CALIFORNIA HIGH-SPEED TRAIN

Project Environmental Impact Report / Environmental Impact Statement

DRAFT

Wetlands Delineation Report

Merced to Fresno Section High-Speed Train Project EIR/EIS

August 2011

CALIFORNIA High-Speed Rail Authority

U.S. Department of Transportation Federal Railroad Administration

DRAFT

TECHNICAL REPORT

Merced to Fresno Section

Wetlands Delineation Report

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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 wetland species
FACW	facultative wet 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).

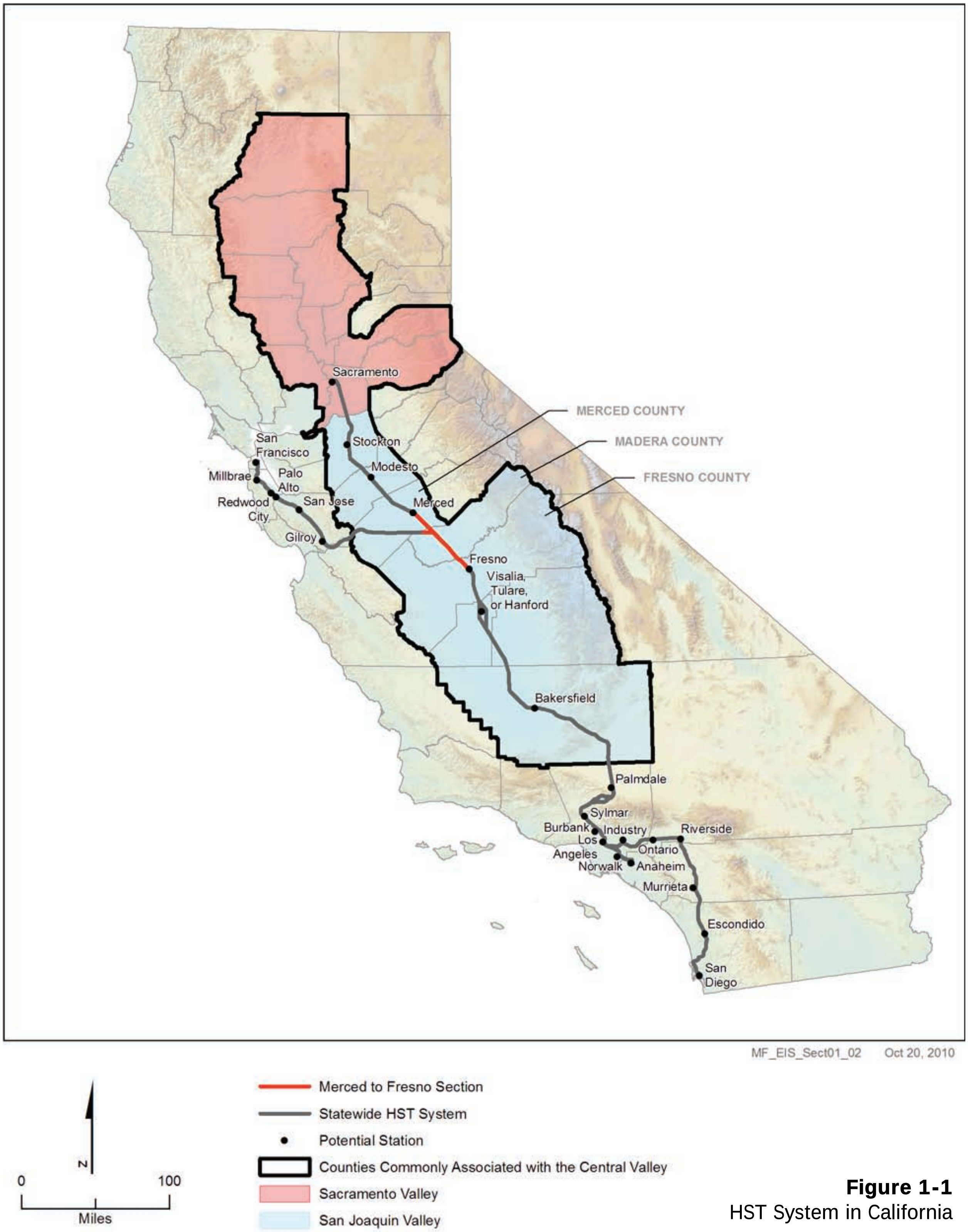


Figure 1-1
HST System in California

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 (see text box on page 2-3) west to the Bay Area, and there are five potential sites for a proposed HMF.

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.

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:

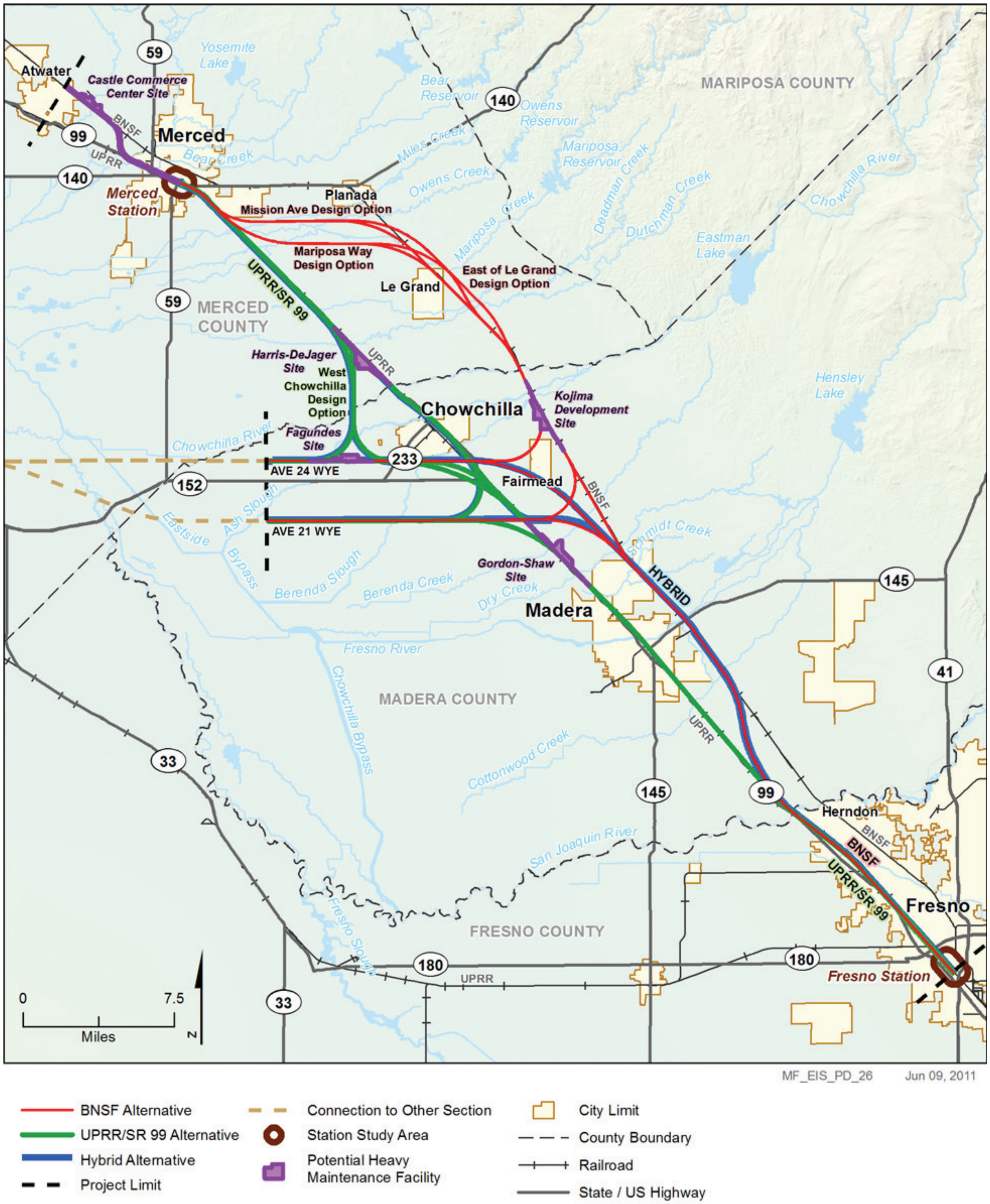


Figure 1-2
Merced to Fresno Section
HST Alternatives

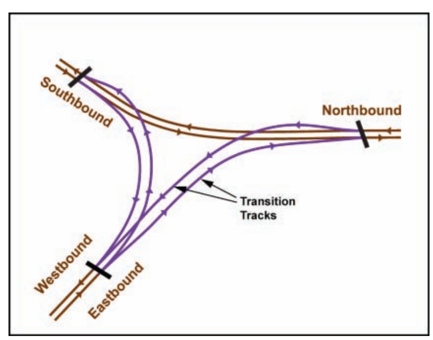
- **East Chowchilla design option:** This design option would transition from the west side of the UPRR/SR 99 corridor to an elevated structure as it crosses the UPRR railway and N Chowchilla Boulevard just north of Avenue 27, continuing on an elevated structure away from the UPRR corridor along the 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 alternative crosses the San Joaquin River, it 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 the station. As part of a station design option, Tulare Street would become either an overpass or undercrossing at the station.

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.



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.

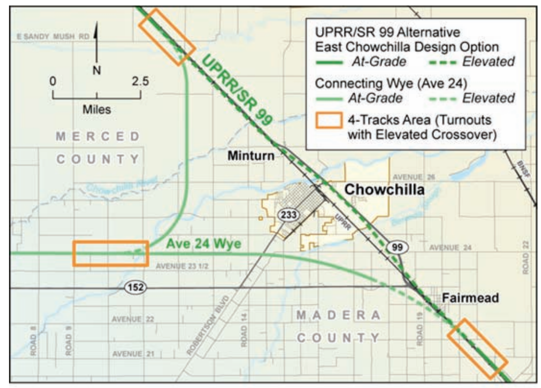
Figure 1-3a shows the wye alignment for the East Chowchilla design option and Figure 1-3b shows the alignment for the West Chowchilla design option. Together, the figures illustrate the difference in the wye triangle formation for each design option connection. The north-south alignment of the West Chowchilla 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.

<u>*Ave 21 Wye*</u>

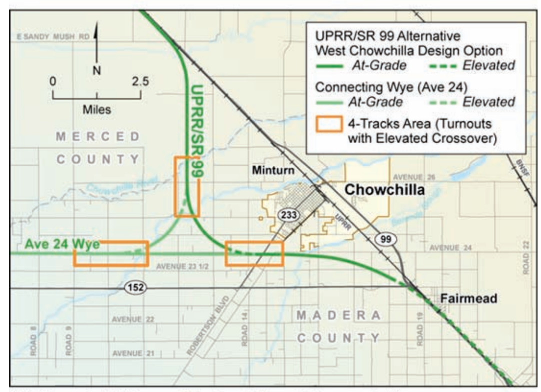
The Ave 21 Wye would travel along the north side of Avenue 21. Just west of Road 16, the HST tracks would diverge north and south to connect to the UPRR/SR 99 Alternative, with the north leg of the wye joining the north-south alignment at Avenue 23½ and the south leg at Avenue 19½.

<u>**HST Stations**</u>

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.



(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

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.

Mariposa Street Station 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. 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

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.

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.

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.

- **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** – 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 criterion 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 other 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 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 den**se 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 Watercourses

Within the study area, common wetland and watercourse resources include vernal pools and other seasonal wetlands, freshwater emergent marshes, forested wetlands, constructed basins, natural watercourses, and constructed watercourses. These wetland and water resources are grouped into two categories: 1) palustrine wetlands (vernal pools and other seasonal wetlands, freshwater emergent marsh, forested wetlands, and constructed basins) and 2) non-vegetated riverine wetlands (constructed and natural watercourses) (Cowardin et al. 1979). The palustrine system is a broad class of non-tidal wetlands that includes vegetated wetlands traditionally called by names such as marsh, swamp, bog, fen, and prairie. The palustrine system also includes small ponds and constructed basins. Riverine wetlands (natural and constructed watercourses) include unvegetated open water habitats contained within a channel. For the purposes of this document palustrine wetlands are synonymous with wetlands and riverine wetlands are synonymous with other waters of the U.S. A description of wetland and water resources common to the study area is provided below.

2.1.4.1 Vernal Pools and other Seasonal Wetlands

Vernal pools are shallow depressions that are seasonally inundated by precipitation, with limited localized inputs from the immediately surrounding landscape. Shallow inundation occurs within the depression for extended periods during the cool season (late fall through early spring), with dry soils throughout the warm season (spring and summer; Zedler 1987). 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). Vernal pools are often associated with 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 part that preclude the downward percolation of water. Vernal pools are a subclass of depressional wetlands and are considered palustrine emergent seasonally flooded wetlands (Cowardin et al. 1979).

Vegetatively, 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. Vernal pools and other seasonal wetlands are nontidal, flooded, depressional wetlands and would be classified as palustrine emergent seasonally flooded wetlands by Cowardin et al. (1979).

Vernal pools are a subset of seasonal wetlands (a broader class of wetland characterized by seasonal inundation). The primary distinction between vernal pools and other seasonal wetlands is the characteristic native flora, general lack of nonnative plant species as well as the association with landscapes that are characterized by mound and inter-mound topography and some form of restrictive layer that result in a seasonally perched water table. Seasonal wetlands support a wide variety of both native and nonnative wetland plant species and may occur in a variety of landforms where there is seasonal saturation or inundation. In the study area, seasonal wetlands may be considered somewhat degraded based on nonnative plant community assemblage and land management modifications (cultivation, grading, etc.) that may reduce flood storage potential.

2.1.4.2 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 2010). Freshwater marsh is equivalent to freshwater emergent wetland as defined by *A Guide to Wildlife Habitats of California* (Mayer and Laudenslayer 1988).

2.1.4.3 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 is typically cottonwood or willow dominated 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).

