. Vegetation within the channel varies, with most areas characterized by dense giant reed. Other vegetation observed within the channel included scattered Himalayan blackberry, Johnsongrass, swamp verbena (*Verbena hastata*), Bermuda grass, tall flat sedge, bristle grass (*Seteria* sp.), and cocklebur. Occasional sandbar and black willows are also present in some locations within the channel. The adjacent riparian vegetation is predominantly dense giant reed with scattered large cottonwood trees. Other observation points indicated substantial disturbance from earth work, gravel mining, and vehicular traffic. As a result of the grading and excavation, it was difficult to determine the extent and depth of the active flow channel. Ash Slough flows for approximately 14 miles to the southwest, where it enters the Eastside Bypass of the San Joaquin River.

Berenda Slough

Near the proposed UPRR/SR 99 Alternative alignment crossing, Berenda Slough is an open sandy channel that was dry at the time of the survey. The active flow channel has an average width of 40 feet with an ordinary high-water depth around 3 feet. The active flow channel is generally devoid of vegetation, with the exception of occasional small areas of Bermuda grass, cocklebur, redstem stork's bill (*Erodium cicutarium*), trefoil (*Lotus* sp.), and giant reed. The broad, low terrace adjacent to the channel supports open riparian woodland characterized by cottonwood, black walnut, arroyo willow, and black locust trees, with an understory of mulefat (*Baccharis salicifolia*), sandbar willow, creeping wild rye, ripgut brome, and mustard. Additional observations at Berenda Slough identified a small section of standing water within the channel, but most of the sandy channel downstream of Avenue 21½ was dry and densely vegetated. The active flow channel in this area is approximately 45 feet wide with an estimated ordinary high-water depth of 3 feet. The riparian community immediately adjacent to the channel is characterized by Himalayan blackberry, sandbar willow, and common soft rush. The outer banks support dense giant reed with scattered eucalyptus and cottonwood trees. Other areas of the slough are characterized by dense growth of cattail with some hardstem bulrush, likely the result of impounded water in this section of the slough. Berenda Slough flows southwest for approximately 15 miles, where it then flows into the Eastside Bypass of the San Joaquin River.

Berenda Creek

Berenda Creek is a small, intermittent stream. The channel in this area has a sandy substrate with some cobbles and woody debris. At the time of the survey, water was not flowing in the creek, but shallow ponded water (6 to 10 inches deep) was present in some areas along the channel bed. In the wetland study area, the channel is characterized by patches of dense cattail and open unvegetated areas. Riparian vegetation along the edges of the channel consists of a dense patch of arroyo and sandbar willow at the edge of the UPRR/SR 99 Alternative right-of-way and two large arroyo willows to the northeast, with an understory of creeping wild rye. Downstream, Berenda Creek has been channelized into a drainage ditch that flows west and then runs north along Avenue 18. The channel is characterized by steep vertical banks approximately 15 feet wide. Water was flowing in this portion of the creek at the time of the survey. The ordinary high-water depth was estimated to be between 2 and 3 feet. Scattered emergent vegetation, including cattails and hardstem bulrush, occurs throughout much of the channel in this area. Vegetation along the upper banks is characterized by Himalayan blackberry, small black walnut trees, giant reed, and scattered cottonwood trees. Berenda Creek flows generally southwest for approximately 9.5 miles before joining the Eastside Bypass of the San Joaquin River.

Dry Creek

Dry Creek is characterized by an open water channel lined with dense growths of cattail and hardstem bulrush on both sides. The channel has a sandy substrate and an active flow channel between 35 to 38 feet wide with an ordinary high-water depth of 3 feet. The adjacent riparian community is characterized by scattered large arroyo willow and cottonwood trees, localized dense thickets of sandbar willow, and open areas with creeping wild rye, ripgut brome, saltgrass (*Distichlis spicata*), mustard, and common soft rush. Farther downstream, Dry Creek has been channelized and converted into a routinely maintained agricultural irrigation canal. The constructed earthen channel is 25 feet wide and approximately 5 feet deep with riprap along the edges. The channel supports small patches of cattail and hardstem bulrush with some tall flat sedge, sprangletop, common soft rush, and horseweed growing along the upper edges. Farm and canal maintenance roads are present along both sides of the channel and no adjacent riparian vegetation was observed. From the downstream location, Dry Creek flows approximately 5 miles southwest into the Fresno River, which continues west for approximately 7 miles, where it discharges into the Eastside Bypass of the San Joaquin River.

Fresno River

The Fresno River originates in the foothills of the Sierra Nevada and drains a watershed of approximately 500 square miles. Rainfall supplies most of the flow in the Fresno River. The Fresno River discharges into the Eastside Bypass of the San Joaquin River. The only regulating dam on the Fresno River is Hidden Dam, which forms Hensley Lake, located about 15 miles northeast of Madera.

