CALIFORNIA
High-Speed Rail Authority

January 27, 2012

Mr. Zachary Simmons
U.S. Army Corps of Engineers
1325 J Street
Sacramento, CA 95814

Subject: Recommendation Regarding Western Madera Alternative (A3) Screening Based on the "HST Merced to Fresno Section Western Madera (A3) Alternative Screening Memorandum Point 1: Waters of the United States Impacts Analysis"

Dear Mr. Simmons:

We appreciate the opportunity to provide a screening recommendation for the Western Madera Alternative (A3) as discussed with Mike Jewell and Paul Maniccia during our meeting on December 19, 2011. At that time, we discussed preparation of the screening memo in two steps, the first addressing waters of the United States impacts and the second, if needed, addressing practicability, other environmental factors, and other direct, indirect, and cumulative impacts. Today, we are submitting to you the *HST Merced to Fresno Section Western Madera (A3) Alternative Screening Memorandum Point 1: Waters of the United States Impacts Analysis* (Memorandum; Attachment 1) and the *Final Outline for Preparing a Technical Memorandum Evaluating the Western Madera Alternative (A3) and Documenting Screening of A3 Consistent with EPA's Section 404(b)(1) Guidelines* (Attachment 2). This letter provides the recommendation for screening A3 from further analysis in the EIR/EIS.

Based on the analysis and results contained in the Point 1 Memorandum, the Authority believes A3 does not warrant further consideration for detailed analysis in the Merced to Fresno Section High-Speed Train Project Environmental Impact Report/Environmental Impact Statement (EIR/EIS) and does not have the potential to be the least environmentally damaging practicable alternative (in terms of compliance with EPA's Section 404(b)(1) Guidelines (40 CFR Part 230)) for the Merced to Fresno Section High Speed Train Project.

The results of the Point 1 Analysis indicate that construction of A3, even without an associated frontage road, would result in direct impacts to approximately 39 acres of Waters of the United States. This is at least 13 acres greater than the direct impacts to waters of the United States associated with the BNSF (A1) and UPRR/SR 99 (A2) alternatives, and approximately 15 acres greater than the Hybrid Alternative. A summary of the direct waters of the United States impact acreages reported in the Point 1 Analysis is provided in the table below. Although not specifically used in screening, the indirect impact to waters of the U.S. for each alternative is also presented.

Summary of Waters of the U.S Potentially Impacted (Acres)							
	Alternative/Design Option Combination						
Impact Type	A1 with Mariposa Way	A1 with Mission Ave	A2 with West Chowchilla	A2 with East Chowchilla	Hybrid	A3 (without Frontage Road)	A3 (with Frontage Road)
Direct	**22.30**	**25.53**	**21.47**	**13.08**	**23.56**	**39.23**	**39.94**
Indirect	87.37	82.19	64.26	47.42	76.59	66.55	66.65
Total	109.67	107.72	85.73	60.50	100.15	105.78	106.59

The Point 1 Analysis concludes that A3 would have lesser impacts on vernal pool complexes than the A1 and Hybrid alternatives and substantially greater impacts on irrigation canal and ditch features than all of the other proposed alternatives. Pursuant to the preamble discussion in the USACE and EPA 2008 Mitigation Rule (Department of Defense regulations at 33 CFR Parts 325 and 332; EPA regulations at 40 CFR Part 230) regarding the importance of recognizing the services provided by aquatic resources, the Authority believes the irrigation service provided by the canal and ditch features in the project area should be equally weighted with the ecological functions provided by the aquatic resources in the waters of the U.S. categories that would be affected.

A3 would therefore have measurably greater total direct impact acreages, as well as greater effects on the comparative functions and services of the aquatic environment, when compared to A1, A2, and the Hybrid Alternatives.

Based on the this information we hereby request USACE and EPA concurrence that the Point 1 analysis presents sufficient information consistent with EPA's Section 404(b)(1) Guidelines to support the elimination of A3 from further analysis based on potential impacts to waters of the United States. Based on discussions held in our meeting on December 19, your concurrence would preclude the need for submittal of the Point 2 (Practicability), Point 3 (other significant adverse impacts on environmental factors described in 404(b)(1) Guidelines Subparts C-F), and Point 4 (other direct, indirect and cumulative effects) analyses.

Thank you for your consideration of this request. We look forward to hearing from you.