2.1.4.4 Constructed Basins

This wetland type includes constructed stormwater retention basins, reservoirs, dairy waste settling ponds, and agricultural tail water ponds. These 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 lack wetland vegetation or 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.

2.1.4.5 Natural Watercourses

The majority of the natural waters in the study area have an intermittent or ephemeral flow regime 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 margins of pool-run habitat units 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 wetlands, depending on the persistence of their surface hydrology and their locations in a watershed. Riverine wetland in the study area may include a variety of bottom and bank substrate types. Palustrine wetlands may be associated with natural watercourses.

2.1.4.6 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. Canals 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 of the canals are routinely cleared of vegetation and/or sprayed with herbicides. Constructed watercourses would be classified 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.

2.2 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,

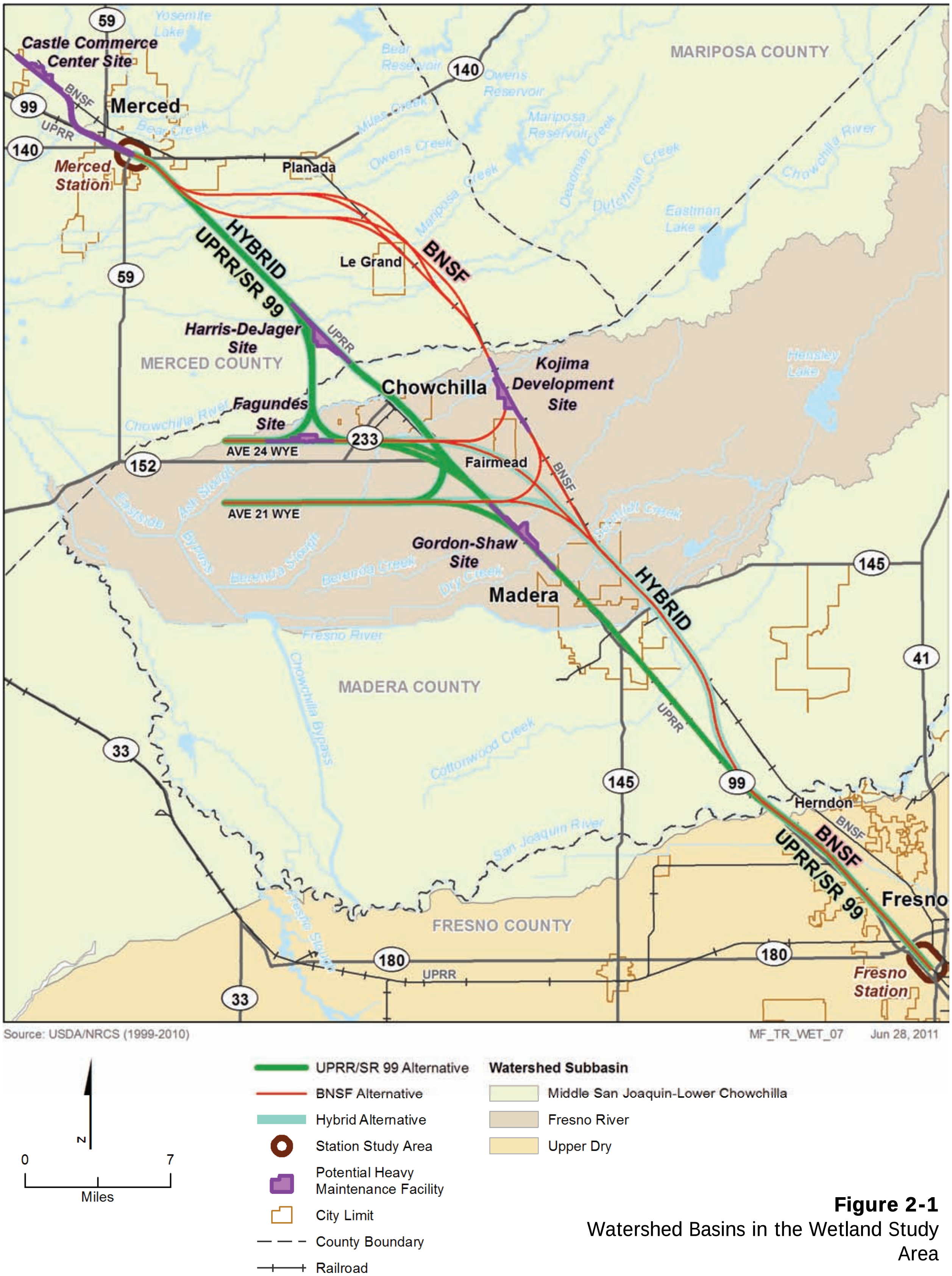


Figure 2-1
Watershed Basins in the Wetland Study Area

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 2-1
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 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.

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**

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).

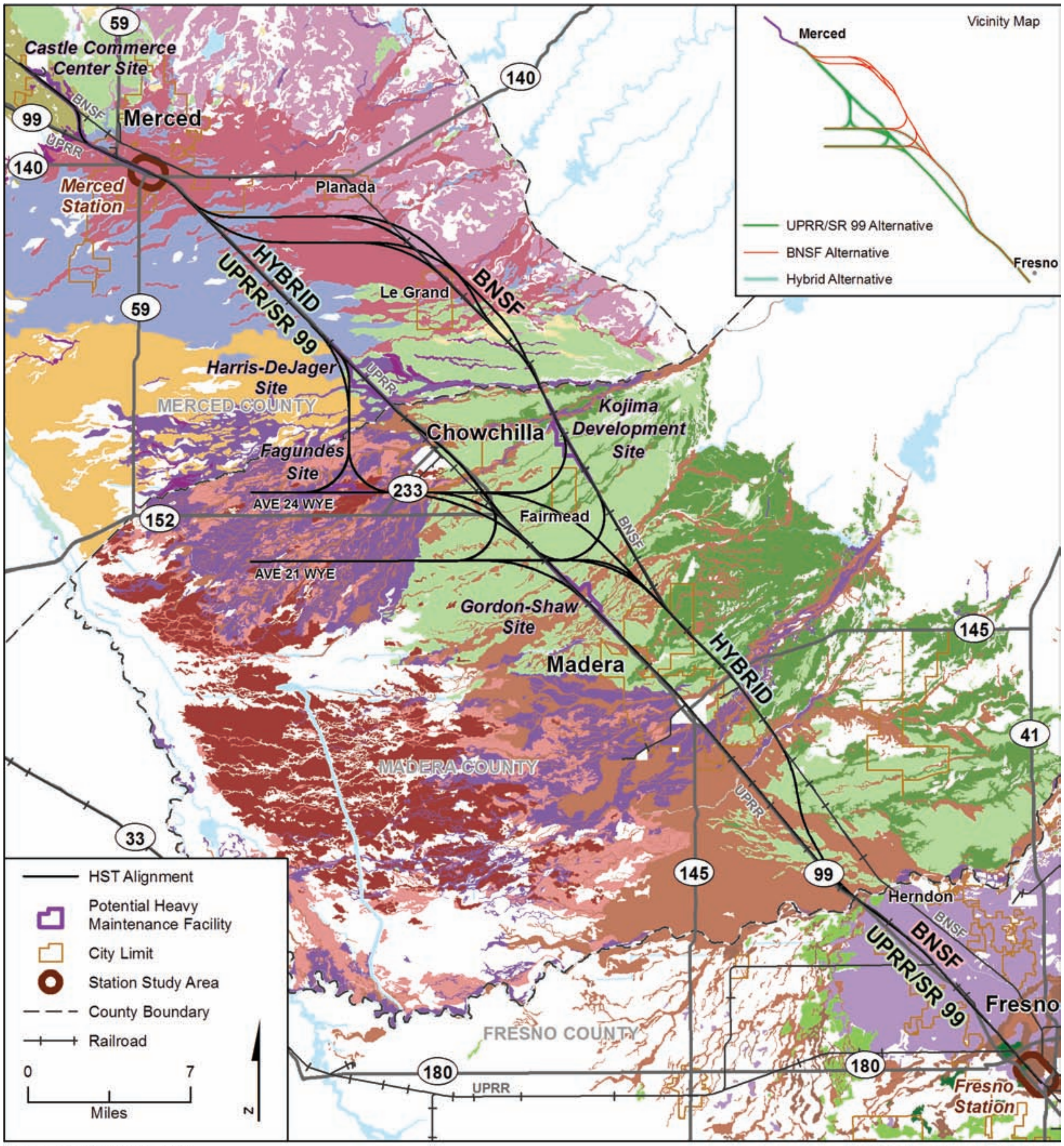
Table 2-4
Daily Precipitation Data-Two Weeks Prior to February 2011 Wetland Field Investigation (CIMIS#145, 2011)

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.



Source: NRCS (1962a,b, 1971).

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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

Table 2-5
Soil Associations in the Merced to Fresno Wetland Study Area

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 2011a]).

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 (BIOS 2009) Mapped Wetlands

A review of the National Wetlands Inventory (NWI) maps (United States Fish and Wildlife Service [USFWS] 2009) identified 70 palustrine emergent marsh wetlands (30.20 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 (Biogeographic Information and Observation System [BIOS] 2009) identified 757 acres of mapped vernal pool communities within the wetland study area. Central Valley Vernal Pool Habitat 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. During the November 2009 surveys, it was determined that 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/Central Valley Vernal Pool Habitat mapped locations no longer support wetlands. These areas have been developed or converted to orchards, inactive farmland, or row cultivation. Current aerial photographs (Mapcon Mapping, Ltd. 2007 and Google Earth 2011) indicate a reduced presence of existing wetland conditions when compared to mapped wetland feature locations.

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 21,562 acres. The wetland study area included each of the project elements including the current proposed alternative rights-of-way, station locations, proposed construction staging and laydown areas, borrow sites, and HMF sites, as well as a 250-foot-radius buffer around all of these project elements The 250-foot buffer is anticipated to include areas subject to direct and indirect impacts on wetlands and waters that may result from the proposed project. Wetland delineations were conducted in the wetland study area as shown in Appendix C, *Wetland 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 2009).
- Central Valley Vernal Pool Habitat dataset (BIOS 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).
- Draft Hydraulics and Floodplain Technical Report. California High-Speed Train Project EIR/EIS Merced to Fresno Section. (Authority and FRA 2011b).

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 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 on May 24 through 29, 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 (BIOS 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 printed aerial imagery 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 was conducted on non-accessible parcels in winter 2011.

Wetland and waters spring 2010 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 spring 2010 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) as well as 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 will be used to obtain a Preliminary Jurisdictional Determination (JD) from USACE. 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 permit process or during the 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 in any way by the permitted activity on the site 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 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 specific waterway assessment forms 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) included prioritized private property access to parcels containing image and 2010 field verified wetlands and other Water resources. 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 width 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 in 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). Data collected from public access vantage points includes observation of natural or constructed waters and observation of wetland hydrology (standing water) corresponding to mapped or newly identified wetland features. OHWM indicators were 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.

Finally, USACE comments on initial delineation results were communicated using Google Earth kmz files and these data were incorporated in May 2011. Edits to the master Wetlands Delineation Report GIS were made following RC receipt of USACE kmz files on May 12, 2011.

3.4 Impact Calculations

Potential impacts to wetlands and other waters of the U.S. were quantified by overlaying the current construction footprint on 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.

Most wetlands and other waters of the U.S. were considered directly and permanently affected for purposes of quantifying impacts, with one exception: where alignment construction footprints are elevated, only the innermost 60 feet of the construction footprint is considered directly and permanently affected. The outermost portions of the construction footprint are considered directly and temporarily affected. Wetlands and other waters of the U.S. directly but temporarily affected in these regions are anticipated to be restored.

4.0 Results

Aerial mapping and field investigations within the wetland study area (23,568 acres) identified a total of 129.08 acres of wetlands and 307.53 acres of other waters of the U.S. (natural watercourses, constructed watercourses, and constructed basins). 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, *Wetland and Other Waters of the U.S. Study Area Maps.* 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 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 129.08 acres of Palustrine wetlands in the wetland study area. Mapped wetlands are presented in Appendix C, *Wetland and Other Waters of the U.S. Study Area Maps*. 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 unquantified 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:

- 97.09 acres of palustrine emergent wetlands, including:
  - 83.47 acres of vernal pools and other seasonal wetlands.
  - 13.62 acres of freshwater marsh.
- 31.99 acres of palustrine forested wetlands.

The field verified wetland types identified in the study area (vernal pools and other 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 Appendix C, *Wetland and Other Waters of the U.S. Study Area Maps*, Appendix D, *Wetland Determination Data Sheets,* and Appendix E, *Wetland and Other Waters Photographs*. 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 G.

4.1.1.1 Vernal Pools and other Seasonal Wetlands

Of the 97.09 acres of palustrine emergent wetlands identified in the wetland study area, 83.47 acres were vernal pools and other seasonal wetlands. Vernal pool systems are characterized as depressional, seasonally saturated wetlands located in hummocky depressions on alluvial terraces. Floristic composition of these systems is influenced by hydrology and topographic position within the wetland. Vernal pools are not associated with watercourses and receive hydrologic inputs from precipitation and limited overland flow from adjacent upland areas. In the study area, mapped vernal pool systems include an unquantified amount of seasonal wetland areas, of which vernal pools are a subclass. 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 resemble vernal pools; however, their vegetation composition may lack a predominance of native vernal pool species and have typically been disturbed through conversion to agriculture.

In the wetland study area, mapped vernal pool acreage includes other seasonal wetlands mapped by aerial photographs. Due to limited property access for field verification, acreages could not be determined for the two types separately and therefore both types are included and discussed as vernal pools. The following text describes vernal pool and other seasonal wetlands conditions identified in field surveyed areas.