The Fresno River near the wetland study area contains sections of low, broad, routinely maintained channel located in an urban area on the east side of Madera. Most of the sandy channel was dry at the time of the survey, but a small flow channel fed by inflows from a stormwater culvert near Riverside Drive was observed at the time of the survey. The sandy channel in this area is highly disturbed as a result of vegetation clearing and grading, presumably done for flood control maintenance. Trash and debris are also common and widespread throughout the channel. The river channel ranges from approximately 185 to 375 feet wide, although the active flow channel consists of several small braided channels estimated to be 35 feet wide in total. The depth of the ordinary high water in these areas appears be around 2 feet. Residential, commercial, and industrial developments are present along both sides of the river and no riparian habitat was observed other than a few small patches of sandbar willow within the channel. Most of the channel bed is characterized by a mosaic of largely ruderal vegetation and open sandy areas. Characteristic plants observed within the channel include giant reed, telegraph weed (*Heterotheca grandiflora*), redstem stork's bill, cocklebur, ripgut brome, mustard, and curly dock. Farther downstream, the Fresno River was dry at the time of the survey. In this location, neither defined channels nor obvious evidence of recent flows were observed; however, an approximately 100-foot-wide channel is present and appears to be maintained occasionally by grading and vegetation removal. The ordinary high-water depth was estimated to be between 2 and 3 feet. At the time of the survey, evidence of past channel maintenance was observed, but a substantial portion of the channel was vegetated with sandbar willow, scattered patches of cattail, hardstem bulrush, sprangletop, tall flat sedge, Bermuda grass, and fireweed. The adjacent riparian area included some large cottonwood trees, mostly along the south bank, and relatively dense sandbar willow on the low terrace adjacent to the presumably maintained portion of the channel.

Cottonwood Creek

In the wetland study area, Cottonwood Creek has a broad, sandy channel with dense emergent vegetation along the edges of an open flow channel. The active flow channel is estimated to be 60 feet wide, with the unvegetated central portion averaging around 25 feet wide. The ordinary high-water depth was estimated to be around 4 feet. Water was not flowing in the creek at the time of the survey, but a large ponded area was present in the section of the creek immediately south of Avenue 12. Large woody debris was also present in this area. Riparian vegetation along both sides of the creek consists of large cottonwood, arroyo willow, and eucalyptus trees, with a dense understory of giant reed, sandbar willow, and Himalayan blackberry. Downstream, Cottonwood Creek contains sections of excavated 25-foot-wide channel with steep vertical banks with weir structures present. The channel has sandy clay substrate with patches of emergent vegetation composed of cattail and hardstem bulrush within the channel, as well as some areas of common soft rush west of the weir structure. The edges of the channel and adjacent banks in this area are characterized by dense growths of giant reed and eucalyptus trees. Sections of the channel are routinely maintained and were devoid of vegetation with no adjacent riparian habitat. From this location, Cottonwood Creek flows approximately 16 miles southwest into the Eastside Bypass of the San Joaquin River.

San Joaquin River

The San Joaquin River is the largest and most substantial water feature in the wetland study area. In the study area, the San Joaquin River receives flows from the Fresno and Chowchilla rivers, Bear and Owens creeks, and Ash and Berenda sloughs. These streams flow through the study area in a generally southwest direction and discharge into the Chowchilla and Eastside Bypass canals that parallel the river along its eastern side. These bypass canals ultimately discharge into the San Joaquin River downstream of the study area.

Sections of the river are characterized by a single large flow channel with an average width of 150 feet. To the southwest of SR 99, the river splits into multiple braided channels, including some larger backwater ponded areas. A detailed investigation of the adjacent riparian habitat was not conducted during the field survey because of property access limitations; however, observations of the area were made from West Herndon Avenue on the southeast side of the river. The riparian community in the wetland study area is an open mixed woodland composed of valley oak, California sycamore, and eucalyptus trees. The open understory consists of typical California annual grassland species with occasional patches of sandbar willow and elderberry.

4.2.1.2 Constructed Watercourses in the Wetland Study Area

In the wetland study area, 119.24 acres of constructed watercourses (canals and drains) were identified. Canals and drains in the study area are linear water features that have been constructed primarily for the conveyance of agricultural irrigation water. Most of these features are excavated U-shaped or trapezoidal channels that are routinely maintained. Canals range in size from small, shallow ditches (10 feet wide and 3 to 4 feet deep) to broad channels as much as 50 feet wide and 10 feet deep. Scattered emergent vegetation is present in some areas, but most of the canals are routinely cleared of vegetation and/or sprayed with herbicides. Many of the canals convey water diverted from and discharge water into the natural drainage features described in the natural waters section above. Constructed watercourses in the study area are considered potentially jurisdictional under the Preliminary Jurisdictional Determination format (USACE 2008b). Appendix K, Other Waters Identified in Study Area, summarizes constructed watercourses that have been identified in the wetland study area. Additional information on water crossing locations is provided in Appendixes C and J.