Sincerely,

Mark A. McLoughlin
Interim Deputy Director, Environmental Planning
California High-Speed Rail Authority

cc: Michael Jewell and Paul Maniccia, USACE
Jason Brush, Sarvy Mahdavi and Rich Sumner, EPA
David Valenstein and Melissa DuMond, FRA

HST Merced to Fresno Section Western Madera (A3) Alternative Screening Memorandum Point 1: Waters of the United States Impacts Analysis

PREPARED BY: Jeff Tupen/CH2M HILL

REVIEWED BY: Lisa Mangione/AECOM
Ken Bogdan/ICFI

PREPARED FOR: California High-Speed Rail Authority

COPY TO: Jodi Ketelsen/CH2M HILL
Karin Lilienbecker/CH2M HILL

DATE: January 27, 2012

This technical memorandum (TM) serves as Point 1, Waters of the United States Impact Analysis, for the Western Madera Alternative (A3) Screening Memorandum. This TM was prepared in accordance with a draft A3 screening memorandum outline, dated December 23, 2011, provided to staff of the U.S. Environmental Protection Agency (EPA) and U.S. Army Corps of Engineers (USACE). This TM is consistent with comments received from the two agencies.

Objectives of Analysis

Based on a request for additional information to support the evaluation and screening of the Western Madera Alternative (A3), consistent with EPA's Section 404(b)(1) Guidelines and the National Environmental Policy Act, this TM calculates the direct and indirect impacts related to the potential waters of the United States within the A3 project footprint. The objective of this TM is to present the relative aquatic resource impacts of A3 consistent with and in comparison to the impact acreages of the alternatives analyzed in detail in the Merced to Fresno Section High-Speed Train Project Environmental Impact Report/Environmental Impact Statement (EIR/EIS). These other alternatives included the BNSF Alternative (A1), UPRR/SR 99 Alternative (A2), and Hybrid Alternative.

Analytical Approach

For the purposes of this analysis, the approach for quantifying and comparing potential impacts of the Merced to Fresno Section of the California High-Speed Train (HST) Project on waters of the United States relies on three primary variables and processes: 1) defining and describing the project footprint area for each alternative and associated design options; 2) identifying aquatic resources to be assessed for impacts; and 3) establishing "zones" to quantify and describe potential direct and indirect impacts on the identified aquatic resources.

For this analysis, it was assumed that direct impacts associated with construction, operation, and maintenance activities would occur within the boundaries of the 100-foot-wide construction footprint; indirect impacts were defined as those impacts that would occur within 250 feet of the construction footprint (i.e., the wetland study area [WSA] of EIR/EIS). Indirect operation impacts and impacts related to growth inducement were not considered in this analysis.[1]

[1] Although it had previously been suggested that it may be relevant to include "growth inducement impacts" in the calculation of potential impacts on waters of the United States particularly because the A3 alignment would traverse primarily undeveloped areas, the Regional Consultant (RC) team concluded that, due to the difficulty of obtaining specific on market-based data, the 10- and 20-50 year growth-inducement projections for the A3 were not used in quantifying the impacts to waters of the U.S. in this memorandum. It should be noted, however, that In the Central Valley, development can generally be seen to follow existing transportation corridors. This pattern may generally show how land use responds to establishment of transportation corridors in this region. Although transportation is a key attraction for development prospects, development is the product of additional variables outside the controls of the HST Project planning. Development is dependent on local jurisdictional land use controls, market drivers, development interests, and willing land sellers. It can be generally stated that the local jurisdiction of Madera County is a pro-growth entity and has opened areas to development outside of growth planning areas in the past. In fact, there are enough approved land development plans to provide for projected growth through 2035. Based on development patterns and discussions with farmers on the implications of a new HST corridor in the area, barriers on farming operations in the form of major land divisions such as would be created by the proposed train corridor, weaken marginal farming market profits and therefore weaken farming interests. Barriers also result in the need for additional equipment, irrigation infrastructure, and additional work forces to produce the same

Tables identifying the types, acreages, and functions and services of aquatic features associated with each alternative are provided to allow an assessment of relative impacts.