Typical vegetation observed in vernal pool wetlands in spring 2010 included annual rabbitsfoot grass (*Polypogon monspeliensis*), prostrate knotweed (*Polygonum aviculare*), purslane speedwell, tarweed (*Holocarpha* sp.), Fremont's goldfields (*Lasthenia fremontii*), coyote thistle, seaside barley, popcornflower, toad rush, and pale spikerush. Observed soils 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 basins were dry due to normal seasonal conditions. Observed hydrologic indicators included remnants of aquatic invertebrates and biotic crust (algal matting). Subsequent field investigations during winter 2011 at vernal pools and other seasonal wetland locations identified wetland hydrology (standing water or surface soil saturation) in all 2010 observed vernal pools and other 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/seasonal wetland plant species in winter 2011 could not always 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 other seasonal wetlands were conducted on accessible parcels, and results are described below. Data sheets are included in Appendix D, *Wetland Determination Data Sheets*, and maps are included in Appendix C, *Wetland and Other Waters of the U.S. Study Area Maps*.

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

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

Wetland ID	Appendix C, Mapbook Page	APN	Hydrophytic Vegetation	Hydric Soils	Wetland Hydrology	Wetland?
10756	37	066-050-011	Yes	Inferred	Yes	Yes
8534	102	027-054-046	Yes	Yes	Yes	Yes
8535	102	027-054-049	Yes	Yes	Yes	Yes
8536	102	027-054-005	Yes	Yes	Yes	Yes
5166	123	029-100-014	Yes	Yes	Yes	Yes
5533 and 5534	134	029-280-031	Yes	Yes	Yes	Yes
5231, 5529, 5594, 5597-5599, 5600, 9868, and 9903	260, 263, 291	068-230-033	Yes	Yes	Yes	Yes
8818	324	068-130-019	Yes	Yes	Yes	Yes
5562 and 5559	340	030-112-010	Yes	Yes	Yes	Yes

Wetland ID	Appendix C, Mapbook Page	APN	Hydrophytic Vegetation	Hydric Soils	Wetland Hydrology	Wetland?
8582	389	036-140-028	Yes	Inferred	Yes	Yes
5158	393	037-010-018	Yes	Yes	Yes	Yes
8803 and 8802	614,615	029-120-006	Yes	Yes	Yes	Yes
8932, 8933, and 8934	626, 627	029-130-012	Yes	Yes	Yes	Yes
8543	383	029-220-004	Yes	Yes	Yes	Yes

Wetland 10756

Appendix C Map Book Page 37; APN 066-050-011

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

Vegetation. The wetland contains one vegetative layer (emergent) dominated by annual rabbitsfoot grass, European knotweed (*Polygonum arenastrum*), and purslane speedwell (obligate wetland species [OBL]). The wetland vegetation criterion is achieved by a predominance of wetland vegetation (50% of the dominant species are facultative wetland 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 is 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. Wetland hydrology criterion is met through identification of at least one primary wetland hydrology indicator.

Wetland 8534

Appendix C Map Book Page 102; APN 027-054-046

Wetland 8534 is a highly disturbed seasonal wetland. The wetland contains car parts, tires, barrels, wood, and treated lumber debris. Wetland delineation data was collected in January 2011 at data points (DP-VL-301-3-UPL and DP-VL-301-2-WL).

Vegetation. Vegetation within 8534 contains one vegetative layer (emergent). The emergent layer provides 22% vegetative cover and is dominated by rush species (FACW assumed), and coyote thistle (FACW). Open water comprises approximately 78% cover of the wetland. Vegetation identification is based on seedlings and non-flowering plants. The wetland vegetation criterion is achieved by a predominance of wetland vegetation [50% of the dominant species are facultative (FAC) or wetter].

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

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

Wetland 8535

Appendix C Map Book Page 102; APN 027-054-049

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

Vegetation. Vegetation within wetland 8535 contains one vegetative layer (emergent). The emergent layer provides 100% vegetative cover and is dominated by popcornflower (FACW assumed). The wetland vegetation criterion is achieved by a predominance of wetland vegetation (50% of the dominant species are FAC or wetter).

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

Hydrology. Hydrology indicators observed within Wetland 8535 include 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 is met based on the observation of the above primary indicators.

Wetland 8536

Appendix C Map Book Page 102; APN 027-054-005

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

Vegetation. Wetland 8536 contains one vegetative layer (emergent). The emergent layer provides 70% vegetative cover and is dominated by seaside barley (FAC) and tarweed (FAC). The wetland vegetation criterion is achieved by a predominance of wetland vegetation (50% of the dominant species are FAC or wetter).

Soils. Soils were sampled from 0 to 10 inches bgs. The soil profile is characterized as a very dark grayish brown (10YR 3/2) silty clay from 0 to 2.5 inches. Soils continue 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 sampled soil is dark grayish brown (10YR 4/2) sandy loam. Hydric soil indicator of F3 Depleted Matrix is met at the sample location.

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

Wetland 5166

Appendix C Map Book Page 123; APN 029-100-014

Wetland 5166 is a shallow weakly expressed depressional seasonal wetland. Wetland delineation data was collected in January 2011 at data points (DP-RH-5166-1-WL and DP-RH-5166-2-UPL).

Vegetation. Vegetation within Wetland 5166 contains one vegetative layer (emergent). The emergent layer provides 90% vegetative cover and is dominated by popcorn flower (FACW assumed). Ten percent cover of biotic crust was identified within the wetland boundary. Vegetation identification is based on seedlings and non-flowering plants. The wetland vegetation criterion was achieved by a predominance of wetland vegetation (50% of the dominant species are FAC or wetter).

Soils. Soils within the wetland is characterized as a brown (10YR 4/3) sandy loam from 0 to 7 inches bgs. Soils continue 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 soils 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 include saturation, biotic crust, and alpha alpha-dipyridyl test positive reaction (faint). The wetland hydrology criterion is met based on the presence of saturation and biotic crust.

Wetlands 5533/5534

Appendix C Map Book Page 134; APN 029-280-031

Wetlands 5533 and 5534 are a vernal pool/seasonal wetland complex adjacent to Dry Creek. Soil and vegetative conditions within the parcel shows evidence of historic agricultural management, currently the area is fallow. Wetland delineation data was 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 contain one vegetative layer (emergent). The emergent layer provides 100% vegetative cover and is dominated by vernal pool popcorn flower (OBL) and woollyheads species (OBL assumed). The wetland vegetation criterion is achieved by a predominance of wetland vegetation (50% of the dominant species are FAC or wetter).

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

Soils sampled at DP-RHSP-5 were inferred hydric as the matrix color is 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, agal 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 wetland include biotic crust and aquatic invertebrates (DP-RHSP-5). Surface soil saturation was observed at DP-GHSP-2. The wetland hydrology criterion is met based on the observation of the above primary indicators.

Wetlands 5231, 5529, 5594, 5597-5599, 5600, 9868, and 9903

Appendix C Map Book Pages 260, 263, 291; APN 068-230-033

Wetlands on this parcel are a vernal pool/seasonal wetland complex in a grassland community adjacent to a historic stream channel. Wetland delineation data was 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 contain one vegetative layer (emergent). The emergent layer provides 30 to 90% vegetative cover. Dominants include Great Valley button celery (*Eryngium castrense*, FACW), Fremont's goldfields (FACW), Italian ryegrass (*Lolium perenne* ssp. *Multiflorum,* FAC), rush (*Juncus* sp., FACW assumed facultative rating), pale spikerush (OBL), and seaside barley (FAC). The wetland vegetation criterion is achieved by a predominance of wetland vegetation (50% of the dominant species are FAC or wetter).

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 a 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. Hydrology indicators observed within wetland complex include at least one of the following primary wetland hydrology indicators: 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 is met based on the observation one primary indicator or two secondary wetland hydrology indicators.

Wetland 8818

Appendix C Map Book Page 324; APN 068-130-019

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

Vegetation. Vegetation within Wetland 8818 contains one vegetative layer (emergent). The emergent layer provides 10% vegetative cover and is dominated by pale spikerush (OBL), hyssop loosestrife (*Lythrum hyssopifolium,* FACW), and Italian ryegrass (FAC). The basin is mostly bare dirt due to the early season survey timing. Vegetation identification is based on seedlings and non-flowering plants. The wetland vegetation criterion was achieved by a predominance of wetland vegetation (50% of the dominant species are FAC or wetter).

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

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

Wetlands 5562 and 5559

Appendix C Map Book Page 340; APN 030-112-010

Wetlands 5562 and 5559 are part of a larger vernal pool complex on this parcel. The parcel is managed under grazing that appears to have not significantly disturbed the vernal pools. Vernal pool fairy shrimp (*Branchinecta lynchi*) and unidentified egg masses were identified in the surface water within the wetlands. Wetland delineation data was 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 contains one vegetative layer (emergent) frequently dominated by spikerush (*Eleocharis* sp., FACW assumed), water-starwort (*Callitriche* sp., OBL), coyote thistle (FACW assumed), or seaside barley (FAC). The emergent layer provides 100% vegetative cover throughout the wetland. Vegetation identification is based on seedlings and non-flowering plants. The wetland vegetation criterion was achieved by a predominance of wetland vegetation (50% of the dominant species are FAC or wetter).

Soils. Soils within the wetlands is characterized as a olive gray (5Y 4/2) sandy loam from 0 to 3 inches bgs. Soils continue 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 are colored as olive (5Y 4/3) with 2.5Y 4/4 redoximorphic features (quantity unspecified). Hydric soils 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 include surface water, saturation, inundation visible on aerial imagery, aquatic invertebrates, and presence of reduced iron. The wetland hydrology criterion is met based on several primary wetland hydrology indicators.

Wetland 8582

Appendix C Map Book Page 389; APN 036-140-028

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

Vegetation. Wetland 8582 contains one vegetative layer (emergent) dominated by seaside barley (FAC). Vegetation identification is based on seedlings and non-flowering plants. The wetland vegetation criterion is achieved by a predominance of wetland vegetation (50% of the dominant species are FAC or wetter).

Soils. No soils were sampled within the seasonal wetland. Standing water within the wetland limited soil capture. Hydric soils are 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 correspond to primary wetland hydrology indicators.

Wetlands 5158

Appendix C Map Book Page 393; APN 037-010-018

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

Vegetation. Vegetation within the wetland contains one vegetative layer (emergent) dominated by seaside barley (FAC) and coyote thistle species (FACW assumed). The emergent layer provides 55% vegetative cover throughout the wetland. The wetland vegetation criterion was achieved by a predominance of wetland vegetation (50% of the dominant species are FAC or wetter).

Soils. Soils within the wetlands is 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 be present but are 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 duration during the growing season.

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

Wetlands 8803 and 8802

Appendix C Map Pages 614 and 615; APN 029-120-006

Wetlands identified within parcel 029-120-006 are seasonal wetlands disturbed by agricultural management. Land management on the parcel includes drill seeding, disking, and/or plowing but the area has not been graded and wetland hydrology is maintained by shallow depressional features throughout the parcel. Wetland delineation data was 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 is variable depending on the intensity of the drill seeding activity in the depression. Several wetlands are entirely seeded and devoid of natural recruits. Other wetland areas are seeded to the wetland margin and contain some native vegetation. Within the parcel, the wetlands contain one vegetative layer (emergent) that are dominated by seeded cereal crop, tufted hairgrass (*Deschampsia cespitosa*, FACW), and/or winged water star-wort (*Callitriche marginata*, obligate wetland species (OBL) depending on the intensity of management within the wetland. Percent vegetative cover within the wetland areas range from 25 to 75%. Vegetation identification is based on seedlings and non-flowering plants. Hydrophytic vegetation criterion was either met (predominance of wetland vegetation) or inferred (disturbed seeded vegetation) within all wetlands delineated within the parcel.

Soils. Soils within the wetlands are 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 continues 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 is 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 is met based on saturation, standing water, and presence of reduced iron.

Wetland 8932, 8933, and 8934

Appendix C Map Book Pages 626 and 627; APN 029-130-012

Wetlands 8932, 8933, and 8934 are a depressional, seasonal wetland complex recently disturbed by agricultural management (disking/plowing). Wetland delineation data was 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 contains one vegetative layer (emergent). The emergent layer ranges from 10 to 90% vegetative cover and is dominated by popcorn flower species (FACW assumed). Vegetation identification is based on seedlings and non-flowering plants. The wetland vegetation criterion was achieved by a predominance of wetland vegetation.

Soils. Wetland soils within the features are 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 F6 Redox Dark Surface and F8 Redox Depression were met within the wetland.

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

Wetland 8543

Appendix C Map Book Page 383; APN 029-220-004

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

Vegetation. Wetland 8543 contains one vegetative layer (emergent) dominated by common sunflower (*Helianthus annuus*, FAC), yellow nutsedge (*Cyperus esculentus*, FACW), and broad leaf plantain (*Plantago lanceloata*, FAC). The wetland vegetation criterion is achieved by a predominance of hydrophytic vegetation (50% of the dominant species are FAC or wetter).

Soils. Soils sampled at wetland 8543 are a dark gray (2.5YR 4/1) loamy sand with 1% (5YR 4/6) redoximorphic features. Hydric soil indicator of F6 Redox Dark Surface is 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 correspond to primary wetland hydrology indicators.

4.1.1.2 Freshwater Marsh

Of the 97.09 acres of palustrine emergent wetlands identified in the wetland study area, 13.62 acres were freshwater marsh. This wetland type is generally associated with the edges and channels of the natural watercourses in the study area. Regional irrigation practices and adjacent agriculture management may degrade the freshwater marsh community by removing riparian vegetation, grading, diversion of water, herbicide application, and nutrient inputs. Floristic composition of these wetlands is influenced by these management techniques, hydrologic regimes, and topographic position within the wetland.

Field investigation (spring 2010) of freshwater marshes identified 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 (Appendix D, *Wetland Determination Data Sheets,* and Appendix C, *Wetland and Other Waters of the U.S. Study Area Maps*).