4.2.1.3 Constructed Basins in the Wetland Study Area

Wetland surveys and imagery interpretation identified 69.88 acres of constructed basins in the wetland study area. This resource type includes stormwater retention basins, reservoirs, dairy waste settling ponds, and agricultural tailwater ponds. Constructed basins are highly disturbed and may be routinely managed through vegetation removal and dredging. Depending on substrate and management regimes, vegetation type and presence varies. Hydrology also varies based on precipitation events, irrigation inputs/removal, and other management objectives. The following text describes the kinds of features that comprise constructed basins.

Stormwater Basin. Stormwater retention basins are generally excavated earthen basins that have been constructed to hold urban stormwater runoff. Most stormwater retention basins in the study area are associated with urban communities and commercial and industrial areas. Most basins are devoid of vegetation or support ruderal (nonnative, weedy) species that become established when water levels are low or the basins are dry.

Reservoirs. Reservoirs include variously sized basins that have been constructed to hold water for urban, industrial, or agricultural use. Water is generally either diverted or pumped into these areas and is held for use at a later time. Reservoirs are often lined to prevent or reduce water loss as a result of seepage into the soil and are generally devoid of vegetation.

Agricultural Tailwater Ponds. Agricultural tail water ponds are generally small, relatively shallow basins that are excavated in the low corners or along the side of an agricultural field or orchard for the purpose of capturing excess irrigation water. Excess water is either allowed to gradually seep into the soil or is pumped into a nearby drain feature. Vegetation in these basins often comprises ruderal wetland plants species such as Bermuda grass, tall flat sedge (*Cyperus eragrostis*), sprangletop (*Leptochloa* spp.), and fireweed or willowherb (*Epilobium* spp.).

4.2.1.4 Open Waters in the Wetland Study Area

Wetland surveys and imagery interpretation identified 11.27 acres of open water features in the wetland study area. This resource type includes areas of shallow, localized ponding in unpaved road rights-of-way.

4.2.2 Other Waters of the U.S. Identified by Alternative

The total number of water crossings (streams, canals, drains, and pipes) identified within the UPRR/SR 99 Alternative including all related design and wye options is 188 water crossing (natural and constructed watercourses). There are 43 crossings of natural watercourses (streams) and 145 crossings of constructed watercourses (canals, drains, and pipes). The BNSF Alternative and related design options and wye combinations include a total of 206 crossings of natural and constructed watercourses (75 natural water crossings and 131 constructed water crossings). The fewest crossings of natural and constructed watercourses, 169 crossings, were identified for the Hybrid Alternative and related design options (40 natural watercourse and 129 constructed water crossings). Crossing information includes all crossings present within each alternative and all corresponding design options. A summary of natural and constructed water crossings by alternative is provided in Appendix J.

Table 4-6 summarizes the extent of other waters of the U.S. associated with the three proposed alternatives and their corresponding design option combinations within the wetland study area.

Additional details regarding acreages of other waters within each proposed alternative and their specific design option combinations are presented in Appendix I.

4.3 Summary of Impacts on Wetlands and Other Waters of the U.S.

Impacts on wetlands and other waters of the U.S. are anticipated to occur due to the Merced to Fresno Section of the HST Project; these impacts are discussed in this section. Wetland impacts are considered major impacts because any loss of wetlands in the San Joaquin Valley is important. In addition, most wetlands are protected by existing federal and state laws. Complete avoidance of wetland impacts is not possible; however, the project will minimize impacts to the extent possible and will compensate for losses of wetland habitat where impacts cannot be avoided.

Despite the Solid Waste Agency of Northern Cook County decision noted in Section 1.5.1, vernal pools and seasonal wetlands that may otherwise not fall within USACE jurisdiction are assumed jurisdictional under the Preliminary JD approach used in the Merced to Fresno Section of the HST Project.

Table 4-7 summarizes the range of potential direct permanent, direct temporary, and indirect permanent impacts on wetlands and other waters of the U.S. by alternative and design option combination. Additional information on impacts on wetlands and other waters of the U.S., including vernal pools and seasonal wetlands, is presented in *Appendix L,* Impacts on Wetlands and Other Waters of the U.S. by Alternative and Design Option Combination.

4.4 Wetland Function – *California Rapid Assessment Method for Wetlands*

Wetlands and other waters provide a range of significant ecological functions that result from both living and non-living components. These functions include all processes necessary for the self-maintenance of the wetland ecosystem such as primary production, nutrient cycling, groundwater recharge, species diversity, and niche habitat, among others. Functions relate to the ecological significance of wetland properties without regard to subjective human values. Functional assessments examine wetland or other Waters characteristics and establish what contributions may be provided by a particular wetland or water system (i.e., value).