This TM analyzes two design options for A1, two design options for A2, the Hybrid Alternative, and A3 configured both with and without a frontage road. Although the frontage road is considered part of the project, "A3 – no frontage road" and "A3 – frontage road included" scenarios have been separated for the purposes of this analysis to allow the reader to see that the frontage road has a relatively minor contribution to waters of the United States impacts (i.e., A3 would have greater total impacts on waters of the United States compared to the other alternatives even without construction of the frontage road). As such, seven variations of the alternatives are evaluated in this TM (Figure 1):

- A1 – BNSF Alternative (with the Mariposa Way design option)
- A1 – BNSF Alternative (with the Mission Ave design option)
- A2 – UPRR/SR 99 Alternative (with the East Chowchilla design option)
- A2 – UPRR/SR99 Alternative (with the West Chowchilla design option)
- Hybrid Alternative (no design options)
- A3 – Western Madera Alternative (no frontage road)
- A3 – Western Madera Alternative (frontage road included)

For the purposes of this analysis, construction of a frontage road adjacent to A3 was considered part of the project, as it has been confirmed with the Project Management Team that the road would be built or contracted by the California High-Speed Rail Authority (Authority).[2] To calculate potential indirect impacts on waters of the United States associated with the frontage road, a typical two-lane county road cross section with a 60-foot right-of-way was assumed. The analysis in this TM includes the effects associated with the construction of a 15-mile-long frontage road, which would be located on the east side of A3 between Avenue 12 to the south and SR 152 to the north. Avenue 12 has an interchange connection with SR 99 and provides the logical connection between SR 99 and the A3 route.

This approach was applied equally to all alternatives to eliminate bias in our analysis. With this approach and assumptions, relative interpretations are meaningful. Finally, results from this analysis may not be consistent with results reported elsewhere because the data are limited in spatial coverage and designed specifically for a landscape-level comparison of the impacts on waters of the United States associated with the alternative configurations.

Establishing Aquatic Resource Impact Areas for Analysis

To be consistent with the Merced to Fresno Section EIR/EIS analysis, the centerline of each alternative alignment is used as the basis for the north-south alignment layout. A 100-foot-wide direct impact area is centered on each alternative alignment centerline. Since this project requires 100% grade-separation,[3] standard roadway overcrossing footprints were included where necessary.

A 100-foot-wide area is the representative construction footprint for the at-grade track profile. For the purposes of this analysis, all impacts are assumed to be permanent. Direct impacts and indirect impacts were quantified relative to the 100-foot-wide construction footprint (includes road crossing footprints), and to the 250-foot-wide indirect impact zone, respectively (Figure 2). All aquatic resources were clipped (i.e., limited) to either the project footprint or to the indirect impact zone using geographic information system (GIS) data. Aquatic features or portions of features occurring within the construction footprint were considered directly impacted. Aquatic features or portions of features that were within the indirect impact zone were assumed to be indirectly impacted.

product returns. These factors may make farmers more receptive to market development pressures, potentially resulting in conversion of agricultural land to commercial or residential development. However, estimating the acreages that may potentially be converted from agriculture to other land uses in projected timeframes, and linking such development to impacts on waters of the United States, would be difficult and highly speculative. Consequently, such projections are not included in this analysis.

2 The Western Madera Alternative (A3) does not follow existing transportation corridors and proceeds generally in a northwesterly to southeasterly direction through rural agricultural lands. As such, construction of the Western Madera Alternative (A3) would require construction of a frontage road to access HST overcrossing points at existing east-west roadways that would be crossed by the Western Madera Alternative (A3).

3 There are no intersections between the HST and other traffic. The HST is located below ground level, at ground level, or elevated above ground level.