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	APN	Hydrophytic Vegetation	Hydric Soils	Hydrology	Wetland?
1833, 1838-1840, 2358, 2359, 2364-2370, 8380	124,125, 127	029-190-007	Yes	Assumed	Yes	Yes
8538	339	013-112-010	Yes	Yes	Yes	Yes
8996 and 8997	379	029-220-020	Yes	Yes	Yes	Yes
3675	386	036-065-009	Yes	No	Yes	No

Wetlands 1833, 1838-1840, 2358, 2359, 2364-2370, 8380

Appendix C Map Book Page 124, 125, 127; APN 029-190-007

The wetland on this parcel is a freshwater marsh contained within Berenda Creek. 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 was collected in January 2011 (data points: DP-GH-200-1-WL and DP-GH-200-2-UPL).

Vegetation. The wetland contains one vegetative layer (emergent) dominated by cattail (100% cover, OBL). The marsh community occupies greater than 90% of the waterway surface area throughout the stream course. Wetland vegetation criterion is achieved by a predominance of wetland vegetation (50% of the dominant species are FAC or wetter).

Soils. No soils were sampled within the marsh community. Steep cut banks prohibited soil capture within the channel. Hydric soils is inferred based on 100% cover of obligate 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

Appendix C Map Book Page 339; APN 013-112-010

Wetland 8538 is a freshwater marsh adjacent to Berenda Reservoir. The wetland contains two vegetative layers (shrub and tree). Wetland delineation data was 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 provides less than 5% cover (mule fat, *Baccharis salicifolia*, FACW). The emergent layer provides 100% vegetative cover and is dominated by rush species (FACW assumed). Vegetation identification is based on seedlings and non-flowering plants. The wetland data point was collected at the upper edge of the wetland community. Dominant vegetation transitions to

OBL species (cattail) closer to the reservoir edge. The wetland vegetation criterion is achieved by a predominance of wetland vegetation (50% of the dominant species are FAC or wetter).

Soils. Soils were sampled from 0 to 18 inches bgs. The soil profile is characterized as a very dark grayish brown (10YR 3/2) sandy loam from 0 to 3 inches. Soils continue 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 soils is inferred based on the highly mixed and graded soil condition from reservoir construction (circa 1964), adjacency to Berenda Reservoir which likely deposits new sediment through alluvial transport, and high sand content in 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.

<u>Wetlands 8996 and 8997</u>

Appendix C Map Book Page 379; APN 029-220-020

Wetlands 8996 and 8997 are a freshwater marsh contained within the Dry Creek channel. The marsh extends slightly outside of the OHWM and extends nearly continuously over the entire water way. Wetland delineation data was collected in January 2011 at data points (DP-GH-303-1-WL; no upland data point was collected at this location).

Vegetation. The wetland area contains one vegetative layer (emergent) dominated by hardstem bulrush (80% cover, OBL). The marsh community occupies greater than 90% of the waterway surface area throughout the stream course. The wetland vegetation criterion is achieved by a dominance of hydrophytic vegetation (50% of the dominant species are FAC or wetter).

Soils. Soils sampled within the wetland are a very dark grayish brown (10YR 3/2) sandy silt from 0 to 4 inches bgs and continue to 9 inches as a very dark grayish brown (10YR 3/2) loamy sand with 5% redoximorphic features (10YR 4.4). Soils from 9 to 14 inches bgs are a dark gray (10YR 4/1) sandy clay with 10% redoximorphic features (10YR 4/4). Hydric soils indicator of F6 Redox Dark Surface is met at the sample location.

Hydrology. Hydrology indicators were satisfied by saturation at 8 inches bgs and high water table identified at 10 inches bgs, both of which are primary wetland hydrology indicators.

<u>Schmidt Creek GH-205-1-UPL (Mapped Feature 3675)</u>

Appendix C Map Book Page 386; APN 036-065-009

Schmidt Creek is an upland swale containing debris (tires, furniture, household trash). At the data point location, no wetland resource was identified (no hydric soil indicator) and the water feature lacked prominent or continuous evidence of OHWM. Adjacent land use is residential. A delineation datasheet was collected in January 2011 at data point (DP-GH-205-1-UPL).

Vegetation. The Schmidt Creek swale contains one vegetative layer (emergent) dominated by Bermuda grass (*Cynodon dactylon*, facultative upland and cocklebur (*Xanthium* sp., FAC). The emergent layer provides 100% vegetative cover. The wetland vegetation criterion is achieved by a predominance of hydrophytic vegetation (50% of the dominant species are FAC or wetter).

Soils. Soils were sampled from 0 to 6 inches bgs. The soil profile is characterized as a dark brown (10YR 3/3) sandy loam with 1% (no color) mottles. Redoximorphic features were very faint and difficult to distinguish in the field. Soils at the sample location did not meet any hydric soil indicator.

Hydrology. Hydrology indicators observed within Schmidt Creek upland swale include surface water (6 inches), and saturation. The wetland hydrology criterion is met based on the observation of the above primary indicators.

4.1.1.3 Forested Wetlands

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 Appendix D, *Wetland Determination Data Sheets*, and Appendix C, *Wetland and Other Waters of the U.S. Study Area Maps*.

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, Mapbook Page	APN	Hydrophytic Vegetation	Hydric Soils	Hydrology	Wetland?
8306	41	066-272-010	Yes	Assumed	Yes	Yes
8871 and 3006	44	066-110-015	Yes	Yes	Yes	Yes

Wetland 8306

Appendix C Map Book Page 41; APN 066-272-010

Wetland 8306 is a cottonwood dominated forested wetland located on a low terrace adjacent to Owens Creek. Wetland delineation data was 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 contains two vegetative layer (tree and emergent). The tree layer contains approximately 25% cover from Fremont cottonwood (FACW) and arroyo willow (FACW). The emergent layer provides 7% vegetative cover and is dominated by cattail (OBL) and wire rush (*Juncus balticus, OBL*). The understory of the wetland is predominantly bare soil with scattered obligate vegetation. No upland plant species were identified within the wetland area. The wetland vegetation criterion is achieved by a predominance of hydrophytic vegetation (50% of the dominant species are FAC or wetter).

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

Hydrology. Hydrology indicators observed at wetland 8306 include 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

Appendix C Map Book Page 44; APN 066-110-015

Wetland polygons 8871 and 3006 are depressional, seasonally saturated, cottonwood dominated forested wetland. The wetland is contained within a series of excavated ponds (former fish farm) adjacent to Duck Slough. 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 is 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. Wetlands 8871 and 3006 are 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%. The wetland contains a prevalence of wetland species (more than 50%) and satisfies the requirement for wetland vegetation.

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 back depressions during May 2011.

4.1.2 Wetlands Identified by Alternative

Wetlands and other Waters identified in the study area of the UPRR/SR 99, BNSF, and Hybrid alternatives and their related design options include a range of wetland and waters acres depending on the alternative and various design option combinations. Table 4-4 summarizes the extent of wetlands (in acres) identified in the wetland study area for three proposed alternatives and their design option combinations, and for each of five alternative HMF sites (acres of other waters of the U.S. within the wetland study area are provided in Table 4-6). Further details regarding wetland and water acres identified in each alternative and specific design options are presented in Appendix H, *Total Range of Wetlands and Other Waters of the U.S. by Alternative (UPRR/SR 99, BNSF, Hybrid, and HMF)*.

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

HST Alternative	Vernal Pools and Other Seasonal Wetlands	Freshwater Marsh	Forested wetlands	*Total Range Of All Wetland Acres by Combination*
Alignment Alternative and Design Option Combination				
UPRR/ SR 99 Alternative				
UPRR/SR 99 Alternative with West Chowchilla DO N-S Design Option Combination	3.60	1.59	6.68	*11.87*
UPRR/SR 99 Alternative with East Chowchilla DO N-S Design Option	4.41 to 4.89	1.40 to 2.96	7.23 to 8.28	*13.04 to 16.13*

HST Alternative	Vernal Pools and Other Seasonal Wetlands	Freshwater Marsh	Forested wetlands	*Total Range Of All Wetland Acres by Combination*
Combination				
BNSF Alternative				
BNSF Alternative and Design Option Combination, Ave 24 Wye	40.63 to 47.28	3.19 to 4.72	2.61 to 11.42	*46.43 to 63.42*
BNSF Alternative and Design Option Combination, Ave 21 Wye	42.80 to 49.45	4.13 to 5.65	2.61 to 11.42	*49.54 to 66.52*
Hybrid Alternative				
Hybrid Alternative, Ave 21 Wye	17.79	2.50	6.45	*26.74*
Hybrid Alternative, Ave 24 Wye	13.47	1.36	6.22	*21.05*
Heavy Maintenance Facility Alternatives				
Castle Commerce Center	1.32	0	1.29	*2.61*
Harris-DeJager	0	0	0	*0*
Fagundes	0	0	0	*0*
Gordon-Shaw	0.34	2.94	0.31	*3.59*
Kojima Development	1.54	2.13	0	*3.67*

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

4.2 Other Waters of the U.S.

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

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

Aerial mapping, best available information (Authority and FRA 2011b), and field investigations (December 2009; April and May 2010; January and February 2011) identified 17 potentially jurisdictional named and unnamed natural waters (116.92 acres), 123.92 acres of potentially jurisdictional constructed waters such as canals and drainages (named and unnamed), and 66.69 acres of potentially jurisdictional constructed basins of the wetland study area as shown in Appendix C, *Wetland and Other Waters of the U.S. Study Area Maps*; Appendix I, *Water Crossings Maps;* and Appendix J, *Other Waters Identified in the Study Area*. A description of natural and constructed watercourses and constructed basins follows in Sections 4.2.1A and 4.2.1B, respectively.

4.2.1.1 Natural Waters in the Wetland Study Area

In the wetland study area, 17 natural named and unnamed watercourses (116.92 acres; Table 4-5 and Appendix J, *Other Waters Identified in Study Area*) have been identified. Natural waters with perennial flow include the San Joaquin River and Bear Creek. The majority of the natural waters in the study area have an intermittent or ephemeral flow regime 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 margins of pool-run habitat units with bottom substrates dominated by fine sediments (i.e., sand, silt, or clay). A summary (Table 4-5) and description of named natural waters 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
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 is part of the Merced County Stream Group that 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. 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 to the southwest for approximately 5.2 miles into Bear Creek, which continues to flow to the west for approximately 12.5 miles to the San Joaquin River.

<u>Black Rascal Creek</u>

Black Rascal Creek is part of the Merced County Stream Group that 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, 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 to the south for approximately 400 feet, where it intersects Bear Creek. From the confluence, Bear Creek flows approximately 16 miles to the west into the San Joaquin River.

<u>Bear Creek</u>

Bear Creek is part of the Merced County Stream Group that originates east and northeast of the City of Merced. The study area includes 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. 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 to the west for approximately 13.3 miles into 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. 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 to the west for 0.6 mile into Owens Creek. From the confluence with Owens Creek, water flows approximately 19 miles generally to the west 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 to the northwest into 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 to the 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 to the west for approximately 25 miles, where it joins Owens Creek. Owens Creek flows to the west-northwest into Bear Creek. Bear Creek then flows to the 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 cement-lined, with no adjacent riparian vegetation. South Slough flows approximately 2 miles to the west through a series of constructed canals and then flows into the Nido Canal. It continues to flow to the 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 to the south for approximately 0.5 mile and then west for another 3.8 miles before returning to its natural channel. It appears to 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 continues to flow generally to the west for 13 miles into 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 are known as 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 to vary, 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 as well as 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 channel 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 to the 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 to the 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 to the west and then runs to the 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 to the southwest for approximately 9.5 miles into 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. Further 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 to the southwest into the Fresno River, which continues to the 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 appears to be 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 to the 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 Waters in the Wetland Study Area

In the wetland study area, 123.92 acres of constructed waters (canals drains, and ditches) were identified. 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. 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 waters in the study area are considered potentially jurisdictional under the Preliminary Jurisdictional Determination format (USACE 2008b). Appendix J, *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 Appendix C, *Wetland and Other Waters of the U.S. Study Area Maps,* and Appendix I, *Water Crossings Maps*.

4.2.1.3 Constructed Basins

Wetland surveys and imagery interpretation identified 66.69 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. These 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 these landscape or management features that, in combination, make-up the constructed basin type.

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

4.2.2 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 187 water crossing (natural and constructed watercourses). There are 43 crossings of natural watercourses (streams) and 144 crossings of constructed watercourses (canals, drains, and pipes). The BNSF Alternative and related design options and wye combinations include a total of 205 crossings of natural and constructed watercourses (75 natural water crossings and 130 constructed water crossings). The fewest crossings of natural and constructed watercourses, 168 crossings, were identified for the Hybrid Alternative and related design options, (40 natural watercourse and 128 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 and adjacent riparian conditions is provided in Appendix K, *Inventory of Natural and Constructed Waters Crossings by Alternative*.

Other waters of the U.S. identified within the UPRR/SR 99, BNSF, and Hybrid alternatives and related design options, include a range of acres depending on the combination of alternative and design option. Table 4-6 summarizes the range of acres identified for other waters of the U.S. within the three proposed alternatives and corresponding design option combinations, and at each of five potential HMF sites, within the wetland study area.

Further details regarding acreages of other Waters within each proposed alternative and their specific design option combinations are presented in Appendix H, *Total Range of Wetlands and Other Waters by Alternative (UPRR/SR 99, BNSF, Hybrid, and HMF alternatives)*. Appendix K, *Inventory of Natural and Constructed Waters Crossings by Alternative*, provides a list of water crossing locations by alternative.

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

High Speed Train Alternative	Constructed Watercourses	Natural Watercourses	Constructed Basins
Acres of Other Waters Identified by Alternative Project Combination [a]			
UPRR/SR 99 Alternative			
UPRR/SR 99 Alternative with West Chowchilla Design Option Combination	38.22	38.54	31.66
UPRR/SR 99 Alternative with East Chowchilla Design Option Combination	32.02 to 41.94	24.63 to 35.96	23.76 to 26.53
BNSF Alternative			
BNSF Alternative, Ave 24 Wye Design Option Combination	31.75 to 42.13	34.55 to 40.64	29.11 to 35.15
BNSF Alternative, Ave 21 Wye Design Option Combination	32.72 to 43.10	31.25 to 37.34	25.31 to 31.35
Hybrid Alternative			
Hybrid Alternative, Ave 21 Wye	43.29	30.22	22.92
Hybrid Alternative, Ave 24 Wye	45.28	36.71	29.02
Acres of Other Waters Identified by Heavy Maintenance Facility Sites [a]			
Castle Commerce Center	7.46	7.91	4.38
Harris-DeJager		0.01	0.00
Fagundes	0.42	0.12	0.89
Gordon-Shaw	0.22	2.17	0.00
Kojima Development	0.11	5.54	0.00
[a]All measurements are rounded to the nearest one-hundredth.			