Resources (wetlands and other Waters) with higher relative functions are expected to be more sensitive to disturbance, rare on the landscape, able to perform many functions well, important for species diversity on the landscape, and may be difficult to replace or mitigate. The emphasis and reasoning for conducting functional assessments is to characterize, compare, and potentially avoid impacts on higher functioning wetlands and other Waters of the U.S.

Selected jurisdictional wetlands and waters located within the Merced to Fresno Section wetland study area were assessed using the *California Rapid Assessment Method for Wetlands* (CRAM; Collins et al. 2008). The following discussion on aquatic resource quality is summarized from the Merced to Fresno Section CRAM report.). The ecological condition is based on the CRAM Evaluation, a Level II Analysis, provided in the *Evaluation of Wetland Condition Using the California Rapid Assessment Method (CRAM)* (Appendix B to the *Watershed Evaluation Report* (WER), which is Appendix G to the *Checkpoint C Summary Report*; Authority and FRA 2012c). The assessment methodology, results, and CRAM datasheets are available in the WER.

Within the Merced Fresno Section wetland study area, the assessed quality of aquatic features are based on CRAM scores obtained from sampling selected aquatic features from each alternative. Based on the distribution of project CRAM scores from 46 assessment areas, jurisdictional waters were organized into categories of poor (25 to 49 points), fair (50 to 74 points), and good (75 to 100 points) quality.

Results from the CRAM assessment indicate that approximately 50% of jurisdictional aquatic resources within the wetland study area are of fair quality, 46% are of poor quality, and 4% are of good quality. Taken as a whole, 96% of aquatic resources within the wetland study area are poor to fair quality and only 4% are of good quality. These condition categories are relative to statewide CRAM scores (which average approximately 74).

Analysis of CRAM data by alternative indicates that the quality of aquatic features is similar (fair/poor) across most alternatives. CRAM assessment scores for potentially affected riverine features indicate fair quality aquatic resources for all alternatives. Riverine CRAM assessment scores are just above the minimum threshold (50 points) for fair quality wetlands:

- BNSF Alternative - 16 sites assessed, with a mean score of 55 (fair);
- Hybrid Alternative - 15 sites assessed, with a mean score of 54 (fair); and
- UPRR/SR 99 Alternative - 15 sites assessed, with a mean score of 51 (fair).

CRAM assessment scores for potentially affected nonriverine aquatic features (i.e., vernal pools and seasonal wetlands) indicate poor to fair quality aquatic resources well below the statewide average CRAM score of 74. Nonriverine CRAM assessment scores are just above the minimum threshold (50 points) for fair quality aquatic resources (BNSF and Hybrid alternatives) and at the upper threshold for poor quality aquatic resources (UPRR/SR 99 Alternative):

- BNSF Alternative - 13 sites assessed, with a mean score of 51 (fair);
- Hybrid Alternative - 8 sites assessed, with a mean score of 50 (fair); and
- UPRR/SR 99 Alternative - 2 sites assessed, with a mean score of 42 (poor).

Overall, the Merced to Fresno Section wetland study area contains lower quality aquatic features, regardless of the alternative (below the average California wetland score of 74). The BNSF Alternative contains and would potentially affect the highest quality riverine and nonriverine aquatic features (scores of 55 and 51, respectively). The Hybrid Alternative contains marginally lower quality riverine (score of 54) and nonriverine (score of 50) aquatic features as compared to the BNSF Alternative. The UPRR/SR 99 Alternative contains and would potentially affect the lowest quality riverine (score of 51) and nonriverine (score of 42) jurisdictional waters. However, based on statistical analysis, total CRAM scores need to be at least 10 points from each other to conclude the quality of resources scored is appreciably different. Only the scores for nonriverine features affected by the BNSF and UPRR/SR 99 alternatives exhibit at least 10 points difference. In general, the CRAM scores for resources affected by the BNSF, Hybrid, and UPRR/SR 99 alternatives are not 10 points different, and the relative function of aquatic resources potentially affected by all alternatives is approximately equivalent. In other words, there is no significant difference in the quality of aquatic features that would be potentially affected by the HST alternatives in the Merced to Fresno Section wetland study area.

Table 4-6
Total Other Waters of the U.S. (in acres [a]) by Alternative within the Wetland Study Area
(Construction Footprint Plus 250-foot Buffer)

North-South Alignment Isolated and with Wye Design Option	UPRR/SR 99 Alternative			Hybrid Alternative		BNSF Alternative								Station Alternative	
						Mariposa Way Design Options				Mission Ave Design Options					
	East Chowchilla Design Option	East Chowchilla Design Option	West Chowchilla Design Option	East Chowchilla Design Option	West Chowchilla Design Option	Le Grand	East of Le Grand	Le Grand	East of Le Grand	Le Grand	East of Le Grand	Le Grand	East of Le Grand	Kern Street Design Option	Mariposa Station Design
	Ave 21	Ave 24	Ave 24	Ave 21	Ave 24	Ave 21		Ave 24		Ave 21		Ave 24		Ave 21	Ave 24
Natural Watercourses	34.36	43.54	46.30	32.52	43.25	42.60	43.30	43.78	44.48	36.45	37.11	37.63	38.29	0	0
Constructed Watercourses	42.71	33.36	40.53	43.15	44.81	33.63	35.13	32.46	33.96	38.84	41.05	37.67	39.88	0	0
Constructed Basins	31.44	31.32	36.45	25.28	31.34	27.61	30.08	30.56	33.03	33.65	32.94	36.60	35.89	0	0
Open Water	5.53	5.39	4.79	5.61	5.00	5.83	5.14	6.10	5.41	5.96	5.86	6.23	6.13	0	0
Total Other Waters of the U.S. by Alternative and Design Option Combination	**114.04**	**113.61**	**128.07**	**106.56**	**124.40**	**109.67**	**113.65**	**112.90**	**116.88**	**114.90**	**116.96**	**118.13**	**120.19**	**0**	**0**

[a] All non-zero measurements are rounded to the nearest one-hundredth acre.

Note: Information on Other Waters identified within the HMF sites is presented in Table 4-4b.

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Table 4-7
Potential Impacts on Wetlands and Other Waters of the U.S. (in acres)
by Alternative/Design Option Combinations

North-South Alignment Isolated and with Wye Design Option	UPRR/SR 99 Alternative			Hybrid Alternative		BNSF Alternative								Station Alternative	
						Mariposa Way Design Options				Mission Ave Design Options					
	East Chowchilla Design Option	East Chowchilla Design Option	West Chowchilla Design Option	East Chowchilla Design Option	West Chowchilla Design Option	Le Grand	East of Le Grand	Le Grand	East of Le Grand	Le Grand	East of Le Grand	Le Grand	East of Le Grand	Kern Street Design Option	Mariposa Station Design
	Ave 21	Ave 24	Ave 24	Ave 21	Ave 24	Ave 21		Ave 24		Ave 21		Ave 24		Ave 21	Ave 24
Vernal Pools															
Total Direct Permanent Impacts (acres)	1.44	0.87	1.05	1.87	2.85	15.69	11.90	15.74	11.95	16.41	16.11	16.46	16.16	0.00	0.00
Total Indirect Permanent Impacts (acres)	2.64	1.62	1.18	10.62	7.52	38.26	41.37	36.46	39.57	35.53	42.29	33.73	40.49	0.00	0.00
Seasonal Wetlands															
Total Direct Permanent Impacts (acres)	1.08	1.08	1.08	0.85	0.93	1.64	1.54	1.64	1.54	1.64	1.62	1.64	1.62	0.00	0.00
Total Indirect Permanent (acres)	0.34	0.29	0.29	2.01	1.93	2.28	2.34	2.14	2.20	2.28	2.45	2.14	2.31	0.00	0.00
Freshwater Marsh															
Total Direct Permanent Impacts (acres)	0.00	0.00	0.00	0.04	0.00	0.30	0.30	0.39	0.39	0.30	0.28	0.40	0.38	0.00	0.00
Total Direct Temporary Impacts (acres)	0.00	0.00	0.00	0.00	0.00	0.04	0.04	0.04	0.03	0.04	0.04	0.03	0.03	0.00	0.00
Total Indirect Permanent Impacts (acres)	0.00	0.00	0.00	0.22	0.00	1.55	1.55	1.52	1.52	2.05	1.53	2.02	1.50	0.00	0.00
Palustrine Forested Wetland															
Total Direct Permanent Impacts (acres)	3.94	4.11	3.89	3.59	3.64	0.80	1.77	0.80	1.77	0.36	1.53	0.37	1.53	0.00	0.00
Total Direct Temporary Impacts (acres)	2.06	2.05	2.01	1.64	1.50	0.28	0.32	0.28	0.33	0.06	0.27	0.06	0.27	0.00	0.00
Total Indirect Permanent Impacts (acres)	3.75	4.65	3.75	3.08	3.37	8.80	9.32	8.80	9.32	2.18	3.23	2.18	3.23	0.00	0.00
Natural Watercourses															
Total Direct Permanent Impacts (acres)	3.76	6.08	7.76	3.73	6.70	5.67	6.68	6.53	7.54	6.03	6.27	6.89	7.13	0.00	0.00
Total Direct Temporary Impacts (acres)	6.20	6.36	6.00	5.93	5.92	5.36	5.58	5.87	6.09	4.93	4.94	5.43	5.45	0.00	0.00
Total Indirect Permanent Impacts (acres)	24.40	31.10	32.53	22.86	30.63	31.57	31.04	31.39	30.85	25.50	25.90	25.31	25.71	0.00	0.00
Constructed Watercourses															
Total Direct Permanent Impacts (acres)	18.38	12.06	14.58	18.83	16.13	10.59	10.38	11.10	10.89	13.82	14.27	14.33	14.79	0.00	0.00
Total Direct Temporary Impacts (acres)	3.87	3.69	3.04	3.78	2.81	0.93	0.94	1.79	1.80	1.17	1.33	2.03	2.20	0.00	0.00
Total Indirect Permanent Impacts (acres)	20.46	17.62	22.90	20.55	25.87	22.11	23.81	19.57	21.27	23.86	25.45	21.31	22.90	0.00	0.00
Constructed Basins															
Total Direct Permanent Impacts (acres)	4.80	6.70	7.81	3.97	5.98	6.54	6.99	6.68	7.14	6.86	6.79	7.00	6.94	0.00	0.00
Total Direct Temporary Impacts (acres)	1.12	1.64	1.19	0.47	1.10	0.18	0.16	0.68	0.65	0.29	0.29	0.78	0.78	0.00	0.00
Total Indirect Permanent Impacts (acres)	25.52	22.98	27.45	20.84	24.25	20.89	22.93	23.20	25.24	26.50	25.86	28.81	28.17	0.00	0.00