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

Wetland and other waters of the U.S. impacts are anticipated to occur from the Merced to Fresno HST Project and 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 of these wetlands are protected by existing federal and state laws. Although complete avoidance of wetland impacts is not possible, the project will minimize impacts to the extent possible and compensate for loss of wetland habitat (e.g., by additional restoration activities or by purchasing credits in a nearby mitigation bank) in areas where impacts cannot be avoided.

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

Table 4-7 summarizes the range of potential direct permanent and direct temporary impacts to wetlands and other waters of the U.S. by alternative and design option combinations. Direct permanent impacts to wetlands and other waters of the U.S., including vernal pools and other seasonal wetlands, are assumed to occur when these resources (1) are located anywhere in the construction footprint for at-grade segments of the alignment, or (2) are located in the approximately 60-foot-wide interior portion of the construction footprint for elevated segments of the alignment. Direct temporary impacts are assumed to occur when resources are located in the 20-foot-wide outboard portions of the construction footprint for elevated segments of the alignment. More detailed information on impacts to wetlands and other waters of the U.S., including vernal pools and other seasonal wetlands, is presented in Appendix L, *Wetland and Other Waters of the U.S. Impacts by Alternative and Design Option Combination*.

Indirect impacts to vernal pools and other seasonal wetlands will be calculated later for ESA compliance and anticipated ESA Section 7 consultations with the USFWS.

4.4 Wetland Function

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 the 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 or other Waters) with higher relative function are expected to be more sensitive to disturbance, rare in the landscape, able to perform many functions well, important for species diversity in 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 to higher functioning wetlands and other Waters.

The criteria used for the functional assessment of palustrine wetlands (vernal pools and other seasonal wetlands, freshwater marsh, and forested wetlands) and other Waters (natural and constructed watercourses, and constructed basins) assessed in winter 2011 are summarized and described below in Tables 4-8 and 4-9, respectively. Functional Assessment datasheets are provided in *Appendix M, Functional Assessment Datasheets*. Results for wetlands and waters functional assessments are summarized in Tables 4-10, *Functional Values of Accessible Palustrine Wetlands* and Table 4-11, *Functional Values of Accessible Other Waters*.

4.4.1 Assessment Description

CH2M HILL developed a project specific wetlands and other Waters functional assessment method based on the *California Rapid Assessment Method for Wetlands* (Collins et al. 2008) and *Fresno to Bakersfield Section Appendix E: Summary Presentation of Environmental Resources and Constraints for the BNSF and UPRR/SR 99 Alternative Alignments* (URS et al. 2010). Preliminary input on the overall functional assessment approach was provided by the USACE in December 2010 (pers. comm., Simmons, Z. USACE 2010). The Merced to Fresno HST functional assessment was designed to broadly characterize wetland and water resources based on their ecological significance, the range of functions they provide, and sensitivity to disturbance. The Merced to Fresno HST functional assessment is intended to be used as the basis for characterizing wetland and water function and managing these resources that may require mitigation.

Functional assessments were completed for all accessible wetlands and water features within the wetland study area in winter 2011. Offsite functional assessments were conducted on inaccessible resources, where possible, during the winter 2011 field investigation. Reconnaissance-level field observations and aerial imagery provides the basis for expanded system-wide functional discussion that includes resources in inaccessible areas.

Table 4-7
Impacts (Permanent vs. Temporary, in Acres [a]) to Wetlands and Other Waters of the U.S. by Alternative/Design Option Combinations within the Construction Footprint

High Speed Train Alternative	Vernal Pools and Other Seasonal Wetlands		Freshwater Marsh		Forested wetlands		Constructed Basin		Constructed Watercourses		Natural Watercourses	
Alignment / Design Option Combination Alternatives												
UPRR / SR 99 Alternative												
	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*
UPRR/SR 99 Alternative with West Chowchilla Design Option Combination	1.44	*0.68*	0.27	*0.23*	2.84	*1.51*	6.77	*1.04*	13.89	*2.98*	7.56	*1.84*
UPRR/SR 99 Alternative with East Chowchilla Design Option Combination	1.31 to 1.73	*0.67 to 0.76*	0.32 to 0.45	*0.20 to 0.24*	3.12 to 3.29	*1.65*	3.39 to 5.44	*0.87 to 1.53*	11.98 to 18.60	*3.69 to 3.84*	3.34 to 5.93	*2.02 to 2.18*
Total Range of UPRR / SR 99 Impacts	**1.31 to 1.73**	***0.67 to 0.76***	**0.27 to 0.45**	***0.20 to 0.24***	**2.84 to 3.29**	***1.51 to 1.65***	**3.39 to 6.77**	***0.87 to 1.58***	**11.98 to 18.60**	***2.98 to 3.84***	**3.34 to 7.56**	***1.84 to 2.26***
BNSF Alternative												
	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*
BNSF Alternative, Ave 24 Wye Design Option Combination	9.08 to 13.85	*0.99 to 2.35*	0.58 to 0.84	*0.14 to 0.21*	0.36 to 1.77	*0.06 to 0.33*	6.05 to 6.51	*1.06 to 1.19*	11.37 to 17.19	*1.49 to 2.01*	6.46 to 7.42	*3.31 to 3.95*
BNSF Alternative, Ave 21 Wye Design Option Combination	8.91 to 13.68	*1.01 to 2.37*	0.54 to 0.80	*0.13 to 0.18*	0.36 to 1.77	*0.06 to 0.33*	5.90 to 6.36	*0.56 to 0.69*	10.68 to 16.50	*0.92 to 1.44*	5.35 to 6.31	*3.07 to 3.72*
Total Range of BNSF Impacts	**8.91 to 13.85**	***0.99 to 2.37***	**0.54 to 0.84**	***0.13 to 0.21***	**0.36 to 1.77**	***0.06 to 0.33***	**5.90 to 6.51**	***0.56 to 1.19***	**10.68 to 17.19**	***0.92 to 2.01***	**5.35 to 7.42**	***3.07 to 3.95***

High Speed Train Alternative	Vernal Pools and Other Seasonal Wetlands		Freshwater Marsh		Forested wetlands		Constructed Basin		Constructed Watercourses		Natural Watercourses	
Hybrid Alternative												
	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*
Hybrid Alternative, Ave 21 Wye	4.77	*0.83*	0.32	*0.09*	3.03	*1.45*	3.38	*0.41*	19.08	*3.72*	4.32	*5.49*
Hybrid Alternative, Ave 24 Wye	4.61	*0.45*	0.20	*0.10*	2.78	*1.31*	6.05	*1.15*	15.94	*2.68*	7.48	*1.82*
Total Range of Hybrid Impacts	**4.61 to 4.77**	***0.45 to 0.83***	**0.20 to 0.32**	***0.09 to 0.10***	**2.78 to 3.03**	***1.31 to 1.45***	**3.38 to 6.05**	***0.41 to 1.15***	**15.94 to 19.08**	***2.68 to 3.72***	**4.32 to 7.48**	***1.82 to 5.49***
Heavy Maintenance Facility Alternatives [b]												
	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*	Perm.	*Temp.*
Castle Commerce Center	0	*0*	0	*0*	0.40	*0.10*	0.85	*0.29*	5.57	*0.06*	1.88	*0.14*
Harris-DeJager	0	*0*	0	*0*	0.09	*0*	0	*0*	0.31	*0*	0.08	*0*
Fagundes	0	*0*	0	*0*	0	*0*	0.09	*0*	0.76	*0*	0.18	*0*
Gordon-Shaw	0	*0*	2.21	*0.15*	0.04	*0*	0	*0*	0.27	*0*	1.67	*0.13*
Kojima Development	1.33	*0.01*	0.50	*0.19*	0	*0*	0.84	*0*	0.10	*0*	0.73	*0.18*

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

[b] Acreage presented within HMF sites includes proposed impacts associated with rail construction and the potential impact related to HMF construction. HMF impact acreages shown in this table (Table 4-7) may be higher than corresponding values in Table 4-4 (wetlands in wetland study area) and Table 4-6 (other Waters in wetland study area) as a result of construction prioritization of the rail and HMF sites, and allocation of resources when footprints and/or buffers overlap. Values reported in this impact assessment table (Table 4-7) are accurate.

Wetlands and other Waters were evaluated using functional criteria developed for the project that are specific to the resource type. Wetlands were evaluated based on hydrology and hydroperiod, hydrologic connectivity and floodplain, water quality, community complexity, habitat use, and social/recreational value. Waters were evaluated based on physical characteristics, hydrology, floodplain, chemical characteristics (water quality), biological characteristics (riparian vegetation and habitat use), and social/recreational use. These functional criteria are common parameters used in functional evaluations (Collins et al. 2008 and URS et al. 2010) and represent field indicators of system ecological integrity and sensitivity to disturbance.

Wetland and water resources are evaluated by the functional criteria specific to the feature type. Each criterion is scored as 0, 1, or 2 (0=low function, 1=moderate function, and 2=high function). The number of 0's, 1's or 2's scored for each feature are summed. The greatest quantity of each score (0, 1, or 2) determines the overall functional value and quality of the resource. Descriptions of each function and evaluation criteria are presented in Tables 4-8 and 4-9 for wetlands and other Waters, respectively.

Table 4-8
Functional Assessment Criteria for Palustrine Wetlands

Function	Functional Criteria Description		
Water Quality This function considers buffer zones and if a wetland unit has the potential to improve water quality (characteristics of surface water flow, soil type, vegetation, and ponding/inundation) and the opportunity to improve water quality (pollutant source).	***Low Water Quality (0 points)*** *WQ significantly degraded.* *Buffer: barren ground, compacted/disturbed soils.* *Potential to receive pollutants to the aquatic system evident (e.g., adjacent agriculture, roadways).* *Insufficient potential for nutrients/contaminant uptake (emergent vegetation absent).* *Impervious substrate.*	***Moderate Water Quality (1 point)*** *WQ altered.* *Buffer: fragmented, isolated from other natural habitats.* *Moderate potential to receive nutrients/toxicants to nutrient/contaminant source.* *Limited potential for nutrient/contaminant uptake (aquatic vegetation present or not).* *No impervious substrate.*	***High Water Quality (2 points)*** *WQ resembles natural conditions.* *Buffer: intact or continuous as part of a larger natural system.* *Low potential to receive nutrients/contaminants.* *Little evidence of human disturbance.* *Sufficient potential for nutrient an contaminate uptake (aquatic vegetation present).* *Fine textured substrate*
Hydrology and Hydroperiod This function considers if a wetland unit has the opportunity to reduce flooding and stream erosion (characteristics of surface water flow, depth of storage during wet periods, protection of downstream property and aquatic resources) and potential to allow patterns of filling, inundation and drying or drawdown.	***Low Hydrology and Hydroperiod (0 points)*** *HH significantly altered/artificial.* *Inundation/drawdown are significantly different from natural conditions resulting in increased or decreased magnitude and or duration.*	***Moderate Hydrology and Hydroperiod (1 point)*** *HH altered.* *Inundation or drawdown are modified resulting in a more rapid or extreme fluctuations from natural conditions.*	***High Hydrology and Hydroperiod (2 points)*** *HH resembles natural conditions.* *Natural patterns of filling, inundation and drying appear to be present.*

Function	Functional Criteria Description		
Hydrologic Connectivity and Floodplain This function considers the potential ability to allow lateral movement of floodwaters in the area surrounding the wetland.	***Low Hydrologic Connectivity and Floodplain (0 points)*** *HCF significantly altered or restricted (adjacent roads, levees).* *Lateral movement of floodwaters is extremely limited relative to regional natural conditions.*	***Moderate Hydrologic Connectivity and Floodplain (1 point)*** *HCF altered or restricted in some locations adjacent to the resource.* *Lateral movement of floodwaters is somewhat limited relative to regional natural conditions. Drainage into the resource is unobstructed.*	***High Hydrologic Connectivity and Floodplain (2 points)*** *HCF resembles natural conditions.* *Very few obstructions to lateral movement of floodwaters.* *Lateral movement of floodwaters is similar to natural regional conditions.*
Community Complexity This function considers the number of community types and vertical layers and degree of interspersion.	***Low Community Complexity (0 points)*** *One or two community types with little interspersion and limited to no structural complexity.*	***Moderate Community Complexity (1 point)*** *Two or more community types present with some degree of interspersion and tow or more vertical layers present.*	***High Community Complexity (2 points)*** *High complexity: three or more community types, interspersed with at least two or more vertical layers present.*
Habitat Use This function considers if a wetland unit has the potential to provide habitat (vegetation, surface water, richness of plant species, interspersion of habitats, special habitat features, buffers, wet corridors, priority habitats, landscape setting, indicators of reduced habitat function) as well as wildlife use.	***Low Habitat Use (0 points)*** *Low quality wildlife habitat.* *Limited wildlife resources present (forage, cover, nesting, and wading habitat).* *Located in areas of frequent human disturbance.*	***Moderate Habitat Use (1 point)*** *Moderate quality wildlife habitat.* *Moderate wildlife resources present (forage, cover, nesting, and wading habitat).* *Evidence of wildlife occurrence may be present.*	***High Habitat Use (2 points)*** *High quality wildlife habitat.* *High wildlife resources present (forage, cover, nesting, and wading habitat).* *In addition to evidence of birds mammals use; reptile, invertebrate or amphibian occurrence may be present.* *Provides critical habitat for state or federally listed wildlife species.*
Social and Recreational This function considers the potential use of the wetland for social or recreational purposes.	***Low Social and Recreational (0 points)*** *No apparent use or potential use for recreational purposes that would involve body contact (swimming) or non- body contact (fishing, hiking).*	***Moderate Social and Recreational (1 point)*** *Seasonal recreation may be possible. Degraded condition of water body.*	***High Social and Recreational (2 points)*** *Supports body contact recreation uses or non-body contact recreational uses during most of the year.*