North-South Alignment Isolated and with Wye Design Option	UPRR/SR 99 Alternative			Hybrid Alternative		BNSF Alternative								Station Alternative	
						Mariposa Way Design Options				Mission Ave Design Options					
	East Chowchilla Design Option	East Chowchilla Design Option	West Chowchilla Design Option	East Chowchilla Design Option	West Chowchilla Design Option	Le Grand	East of Le Grand	Le Grand	East of Le Grand	Le Grand	East of Le Grand	Le Grand	East of Le Grand	Kern Street Design Option	Mariposa Station Design
	Ave 21	Ave 24	Ave 24	Ave 21	Ave 24	Ave 21		Ave 24		Ave 21		Ave 24		Ave 21	Ave 24
Open Water															
Total Direct Permanent Impacts (acres)	1.65	1.64	1.30	1.64	1.49	2.54	1.86	2.75	2.07	2.57	2.49	2.77	2.69	0.00	0.00
Total Indirect Permanent Impacts (acres)	3.89	3.75	3.48	3.97	3.52	3.29	3.28	3.35	3.34	3.39	3.37	3.45	3.43	0.00	0.00
Total Wetland and Water Impacts by Alternative and Design Options	**129.30**	**128.29**	**141.29**	**130.49**	**146.14**	**179.31**	**184.10**	**180.72**	**185.50**	**175.77**	**186.31**	**177.14**	**187.71**	**0.00**	**0.00**

5.0 Discussion

Wetlands identified in the wetland study area (24,048 acres) include vernal pools (84.93 acres), seasonal wetlands (84.93 acres), freshwater marshes (5.03 acres), and forested wetlands (32.15 acres). Vernal pools harbor unique assemblages of plants and animals, many of which are considered rare and endangered. Non-wetland waters of the U.S. identified in the wetland study area include natural watercourses (125.80 acres), constructed watercourses (119.24 acres), constructed basins (69.88 acres), and open water (11.27 acres).

Within the watershed context, the greatest, total delineated wetland acreage (92.45 total acres) is located within the Middle San Joaquin-Lower Chowchilla (north) watershed. This watershed includes 60.88 acres of delineated vernal pools, 1.46 acres of delineated seasonal wetlands, 0.81 acre of freshwater marsh, and 29.30 acres of palustrine forested wetlands (see Appendix G). The greatest total acreage (116.40 acres) of delineated other waters is located within the Upper Chowchilla-Upper Fresno (Fresno River) watershed. This watershed includes 48.26 acres of delineated natural watercourses, 48.16 acres of constructed watercourses, 17.21 acres of constructed basins, and 2.32 acres of delineated open water features (see Appendix G).

All wetlands and other waters of the U.S. identified in the Merced to Fresno Section wetland study area are considered jurisdictional based on the Preliminary JD as described in the *Jurisdictional Determinations, Regulatory Guidance Letter* (USACE 2008b).

5.1 Wetlands and Other Waters of the U.S. in the Wetland Study Area, by Category

Wetlands and other waters of the U.S. within the wetland study area, by alternative and design option combination, are presented in Table 4-4a, 4-4b, 4-6, and in Appendix I.

5.1.1 Wetlands and Other Waters of the U.S., by Alignment Alternative

Overall, the range of existing wetland acreage among HST alternatives and design option combinations is low relative to the total extent of wetlands and other waters resources in the entire Merced to Fresno Section wetland study area. By alternative, the greatest total acreage of wetland resources (vernal pools, seasonal wetland, freshwater marsh, and forested wetlands) occurs within the BNSF Alternative design option combinations.

The BNSF Alternative contains the most wetland resource (59 to 70 acres of wetland resource) and the fewest acres other waters of the U.S. (approximately 100 acres). The Hybrid Alternative contains 22 to 24 acres of wetland resources and approximately 105 to 125 acres of other waters of the U.S. The UPRR/SR 99 Alternative contains 13 to 15 acres of wetland resource and contains an approximate range of 113 to 128 acres of other waters of the U.S. (Tables 4-4a and 4-6).

5.1.2 Wetlands and Other Waters of the U.S., by HMF Site

Pertaining to HMF sites, most jurisdictional wetlands and other waters (24.13 acres total) are associated with the Castle Commerce Center HMF site. The wetland study area of this HMF site includes 0.24 acres of vernal pools, 0.99 acre of seasonal wetlands, 1.28 acres of palustrine forested wetlands, 7.27 acres of constructed watercourses, 4.38 acres of constructed basins, and 0.57 acre of open water features. The Kojima Development HMF site contains the second highest aquatic resources (12.88 acres of wetlands and other waters of the U.S.), including 1.27 acres of vernal pools, 0.59 acres of seasonal wetlands, 2.70 acres of freshwater marsh, 6.82 acres of natural watercourses, 0.34 acres of constructed watercourses, 0.84 acre of constructed basin, and 0.32 acre of open water features. The fewest delineated acres (1.96 acres) of wetlands and other waters of the U.S. are contained within the Harris-DeJager HMF site. This site contains no vernal pools, seasonal wetlands, freshwater marshes, or constructed basins. Instead, it contains 0.44 acre of palustrine forested wetland, 0.19 acre of natural watercourses, 0.91 acre of constructed watercourses, and 0.42 acre of open water features (Table 4-4b).

5.1.3 Wetlands and Other Waters of the U.S., by Resource Type

Analysis by resource type indicates that more vernal pools (58.41 acres) are associated with the wetland study area of the BNSF Alternative, Mission Avenue with the East of Le Grand design option and Ave 21 Wye than other alternative/design option combination. In contrast, the fewest acres of vernal pools (2.23 acres) are associated with the wetland study area of the UPRR/SR 99 Alternative with the West Chowchilla design option and Ave 24 Wye (Table 4-4a).

The total acreage of seasonal wetlands (4.06 acres) is greatest in association with the wetland study area of the BNSF Alternative, Mission Avenue with the East of Le Grand design option and Ave 21 Wye relative to other alternative/design option combinations. The fewest acres of seasonal wetlands are reported within the wetland study area of the UPRR/SR 99 Alternative with either the West Chowchilla design option and Ave 24 Wye or the East Chowchilla design option and Ave 24 Wye combination (both contain 1.37 acres (Table 4-4a).

The total acreage of freshwater marshes is greatest within the wetland study area of the BNSF Alternative, Mission Avenue with the Le Grand design option and Ave 24 Wye (2.45 acres). No freshwater marsh resources are located within the wetland study areas of the Hybrid Alternative or within any of the UPRR/SR 99 design option combinations (Table 4-4a).

The total acreage of forested wetlands is greatest in the wetland study areas of the BNSF Alternative with the Mariposa Way East of Le Grand design option and Ave 21 Wye or Avenue 24 Wye (both include 11.42 acres). The wetland study area of the BNSF Alternative with the Mission Avenue East of Le Grand design option and Ave 21 Wye contains 2.60 acres of forested wetlands, which is the fewest of any alternative/design option combination (Table 4-4a).

The total greatest acreage of natural watercourses contained within the wetland study area is within the UPRR/SR 99 Alternative with the West Chowchilla design option and Ave 24 Wye combination (46.30 acres. Conversely, the Hybrid Alternative with the East Chowchilla design option and Ave 21 Wye contains the fewest acres of natural watercourses (32.52 acres) of any alternative/design option combination (Table 4-6).

The acreage of constructed watercourses is greatest within the wetland study area of the Hybrid Alternative with the West Chowchilla design option and Ave 24 (44.81 acres). The wetland study area of the BNSF Alternative with the Mariposa Way Le Grand design option and Ave 24 Wye contains the fewest acres (32.46) of constructed natural watercourses relative to the other alternative/design option combinations (Table 4-6).

Constructed basin acreage is greatest within the wetland study area of the BNSF Alternative with the Mission Avenue Le Grand design option and Ave 24 Wye (36.60 acres). The lowest constructed basin acreage is identified within the wetland study area of the Hybrid Alternative with the East Chowchilla design option and Ave 21 Wye (25.28 acres) (Table 4-6).

The greatest quantity of open water acreage is identified in the wetland study area of the BNSF Alternative (6.23 acres), with the fewest acres found within the wetland study area of the UPRR/SR 99 Alternative (4.78 acres) (Table 4-6).

5.2 Potential Impacts on Wetlands and Other Waters of the U.S., by Alternative

Anticipated impacts on wetlands and other waters of the U.S. associated with alternative/design option combinations are presented in Table 4-7 and in Appendix L.