Table 4-9
Functional Assessment Criteria for Other Waters

Function	Criteria Description		
Physical Type Considers the physical nature of the waterway in terms of whether the feature is natural (unaltered), manipulated (human-altered) or artificially created (human-made).	***Low Physical Type (0 points)*** *Artificial.*	***Moderate Physical Type (1 point)*** Manipulated (human-altered); concrete or earthen, culverted.	***High Physical Type (2 points)*** Natural (unaltered).
Water Quality Considers the potential of adjacent natural or undisturbed areas or riparian vegetation that buffer the feature from non-point source contaminants. Considers the potential for nutrient and contaminant uptake.	***Low Water Quality (0 points)*** *Water quality is significantly degraded. Buffer is barren ground, highly compacted or highly disturbed soils. Evidence of intensive human disturbance, such as agriculture land use practices that could contribute pollutants to the aquatic system. Insufficient potential for nutrients or contaminant uptake.*	***Moderate Water Quality (1 point)*** *Water quality is altered. Adjacent fragmented or reduced riparian vegetation buffers feature somewhat from non-point source nutrients and contaminants. Aquatic vegetation present or not. Limited potential for nutrients and contaminants uptake.*	***High Water Quality (2 points)*** *Water quality services resemble natural conditions. Feature is adjacent to natural areas, or undisturbed areas that buffer aquatic system from non point source contaminants. Riparian vegetation is present. Sufficient potential for nutrients and contaminant uptake.*
Hydrology This function considers if a wetland unit has the potential to reduce flooding and stream erosion (characteristics of surface water flow, depth of storage during wet periods) and if it has the opportunity to reduce flooding and erosion (protection of downstream property and aquatic resources).	***Low Hydrology (0 points)*** *Hydrology severely altered; controlled through channelization, upstream impoundments, water diversion or by engineered or mechanical means.*	***Moderate Hydrology (1 point)*** *Hydrology somewhat altered controlled through channelization, upstream impoundments, water diversion or by engineered or mechanical means resembling natural hydrologic conditions.*	***High Hydrology (2 points)*** *Hydrology closely resembles natural conditions. No alterations by upstream or downstream engineered or mechanical means.*
Floodplain The ability of water to flow into or out of adjacent wetlands, or to flood its adjacent upland areas.	***Low Floodplain (0 points)*** *Completely confined or significantly altered or reduced. Lateral movement of floodplain water is restricted or limited.*	***Moderate Floodplain (1 point)*** *Altered or reduced, but lateral movement of water may overtop existing obstructions.*	***High Floodplain (2 points)*** *No obstacles or restrictions to the lateral movement of water.*

Function	Criteria Description		
Biologic Characteristics-Riparian Corridor This function considers the potential native and nonnative riparian vegetation.	***Low Riparian Corridor (0 points)*** *No riparian vegetation present, or there are few scattered terrestrial trees; more than 30% of cover is invasive; 5 or less co-dominant species present.*	***Moderate Riparian Corridor (1 point)*** *Mostly continuous cover of native and nonnative riparian vegetation; less than 30% of cover is invasive; 6-9 co-dominant species present.*	***High Riparian Corridor (2 points)*** *Well developed riparian cover extending beyond banks of water feature; less than 15% of cover is invasive plants; 10 or more co-dominant species present.*
Biologic Characteristics-Habitat Use This function considers if a linear feature has the potential to: provide habitat for forage, cover and denning/nesting; provide habitat for a large range of species; and serve as a wildlife linkage or essential connectivity corridor. As well, this function considers if the linear feature is within a designated critical habitat or core recovery area.	***Low Habitat Use (0 points)*** *Low quality wildlife and/or fish habitat. Limited availability of wildlife resources such as forage, cover, and denning/nesting habitat. Located in areas of frequent human disturbance.*	***Moderate Habitat Use (1 point)*** *Moderate quality wildlife and/or fish habitat. Moderate availability of wildlife resources such as forage, cover, and denning/nesting habitat. Evidence of bird or mammal occurrence may be present.*	***High Habitat Use (2 points)*** *High quality wildlife and/or fish habitat. High availability of wildlife resources such as forage, cover, and denning/nesting habitat. In addition to birds and mammals, evidence of reptile and/or amphibian occurrence may be present. Part of a wildlife linkage or essential connectivity area, designated critical habitat unit or core recovery area.* *Provides critical habitat for state or federally listed wildlife species.*
Social and Recreation This function considers the potential use of the waterway for social or recreational purposes.	***Low Social and Recreational (0 points)*** *No apparent use or potential use for recreational purposes that would involve body contact (swimming) or non- body contact (fishing, hiking).*	***Moderate Social and Recreational (1 point)*** *Seasonal recreation may be possible. Degraded condition of water body.*	***High Social and Recreational (2 points)*** *Supports body contact recreation uses or non-body contact recreational uses during most of the year.*

4.4.2 Wetland Functions and Values

Wetlands differ in their functions and values. Some wetland types are common, while other area rare. Palustrine wetland have the potential to function at high, moderate or low levels depending on several characteristics vegetative structure, landscape position, disturbance levels, adjacent land uses, ponding duration, adjacency to other wetland or wet corridors, and substrate type. Examples of high, moderate, and low functioning wetlands is provided below (Collins et al. 2008, Hruby 2004).

High functioning wetlands are those that (1) represent a unique or rare wetland type; (2) are sensitive to disturbance; (3) are relatively undisturbed and contain ecological attributes that may be impossible to replace within a human's lifetime; (4) support high availability of resources for a variety of native plant or animal species, including special-status species; or (5) provide a high level of functions. Preservation of these wetlands is critical because their functions and values may be difficult to replace. Generally, these wetlands are not common and make up a small percentage of the wetlands in the region.

Moderately functioning wetlands may include (1) isolated or modified wetlands and (2) wetlands with a moderate level of functions. In general, moderately functioning wetlands have been disturbed in some way, and are often smaller, less diverse, and/or more isolated from other natural resources in the landscape than high functioning wetlands. These wetlands occur more commonly than those categorized as high wetlands, but still require a relatively high level of protection.

Low functioning wetlands have the lowest levels of functions and are often significantly disturbed. These are wetlands that should be possible to replace, and in some cases can be improved. These wetlands may provide some important functions and may include constructed basins, palustrine fringe wetlands associated with irrigation features, and other highly disturbed/managed wetland communities.

4.4.2.1 Results of Palustrine Wetland Functional Assessment

Palustrine wetland functions and values may change over time due to human and natural events. The relative functional discussion may be used to examine wetland characteristics and establish wetland contributions to the landscape and surrounding communities. Table 4-10 lists the results of the functional values of each accessible palustrine wetland within the study area based on the functional value datasheets collected in the field (winter 2011). A discussion of the relative functions and values of each palustrine wetland type in the Merced to Fresno wetland study area follows. Functional assessment datasheets for palustrine wetlands are provided in Appendix M, *Functional Assessment Datasheets*.

Vernal Pools and Other Seasonal Wetlands

Accessible vernal pools and other seasonal wetlands in the wetland study area are considered moderate to high functioning wetlands relative to other identified wetland resources in the area and commonly received a score of 1 or 2. This assessment is based primarily on the ecologically special characteristics of vernal pools, but is also supported by their potential to provide high water quality (indicators that the wetland improves water quality) and hydrologic connectivity functions, moderate hydrologic function (indicators that the wetland reduces flooding), and moderate habitat function (indicators that the wetland provides habitat). Several of the vernal pool systems in the wetland study area have been moderately to significantly disturbed or altered through land use activities. Other seasonal wetlands provide moderate water quality and hydrologic functions, moderate hydrologic connectivity, and low habitat and community complex functions. The quality of vernal pools and other seasonal wetlands identified in the wetland study area ranges from low quality where they occur in areas of active or fallow farmland (typical of the UPRR/SR 99 alignment) to high quality where they occur in grazed California annual grasslands (typical of the BNSF alignment).

Water Quality

Vernal pools and other seasonal wetlands have a high potential to improve water quality as they have no surface water outlet, frequently contain a clay or organic component in the soil surface layer, and are seasonally ponded for most of their surface area. These wetlands also have the opportunity to improve water quality where they occur adjacent to grazing, stormwater discharges, and tilled fields and orchards. These land-use activities increase pollutants in the groundwater and surface water and filtering in vernal pool wetlands may reduce these pollutant levels.

Hydrology and Hydroperiod

Vernal pools and other seasonal wetlands in the study area have a moderate potential to reduce flooding. These wetlands are characterized as lacking surface water outlets or as having intermittently flowing surface water outlets (swales). Vernal pools also store water during wet seasonal periods. These wetlands have moderate storage potential as total ponding depth may only be 6 to 12 inches. Overall, vernal pool wetlands have the opportunity to reduce flooding as these wetlands typically lack outlets and impound surface water that might otherwise flow into a river or stream that has flooding problems.

Table 4-10
Functional Values of Accessible Palustrine Wetlands

Feature Type	APN	Water Quality	Hydrology/ Hydroperiod	Hydrologic Connectivity/ Floodplain	Community Complexity	Habitat Function/ Use	Social/ Recreation Functional Value	Overall Functional Value
Vernal Pool/Seasonal Wetland	036-140-028	1	1	1	0	0-1	0	Moderate
Vernal Pool/Seasonal Wetland	027-054-046	0-1	1	0	1	1	0	Moderate
Vernal Pool/Seasonal Wetland	029-120-006	1	1	2	0	1	0	Moderate
Vernal Pool/Seasonal Wetland	029-120-006	1	2	2	0	1	0	High
Vernal Pool/Seasonal Wetland	027-054-049	1	2	1	1	0	0	Moderate
Vernal Pool/Seasonal Wetland	030-112-010	2	2	2	Could not determine due to seasonality	2	1	High
Vernal Pool/Seasonal Wetland	068-130-019	2	2	2	Could not determine due to seasonality	2	0	High
Vernal Pool/Seasonal Wetland	037-010-018	2	1	2	1	2	0	High
Vernal Pool/Seasonal Wetland	029-100-014	0	1	1	0	0	0	Low
Vernal Pool/Seasonal Wetland	029-220-004	1	1	0	0	1	0	Low/ Moderate
Vernal Pool/Seasonal Wetland	029-130-012	0	1	0	0	0	0	Low
Vernal Pool/Seasonal	068-230-033	1	0	0	0	0	0	Low

Feature Type	APN	Water Quality	Hydrology/ Hydroperiod	Hydrologic Connectivity/ Floodplain	Community Complexity	Habitat Function/ Use	Social/ Recreation Functional Value	Overall Functional Value
Wetland								
Vernal Pool/Seasonal Wetland	029-280-031	1-2	2	1-2	0	1-2	0	Moderate/ High
Freshwater Marsh	029-190-007	1	0	1	0	1	0	Low/ Moderate
Freshwater Marsh	029-220-020	1	0	1	0	1	0	Low/ Moderate
Freshwater Marsh	013-112-010	0-1	1	1-2	1	1	2	Moderate
Forested Wetland	066-110-015	1	0	2	2	1	1	Moderate
Forested Wetland	066-272-010	1	1	2	2	1	1	Moderate
Vernal Pool/Seasonal Wetland/Constructed Basin	027-054-005	1	0-1	1	0	0	0	Low
Legend: 0= Low functional Value; 1 = Moderate Functional Value; 2 = High Functional Value; 0-1 = Low to Moderate Functional Value.								

Hydrologic Connectivity and Floodplain

Hydrologic connectivity and floodplain functional value of vernal pools and other seasonal wetlands is high. There are no obstructions that would limit or restrict flood waters or connectivity.

Community Complexity

Community complexity was determined to be low or unknown since much of the vegetation was not evident during the winter 2011 winter survey. Vernal pools and other seasonal wetlands are typically one or two community types but contain high plant species richness, moderate interspersion of vegetation associations and are considered to be moderately complex. Seasonal wetlands which have been modified by land use activities exhibit fewer species and are considered to have low to moderate community complexity.

Habitat Function and Use

Vernal pools in the study area have a moderate potential to provide important habitat. These wetlands typically contain low vegetative structure, but contain high plant species richness, moderate interspersion of vegetation associations, and may be part of large wet corridors with vegetated buffers. However, other seasonal wetlands have low potential to provide important habitat due to their disturbed nature as a result of current or historic agricultural practices.

Social and Recreational Function

Vernal pools and other seasonal wetlands lack social and recreational functions and are not typically used for swimming, fishing or hiking.

Special Characteristics

Vernal pools in the study area contain special characteristics that increase their functional potential. Specifically, vernal pool systems are regarded as ecologically important in the Central Valley landscape as they provide unique and critical habitat for plants and animals, contain unique hydrologic cycles, and are important in supporting biological diversity in the region. Disturbed seasonal wetlands may not have special characteristics a result of current agricultural practices.

Freshwater Marsh

Freshwater marshes in the wetland study area are considered moderate functioning wetlands relative to other identified wetland resources in the area. These wetlands achieve moderate ecological potential largely based on their high species diversity and landscape position (fringing rivers and sloughs) adjacent to intensively cultivated agricultural fields with high pollutant inputs. The wetlands occur within highly managed (fragmented) landscape that limits their connectivity to other upland and wetland habitats. This assessment is based primarily on the potential to provide moderate to high water quality function, low to moderate hydrologic function, and low to moderate habitat function. In the wetland study area, many of the watercourses that freshwater marshes have established are used for irrigation conveyance. Irrigation and adjacent agriculture often include management practices that may degrade the freshwater marsh community by removal of riparian vegetation, grading, diversion of water, herbicide application, and nutrient inputs. Floristic composition of these wetlands is influenced by management techniques, hydrologic regimes, and topographic position within the wetland. Freshwater marsh wetlands do not typically provide social and recreational uses.