As summarized in Table 4-7, the BNSF Alternative would have the greatest impact (direct and indirect) on jurisdictional waters of the U.S., including wetlands. Each of the BNSF design option combinations would result in substantially greater impacts (i.e., direct permanent, direct temporary, and indirect permanent) on waters of the U.S. than any of the UPRR/SR 99 or Hybrid Alternative design option combinations. Under the best-case scenario for the BNSF Alternative (with the Mission Avenue Le Grand design option and Ave 21 Wye), total impacts may occur on approximately 176 acres of jurisdictional waters of the U.S., including wetlands. The design option with the greatest impacts on jurisdictional waters for the Hybrid Alternative (West Chowchilla with Ave 24 Wye) would impact a total of approximately 146 acres of jurisdictional waters of the U.S., or nearly 30 acres less than the best-case design option under the BNSF Alternative.

The UPRR/SR 99 Alternative would have the least total impacts on jurisdictional waters of the U.S. in terms of acreage. Under the best-case design option for the UPRR/SR 99 Alternative (the East Chowchilla and Ave 24 Wye design option combination), a total of approximately 128 acres of jurisdictional waters of the U.S., including wetlands, could be affected. Under the best-case design option for the Hybrid Alternative (the East Chowchilla and Ave 21 Wye design option combination), a total of approximately 130 acres of waters of the U.S. could be affected, a difference of about 2 acres. However, a portion of this 2-acre difference in total impact acreage actually consists of indirect, rather than permanent direct impacts on jurisdictional waters associated with the Hybrid Alternative.

Indirect impacts are calculated to for any portion of a jurisdictional feature located outside of the construction footprint and within the 250-foot wetland study area buffer. Estimates of indirect impacts on all jurisdictional features within the 250-foot buffer illustrate a worst-case scenario and present the highest acreage of indirect impacts that would be expected. For example, vernal pools within the 250-foot construction footprint buffer would likely have very small watersheds that are completely isolated from the construction footprint. Therefore, adverse changes in hydrology (assumed in the indirect impact analysis) would not actually be expected to result from project implementation. Furthermore, indirect impacts are assumed in the impact analysis to adversely affect aquatic features within the buffers, even if those features are located upstream or upgradient of the construction footprint. However, such impacts would likely be avoided when site-specific hydrology and topography is considered. Project design features could further reduce potential indirect hydrology and water quality impacts on jurisdictional waters through management of stormwater and pollutant discharge control measures, erosion control measures, and application of other best management practices. As a result, when a refined site-specific context is considered in evaluating indirect impacts on jurisdictional waters, the indirect impacts are anticipated to be much lower than those estimated in this impact assessment.

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7.0 Preparer Qualifications

Gretchen Herron Wetland Ecologist	B.S., Environmental Science, Allegheny College. M.S., Disturbed Land Restoration, Montana State University. Over 10 years of experience in wetland ecology and environmental resources management. Primary Author Field Surveys
Russell Huddleston, PWS Wetland Ecologist	B.S., Biology, Southern Oregon University. M.S., Ecology, University of California, Davis. Certified Professional Wetland Scientist with over 12 years of experience in wetland ecology and environmental resources management. Senior Review Field Surveys
Michael Clary Biologist	B.S., Biology and Zoology, California State University, Humboldt. 14 years of experience conducting ecological studies. Field Surveys
Danielle Tannourji Biologist	B.S., Ecology and Evolution, University of California, Santa Barbara, M.S., Conservation Biology, San Jose State University. Over 10 years of experience as a biologist in California. Field Surveys
Corinna Lu Biologist	B.A., Biology, University of California, Santa Cruz. M.S., Geography, University of California, Los Angeles. Over 11 years experience implementing and managing biological resource projects. Field Surveys
Craig Williams Fisheries Ecologist	B.S., Biology, California Polytechnic State University. M.S., Fisheries and Wildlife Science, Virginia Polytechnic Institute & State University. Over 13 years of experience involving aquatic and terrestrial ecosystems. Field Surveys Aquatic Habitat Assessment
Deborah Waller Biologist	B.S., Conservation of Resources, University of California, Berkeley. 17 years of experience in wetlands and botanical biology. Field Surveys

Victor Leighton III Wetland Biologist	A.S., Forestry, Wildlife and Natural Resource Biology, American River College, Sacramento. Over 16 years of experience in wetland, wildlife and botanical biology and environmental resource management. Field Surveys
Yolanda Molette Plant Ecologist	B.A. Biology, Whittier College. M.A. Ecology and Systemmatics with Emphasis in Conservation Biology 12 years of experience in wetland ecology and environmental resources management. Field Surveys
Steve Long Register Environmental Assessor II	B.S., Forest Resources (Forest Biology), University of New Hampshire, Durham. M.S. Soil Science (Soil Physics), Texas A&M University, College Station. 28 years of experience in wetlands and natural resource assessment and mapping. Field Surveys
Morgan King Biologist	B.S., Wildlife, Fish, Conservation Biology, University of California, Davis. 5 years of experience conducting ecological surveys. Field Surveys