Water Quality

Freshwater marshes have a moderate to high potential to improve water quality as they trap sediment with vegetation and within localized depressions during a flood event. These wetlands also have the opportunity to improve water quality as they are adjacent to grazing, tilled fields, and orchards and intercept untreated stormwater discharges.

Hydrology and Hydroperiod

In the study area, marshes have a low to moderate potential to reduce flooding. These wetlands are characterized as having low overbank storage capacity due to ditching and levee construction. In addition, freshwater marshes lack shrub or tree cover that is beneficial in slowing down water velocities during floods. These wetlands have the opportunity to reduce flooding as they are in a location where flood storage or reduction in water velocity may protect downstream property.

Hydrologic Connectivity and Floodplain

Hydrologic connectivity of freshwater marshes lie adjacent to waters which allows for unrestricted hydrologic connectivity. However, the floodplains are somewhat restricted.

Community Complexity

Community complexity of freshwater marsh is low. These wetlands are typically one community type and not considered complex. Irrigation and adjacent agriculture often include management practices that may degrade the freshwater marsh community by removal of riparian vegetation, grading, diversion of water, herbicide application, and nutrient inputs. Floristic composition of these wetlands is influenced by management techniques, hydrologic regimes, and topographic position within the wetland.

Habitat Function and Use

Freshwater marshes in the study area have a low to moderate potential to provide important habitat. These wetlands typically contain low vegetative structure, moderate plant species richness, low to moderate interspersion of vegetation associations, and are most typically associated with disturbed wet corridors with highly disturbed vegetated buffers.

Social and Recreational Function

Freshwater marsh typically lack social and recreational functions and are not typically used for swimming, fishing or hiking.

Special Characteristics

No special characteristics were noted within the freshwater marsh communities.

Palustrine Forested Wetlands

Forested wetlands in the study area have the potential to provide moderate to high ecological function largely based on higher quality vegetative structure (tree, shrub, and herbaceous layers) and the potential to provide water quality and hydrologic improvement. Forested wetland systems are expected to retain and treat surface water at an elevated level in comparison to wetland systems that are unable to detain or slow larger quantities of surface water or experience high flow events. The system has high water quality function, high hydrologic function, and moderate to high habitat function. The forested wetlands systems in the study area have been slightly disturbed with few land use activities within the wetland system itself.

Water Quality

Forested wetlands have a moderate potential to improve water quality depending on site conditions and quantity of persistent ungrazed vegetation for most of its surface area. This wetland type has the opportunity to improve water quality as residential and agricultural areas are located adjacent to the wetland.

Hydrology and Hydroperiod

In the study area, the forested wetlands have a high potential to reduce flooding. The wetlands may retain high water from high flow events, with total ponding or highwater depths as much as 2 to 3 feet.

Hydrologic Connectivity and Floodplain

Field verified forested wetland systems either lack surface water outlets (as seen at Duck Slough) or are located on well developed floodplains (Owens Creek). These systems are expected to retain surface water at an elevated level in comparison to wetland systems that do not experience high levels of flooding they are also expected to detain larger quantities of surface water flow during floods or rain events.

Community Complexity

Forested wetlands within the study area have high vegetative structure (tree, shrub, and herbaceous layers) with three or more community types present. However, most of these wetlands are fragmented and may contain invasive species up to 20 % cover.

Habitat Function and Use

The forested wetland type is expected to have moderate potential to provide important habitat. The wetlands contain moderate to high vegetative structure, high plant species richness, and moderate interspersion of vegetation associations. Alternately, the wetlands are not part of a continuous wetland corridor with undisturbed vegetative buffers. Riparian buffers differ greatly in their disturbance level and canopy cover throughout the study area. Forested wetlands provide potential foraging, cover and/or denning/nesting habitat for common and special-status passerines and raptors, reptiles, amphibians and mammals.

Social and Recreational Function

Forested wetlands do not provide social and recreational uses. However, recreational uses, such as fishing or swimming may occur adjacent to this wetland type.

Special Characteristics

The forested wetland systems assessed were not noted contain any special characteristics that increase the functional potential.

4.4.3 Other Waters Functions and Values

A description of the three functional ratings, high, moderate, and low (Collins et al. 2008, Hruby 2004), for other Waters (natural and constructed watercourses) follows. Table 4-9 summarizes the other Waters functional assessment criteria. The assessment for water features includes the open water channel or basin and its active floodplain, plus any portions of the adjacent riparian area that are likely to be strongly linked to the channel or floodplain through bank stabilization and inputs of terrestrial detritus.

High functioning waters are those that: (1) represent natural watercourses; (2) have a well developed riparian corridor (natural and native vegetated buffer zone) with multiple vertical plant layers and co-dominants, and less than 15% of invasive species cover; (3) are relatively undisturbed and contain ecological attributes that may be impossible to replace within a human's lifetime; (4) support high availability of resources for a variety of native plant or animal species, including special-status species; or (5) are part of a wildlife linkage or essential connectivity area, designated critical habitat unit or core recovery area. Preservation of these waters is critical because their functions and values may be too difficult to replace. In general, natural unaltered waters with well developed riparian corridor performing all identified functions well are considered high functioning.

Moderately functioning waters may include (1) manipulated natural waters (2) mostly continuous riparian corridor (mostly natural and native vegetated buffer zone) with less number of vertical plant layers and co-dominants, and less than 30% of invasive species cover; (3) support moderate availability of resources for several native plant or animal species, including special-status species, that may be present; or (4) provide some possible recreational use. In general, moderately functioning waters have been disturbed in some ways, and are often less diverse than high functioning waters. Moderately functioning riverine systems may include: manipulated natural water courses, constructed water courses closely resembling natural courses and waters that perform most functions well.

Low functioning waters have the lowest levels of functions and are often significantly manipulated or constructed for agricultural purposes. These waters may provide recreational uses and limited availability of wildlife resources. These waters may provide some important functions and should be possible to restore or enhance. Low functioning waters may include significantly modified features, concrete or earthen canals, and irrigation ditches and drainages in areas with frequent human disturbances.

4.4.3.1 Results of Other waters Functional Assessment

Table 4-11 lists the results of the functional values of accessible watercourses and constructed basins within the study area. A discussion of the relative functions and values of waters in the Merced to Fresno wetland study area follows. Functional assessment datasheets are provided in Appendix M, *Functional Assessment Datasheets*.

Natural Watercourses

Majority of the accessible natural waters in the wetland study area have moderate functional value. This assessment is primarily based on their modified hydrologic integrity and disturbed conditions due to upstream impoundments or diversions for agricultural purposes. The presence of moderately fragmented riparian vegetation and in-stream wetlands somewhat buffers these systems from non-point source nutrients and contaminants. All are low-gradient systems and have reduced potential for nutrient and contaminant uptake. These systems provide moderate recreational uses and moderate habitat function.

Physical Type

Many of the natural waters are moderately disturbed. Many of these systems assessed in the study area have been confined with earthen berms primarily for agricultural access and management

Water Quality

Natural waters have the potential to provide moderate to high water quality function as a result of the presence of somewhat fragmented riparian vegetation and in-stream wetlands, which have the potential to buffer the waters from non-point source nutrients and contaminants.

Hydrology

Natural waters in the wetland study area have moderate hydrologic functional value. Many of these systems have upstream water impoundments or diversions, but resemble natural hydrologic conditions.

Floodplain

Natural waters in the wetland study area have a low to moderate functional floodplain. Most of the systems have levees that have altered or reduced the lateral movement of floodplain waters; as such, floodplains of some waters are significantly altered or reduced.

Riparian Corridor

Natural waters in the wetland study area have a moderate functional riparian corridor that buffers the watercourses. The majority contain a mostly continuous cover of native and nonnative riparian vegetation with about 30% or less cover of invasive plant species (primarily giant reed) and six to nine species of

Table 4-11
Functional Values of Accessible Other Waters

Feature Name	APN (Feature Crossing ID)	Physical Type Value	Water Quality Value	Hydrology Value	Floodplain Value	Riparian Corridor Value	Habitat Use Value	Social / Recre-ational Value	Overall Functional Value
Natural Waters									
Canal Creek	005-090-010 (010S-CaCk)	1	1	1	0	1	1-2	1	Moderate
Black Rascal Creek	Adjacent to 059-030-032 (020S-BrCk)	1	1	1	0	0	1	1	Moderate
Bear Creek	031-352-027 (030S-BaCk)	2	1	2	1	1	1	1	Moderate
Miles Creek	066-272-001	1	1	1	0	1	1	0	Moderate
Miles Creek	066-033-005 (060S-MiCk)	2	2	2	2	0	1	1	High
Owens Creek	066-272-010 (079S-OwCk)	1	1	1	1	2	1	0	Moderate
Owens Creek	066-272-007 (079S-OwCk)	2	1	1	1	2	2	0	Moderate/High
Duck Slough	000-000-000_0444 (110S-DuSl)	1	2	1	1	2	1	2	Moderate/High
Dutchman Creek	075-110-046 (211S-DtCk and 210S-DtCk)	2	1	2	1	1	1	1	Moderate
Ash Slough	026-130-013 (230S-AsSl)	2	2	2	1	2	2	2	High
Ash Slough	030-062-009 (231S-AsSl)	2	1	2	2	0	1	1	Moderate/High

Feature Name	APN (Feature Crossing ID)	Physical Type Value	Water Quality Value	Hydrology Value	Floodplain Value	Riparian Corridor Value	Habitat Use Value	Social / Recre-ational Value	Overall Functional Value
Ash Slough	025-080-012 (523S-AsSl)	1	1	1	0-1	1	1	1	Moderate
Ash Slough	025-080-004 (522S-AsSl)	2	2	2	2	1	2	1	High
Berenda Slough	026-240-027 (802S-BeSl)	2	2	2	1	1	2	1	High
Berenda Slough	026-260-012 (250S-BeSl)	2	1	2	1	1-2	2	1	High
Berenda Creek	029-190-007 (290S-BeCk)	1	0	1	1	0	2	0	Low/Moderate
Berenda Reservoir	013-112-010 (253S-BeCk)	1	1	0	1	1	2	2	Moderate
Dry Creek	029-220-020 (301S-DrCk)	1	1	1	0	1	1	1	Moderate
Dry Creek	029-280-031 (east of 302S-DrCk)	1	1	1	1	1	1	1	Moderate
Fresno River	013-120-004 (331S-FrRi)	1	0	1	1	0	0	1	Low/Moderate
Mariposa Creek	068-230-034 (1132S-MaCk)	2	2	2	2	1	1-2	1	High
Mariposa Creek	068-230-033 (312S-MaCk and 732S-MaCk)	1	1	0	1	1	1	0	Moderate
Schmidt Creek	036-065-009 (east of 310S-ScCr)	1	1	1	1	0	0	0	Moderate
Schmidt Creek	036-240-011 (310S-ScCr)	1	1	1	1	0	0	0	Moderate

Feature Name	APN (Feature Crossing ID)	Physical Type Value	Water Quality Value	Hydrology Value	Floodplain Value	Riparian Corridor Value	Habitat Use Value	Social / Recre-ational Value	Overall Functional Value
Schmidt Creek	013-240-001 (311S-ScCk)	1	1	1	1	0	1	0	Moderate
Canal Creek	Adjacent to 047-050-049 (371S-CnCk)	2	2	1	1	1	1	1	Moderate
Upland Swale	036-010-012 (320S)	2	1	2	1	0	0	0	Low
Constructed Water									
Irrigation Ditch	Adjacent to 066-272-007 (083C-KoLt)	0	0	0	0	0	0	0	Low
Irrigation Canal	068-230-033 (728C-BNo-3A)	0	0	0	0	0	0	0	Low
Irrigation Canal	Adjacent to 029-220-004 (306C-242	0	0	0	1	0	1	0	Low
Irrigation Canal	Adjacent to 026-260-012 (240C-HtLt)	0	0	0	0	0	1	0	Low
Urban Drainage Canal	007-181-004 (no crossing at this location)	0	0	0	0	0	0	0	Low
Irrigation Canal	027-020-012 (261C-CALA and 260C-CALA)	0	0	0	0	0	1	0	Low
Constructed Basin									
Constructed Basin	029-220-002	na	0	0	na	0	0	0	Low
Legend: 0= Low functional Value; 1 = Moderate Functional Value; 2 = High Functional Value; 0-1 = Low to Moderate Functional Value; 1-2 = Moderate to High Functional Value.									

co-dominant trees, shrubs and herbs present. Presence and disturbance level of riparian corridors adjacent to natural watercourse crossings is provided in Appendix K, *Inventory of Natural and Constructed Waters Crossings by Alternative.*

Habitat Use

Natural waters in the wetland study area have moderate potential for habitat use. Most of the waters provide potential foraging, cover and/or denning/nesting habitat for common and special-status passerines and raptors, reptiles, amphibians and mammals.

Social and Recreational Function

Natural waters in the wetland study area have moderate social and recreational value in which they may provide seasonal recreational uses, such as fishing and swimming.

Special Characteristics

Accessible natural waters identified during the wetland delineation do not contain special characteristics that increase their functional potential.

Constructed Watercourses

Constructed waters in the wetland study area have low functional value. This assessment is based primarily on their disturbed nature. Constructed waters are artificial and have the potential to provide low to moderate water quality function, high hydrologic function, low floodplain function, low riparian corridor function, and low to moderate habitat use function, low social and recreational use function and no special characteristics.

Similar to constructed basins described above, constructed waters are highly disturbed systems that are designed for managing surface water; thus, they have high hydrologic functional value. Management of these systems through excavation and vegetation removal have reduced the vegetative structure of these systems to bare soil, and have influenced the nutrient, nitrogen, and carbon cycles of natural riverine systems.

Physical Type

All of the constructed waters in the study area are artificial.

Water Quality

Majority of the constructed waters have a low water quality functional value as they usually lack a vegetative buffer and have highly compacted soils. Most constructed waters are located adjacent to agricultural areas, which could contribute pollutants to the watercourse. There is usually insufficient potential for nutrient and contaminant uptake as a result of the lack of emergent or riparian vegetation.

Hydrology

Constructed systems have high hydrologic function and were primarily for the conveyance of agricultural irrigation water. They are controlled through channelization. Many of the canals convey water diverted from and discharge water into the natural drainage features.

Floodplain

Overall, constructed waters in the study area have low functioning floodplains. Constructed waters have a low potential to reduce flooding as these features are completely confined by berms that restricted the lateral movement of water.

Riparian Corridor

Constructed waters in the study area have low riparian corridor function. No riparian vegetation is present along constructed waters. Scattered emergent vegetation is present within few constructed systems, but most of the canals are routinely cleared of vegetation and/or sprayed with herbicides.

Habitat Use

Constructed watercourses were assessed to have low potential for habitat use and the potential to provide important habitat. These systems typically lack vegetation or contain low vegetative structure, low plant species richness, low interspersion of vegetation associations, and are considered highly disturbed systems ecologically. Earthen constructed waters may provide low to moderate potential for foraging, wildlife movement, cover and/or denning/nesting habitat for common small mammals and burrowing owl.

Social and Recreational Function

Constructed waters have low social and recreational function. There are no apparent uses or potential use for social or recreational purposes that would involve body contact, such as swimming, or non-body contact, such as fishing or hiking.

Special Characteristics

Constructed waters identified during the wetland delineation do not contain special characteristics that increase their functional potential.

Constructed Basins

Constructed basins in the wetland study area are considered to be low functioning resources. This assessment is based primarily on their disturbed and constructed nature. Constructed basins have the potential to provide low to moderate water quality function, high hydrologic function, and low habitat function. Despite some higher functioning characteristics (water quality and hydrologic function), constructed basins are highly disturbed constructed wetland systems that are utilized for surface water management. These systems may function in capacity similar to natural wetlands (water storage and some water quality benefits); however, their excavated substrates may not reflect hydric wetland soil (organic and clay component) conditions, and may lack the persistence in the environment that promotes habitat function and nutrient cycling found in natural and unmanaged systems. Management of these systems through excavation and vegetation removal may reduce vegetative structure to bare soil and influence nutrient, nitrogen, and carbon cycles present in natural wetland systems. Constructed basins do not provide social and recreational uses.

Water Quality

Constructed basins have a low to moderate potential to improve water quality as they may contain a restricted surface water outlet and are seasonally ponded for most of their surface area. However, basins may lack persistent ungrazed vegetation. These wetlands have the opportunity to improve water quality as they may occur adjacent to polluting land-use activities and receive untreated stormwater inputs.

Hydrology and Hydroperiod

Constructed basins have a high potential to reduce flooding. These basins contain intermittently flowing surface water outlets with ponding depths ranging from 2 to 4 feet. Constructed basins are created to manage surface water and have the potential to reduce flooding.

Hydrologic Connectivity and Floodplain

Constructed basins are created to have high hydrologic connectivity and unrestricted movement of surface water.

Community Complexity

The community complexity of constructed basins is mostly low. These 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.

Habitat Function and Use

Constructed basins have a low potential to provide important habitat. These wetlands typically contain low vegetative structure, low plant species richness, low interspersion of vegetation associations, and are considered highly disturbed systems ecologically.

Social and Recreational Function

Constructed basins do not provide social and recreational uses.

Special Characteristics

Constructed basins identified during the wetland delineation do not contain special characteristics that increase their functional potential.

5.0 Discussion

Wetland types identified in the wetland study area (23,568.19 acres) include palustrine wetlands (129.08 acres) such as vernal pools and other seasonal wetlands (83.47 acres), freshwater marshes (13.62 acres), and forested wetlands (31.99 acres). Vernal pools are important as special-status species habitat. Non-wetland waters investigated in the wetland study area include natural and constructed watercourses, and constructed basins. Natural watercourses (116.92 acres) include rivers, creeks, and sloughs, while constructed watercourses include primarily agricultural canals, ditches, and drains (123.92 acres). Constructed basins (66.69 acres) include constructed features such as agricultural ponds, tailwater ponds, and retention ponds. All wetlands and other waters of the U.S. identified in the wetland study area are considered jurisdictional based on the Preliminary Jurisdictional Determination as described in the Jurisdictional Determinations, Regulatory Guidance Letter (USACE 2008b).

5.1 Wetlands and Other Waters of the U.S. Present in Wetland Study Area by Alternative

Presence of wetlands and other waters of the U.S. within the wetland study area by alternative and design option combinations are presented in Table 4-4 and 4-6 and Appendix H, *Total Range of Wetlands and Other Waters of the U.S. by Alternative*.

Overall, the range of existing wetland acreage within HST alternatives and design option combinations is relatively low in comparison 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 and other seasonal wetland, freshwater marsh, and forested wetlands) occurs within the BNSF Alternative and design option combinations. The BNSF Alternative with Ave 24 Wye combination (9,311 acres total within combination) contains a range of 46.23 to 63.42 acres of wetland resource and 95.41 to 117.92 acres of other waters (Tables 4-4 and 4-6). The BNSF Alternative and design option combination with Ave 21 Wye (8,698 acres within alternative combination) contains a range of 49.54 to 66.52 acres of wetland resources and 89.28 to 111.79 acres of other waters (Tables 4-4 and 4-6).

Analysis by resource (Table 4-4) type indicates that acreage of vernal pools and other seasonal wetlands may be greatest in the BNSF Alternative and design option combination with Ave 21 Wye (42.80 to 49.45 acres) with similar acreage reported for the BNSF Alternative with Ave 24 Wye (40.63 to 47.28 acres). The fewest acres of vernal pools and other seasonal wetlands are reported within the UPRR/SR 99 Alternative with the West Chowchilla combination (3.60 acres) and in the UPRR/SR 99 Alternative with the East Chowchilla design option combination (4.41 to 4.89 acres). Moderate vernal pool and seasonal wetland acreage is reported in the Hybrid Alternative with Ave 21 Wye combination (17.79 acres) and the Hybrid Alternative with Ave 24 Wye combination (13.47 acres).

Acreage of freshwater marsh is potentially greatest within the BNSF Alternative with Ave 21 Wye (4.13 to 5.65 acres; Table 4-4) and within the BNSF Alternative with Ave 24 Wye (3.19 to 4.72 acres). The fewest acres of freshwater marsh are located within the Hybrid Alternative with Ave 24 Wye combination (1.36 acres). The Hybrid Alternative with Ave 21 Wye contains 2.50 acres of freshwater marsh. The UPRR/SR 99 Alternative with the West Chowchilla design option combination contains 1.59 acres of freshwater marsh and the UPPR/SR 99 Alternative with the East Chowchilla design option combination has slightly higher acreage associated with it (1.40 to 2.96 acres).

Forested wetland acreage is greatest in the BNSF alternatives and design option combinations (up to 11.42 acres reported for both the Ave 24 and Ave 21 wyes; Table 4-4). However, the BNSF alternatives may also, depending on the combination, contain the fewest acres of forested wetland resource (as low as 2.61 acres). Outside of the BNSF alternatives, similar acreage of forested wetland is reported for the Hybrid and UPRR/SR 99 alternatives combinations. The Hybrid Alternative with Ave 24 Wye contains 6.22 acres of forested wetlands, while the Hybrid Alternative with Ave 21 Wye contains 6.45 acres. The UPRR/SR 99 Alternative with the East Chowchilla design option combination contains 7.23 to 8.28 acres of forested wetland while the UPRR/SR 99 Alternative with the West Chowchilla design option contains 6.68 acres of forested wetland (Table 4-4).

The extent of natural waters located within all of the alternatives and design option combinations shows a high level of overlap (Table 4-6). The greatest natural waters acreage is associated with the BNSF Alternative with Ave 24 Wye combination, which includes 34.55 to 40.64 acres of natural waters, while the BNSF Alternative with Ave 21 Wye combination contains 31.25 to 37.34 acres. The UPRR/SR 99 Alternative with the West Chowchilla design option combination includes 38.54 acres of natural waters, while the UPRR/SR 99 Alternative with the East Chowchilla design option includes a range of 24.63 to 35.96 acres. The Hybrid Alternative with Ave 24 Wye combination includes 36.71 acres of natural waters and the Hybrid Alternative with Ave 21 Wye combination contains 30.22 acres of natural waters.

Similarly, constructed waters are somewhat equally extensive among the alternative combinations. The greatest quantity of constructed watercourses is reported within the Hybrid Alternative with Ave 24 Wye (45.28 acres), while the Hybrid Alternative with Ave 21 Wye includes 43.29 acres. Moderate acreages of constructed waters are reported within the BNSF Alternative with Ave 21 Wye combination (32.72 to 43.10 acres), the BNSF Alternative with Ave 24 Wye combination (31.75 to 42.13 cares), the UPRR/SR 99 Alternative with the East Chowchilla design option combination (32.02 to 41.94 acres), and the UPRR/SR 99 Alternative with the West Chowchilla design option combination (38.22 acres) (Table 4-6).

Constructed basin acreage is potentially greatest within the BNSF Alternative with Ave 24 Wye combination (29.11 to 35.15 acres) while the BNSF Alternative with Ave 21 Wye combination includes 25.31 to 31.35 acres of constructed basins. The UPRR/SR 99 Alternative with the West Chowchilla design option combination contains moderate quantities of constructed basin acreage (31.66 acres), while the UPRR/SR 99 Alternative with the East Chowchilla design option combination includes 23.76 to 26.53 acres of constructed basin. The Hybrid Alternative with Ave 24 and Ave 21 Wye combinations contain 29.02 acres and 22.92 acres, respectively.

Mapping and analysis of wetlands and other Waters associated with each of the potential HMF sites shows that the Gordon-Shaw and Kojima Development sites contain the greatest acreage of freshwater marsh (2.94 and 2.13 acres, respectively; Table 4-4). The remaining HMF sites do not contain any freshwater marsh features. Vernal pools and other seasonal wetlands are most extensive at the Castle Commerce Center (1.32 acres) and Kojima Development (1.54 acres) HMF sites. Forested wetlands are greatest at the Castle Commerce Center (1.29 acres), and less extensive at the Gordon-Shaw HMF site (0.31 acre) (see Table 4-4).

Pertaining to the HMF sites, natural watercourses are most extensive at the Castle Commerce Center and the Kojima Development HMF sites (7.91 and 5.54 acres, respectively: Table 4-6), with the Gordon-Shaw HMF site including 2.17 acres of natural watercourses. Constructed water features are most extensive at the Castle Commerce Center (7.46 acres), and much less extensive at the other five potential HMF locations. The greatest acreage of constructed basins is identified at the Castle Commerce Center (4.38 acres), with the Fagundes site containing 0.89 acre of this wetland type (Table 4-6).

5.2 Wetlands Impacts by Alternative

Anticipated permanent impacts on wetlands and other Waters associated with Alternative and design option combinations are presented in Table 4-7 and Appendix L, *Wetlands and Other Waters of the U.S. Impacts by Alternative and Design Option Combination*. Analysis of wetlands and other Waters that intersect the construction footprint indicate the following:

- The BNSF Alternative with Ave 24 Wye and design option combination has the greatest potential for permanent impact to vernal pools and other seasonal wetlands (9.08 to 13.85 acres; Table 4-7). In addition, the BNSF Alternative with Ave 21 Wye combination also has higher vernal pool permanent impacts (8.91 to 13.68 acres). The BNSF Alternatives regardless of design combination also has the greatest direct impact to freshwater marsh (0.58 to 0.84 acres for the BNSF Alternative with Ave 24

Wye combination and 0.54 to 0.80 acres associated with the BNSF Alternative with Ave 21 Wye combination).

- The UPRR/SR 99 Alternative with the East Chowchilla design option combination and the Hybrid Alternative with Ave 21 Wye combination both have the greatest potential to impact forested wetlands (3.12 to 3.29 acres for the UPRR/SR 99 Alternative with the East Chowchilla design option combination and 3.03 acres for the Hybrid Alternative with Ave 21 Wye). The least forested wetland impacts are associated with the BNSF Alternative design combinations (0.36 to 1.77 acres for both the BNSF Alternative with the Ave 24 and Ave 21 Wye combinations).

- Permanent impacts to constructed basins are greatest along the UPRR/SR 99 with the West Chowchilla design option combination (6.77 acres). However, most of the remaining alternatives have similar upper ranges of proposed impact with the exception of the Hybrid Alternative with Ave 21 Wye combination (3.03 acres of expected impact).

- Permanent impacts to natural watercourses are similar among all alignment alternatives with the greatest quantity of impacts associated with the UPRR/SR 99 Alternative with the West Chowchilla design option combination (7.56 acres), the Hybrid Alternative with Ave 24 Wye (7.48 acres), and the BNSF Alternative with Ave 24 Wye combination (6.46 to 7.42 acres; Table 7-4).

- Impacts to constructed watercourses are greatest along the Hybrid Alternative with Ave 21 Wye (19.08 acres). The UPRR/SR 99 Alternative with the East Chowchilla design option combination (11.98 to 18.60 acres) and the BNSF Alternative with Ave 21 Wye combination (11.37 to 17.19 acres) also have the potential to impact greater acreage of constructed watercourses in comparison to the remaining alternatives. The least impact to constructed watercourses is associated with the UPRR/SR 99 Alternative with the West Chowchilla design option combination (13.89 acres) or potentially the BNSF Alternative with Ave 21 Wye combination (10.68 to 16.50 acres).

- The Castle Commerce Center HMF site has the greatest permanent impact to forested wetlands (0.40 acres), natural watercourses (1.88 acres), and constructed watercourses (5.57 acres).

- The Gordon-Shaw HMF site contains the greatest permanent impact to freshwater marsh (2.21 acres).

- The Kojima Development HMF contains the greatest permanent impacts to vernal pools and other seasonal wetlands (1.33 acres).

6.0 References

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