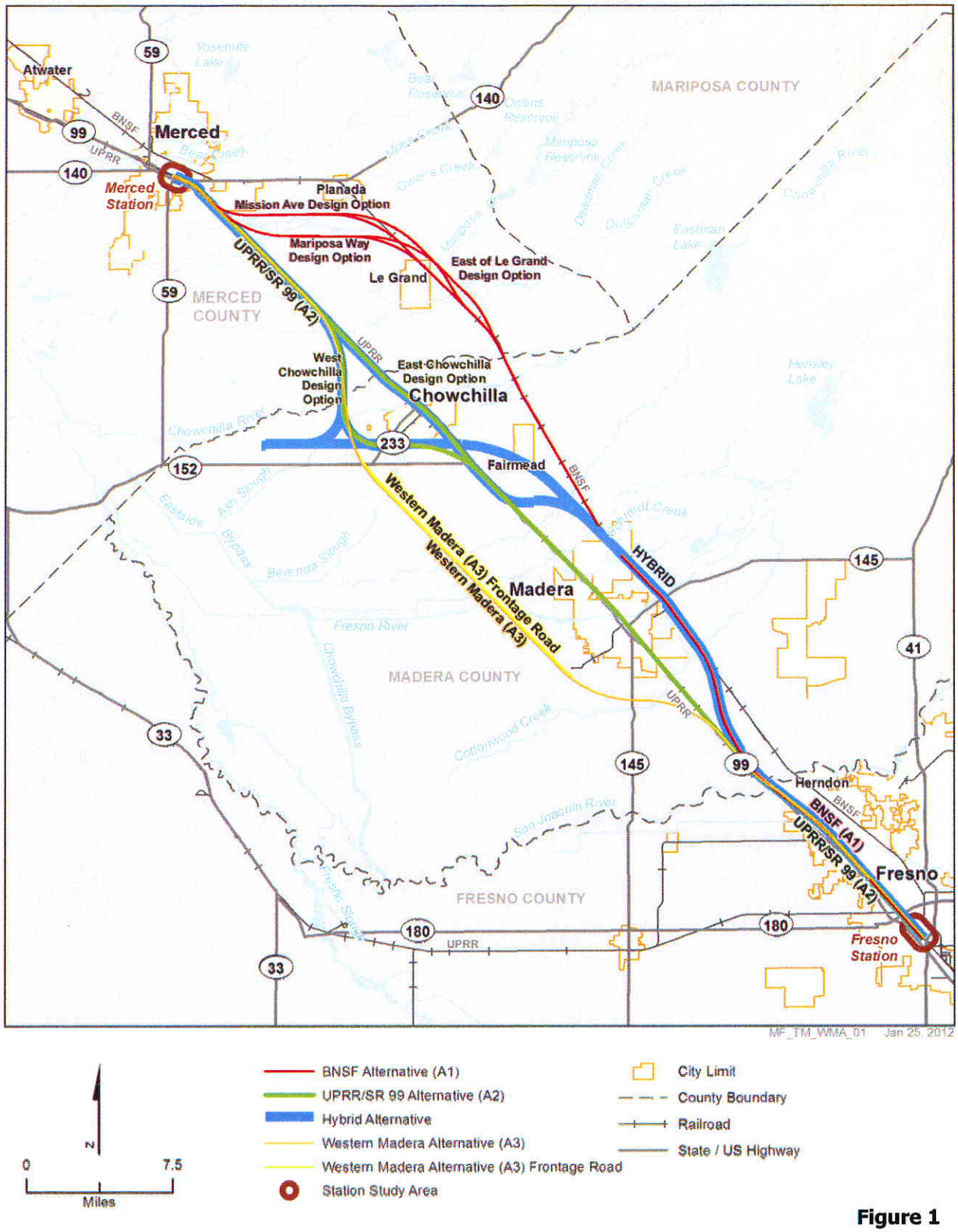

Figure 1
Alternative Variations Analyzed in this Technical Memorandum

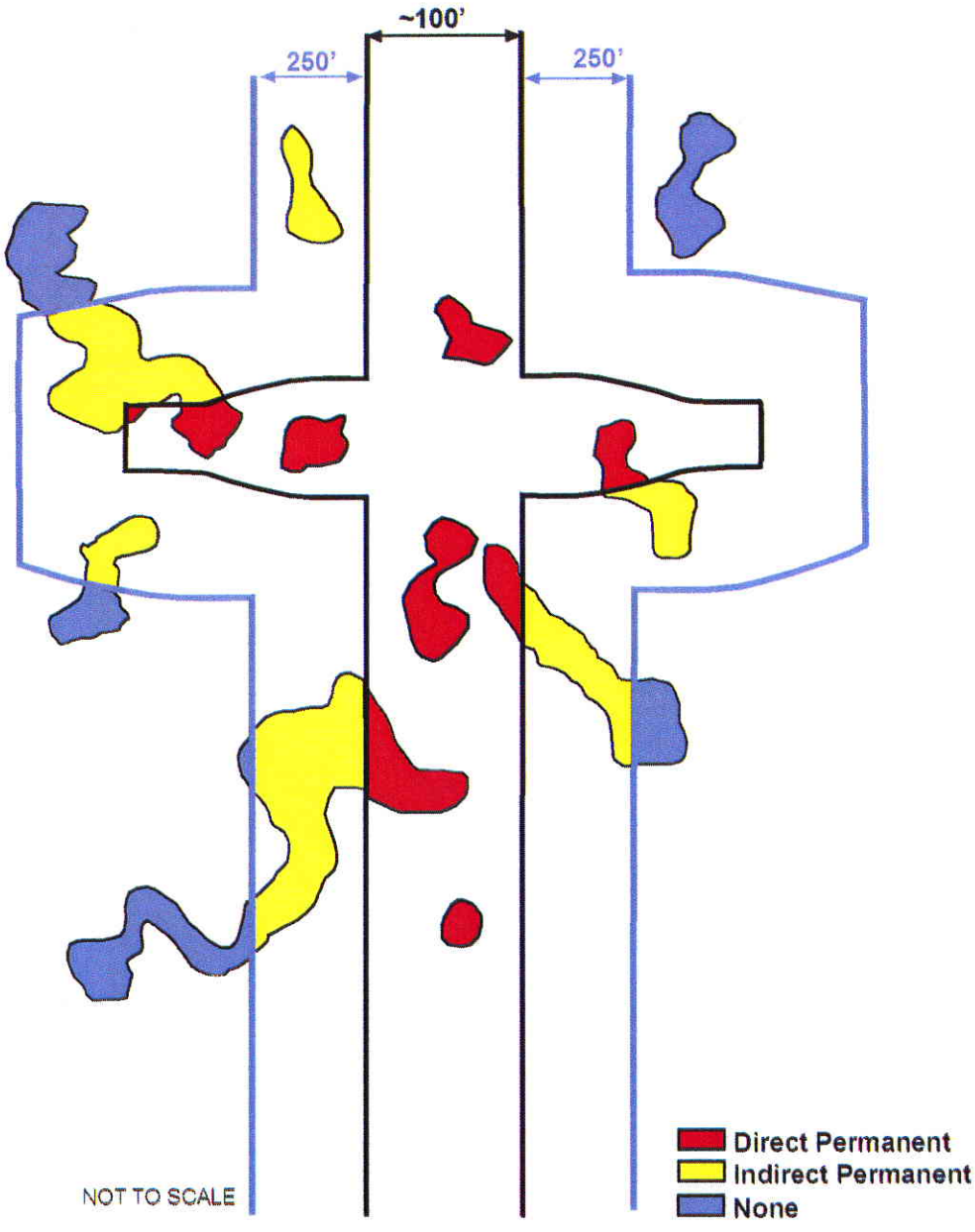

Figure 2
Impact Calculation Model used in this Technical Memorandum

Identifying Aquatic Resources for Analysis

Three data sources were used to identify aquatic resources for purposes of this analysis. They are the National Wetlands Inventory (NWI) dataset (USFWS 2012), the National Hydrography Dataset (NHD) (USGS 2010a,b), and the Holland vernal pool complex dataset (BIOS 2009).

National Wetland Inventory Dataset

The NWI dataset represents the extent, approximate location, and type of wetlands and deepwater habitats in the conterminous United States. These data delineate the areal extent of wetlands and surface waters as defined by Cowardin et al. (1979). The NWI dataset for this analysis was accessed in January 2012. The NWI metadata did not identify when this dataset was last updated.

National Hydrography Dataset

The NHD is a comprehensive set of digital spatial data that encodes information about naturally occurring and constructed bodies of water, paths through which water flows, and related entities. The information encoded about these features includes classification and other characteristics; geographic names; positions, lengths, and areas; "reach codes" through which other information can be related to the NHD; and the direction of water flow. This dataset was also accessed in January 2012, and was last updated in October 2011.

Constructed ditches and canals are reported by the NHD in linear feet. To convert these distance units to area units, GIS was used to calculate the average field-collected canal/ditch widths associated with A1, A2, and the Hybrid Alternative (field data were not available for A3). The resulting average feature width was approximately 25 feet. Therefore, for the purposes of this analysis, canal/ditch features associated with A3 were assumed to be approximately 25 feet in width. Average feature widths and intersected lengths were then converted to acres for tabulation. The abundance of canal/ditch features by alternative are reported in Table 1 (located at the end of this document) in both units of linear feet and acres.

For this analysis, all irrigation and drainage canals and ditches are considered waters of the United States To estimate what proportion of ditch/canal features were potentially lined versus unlined, GIS was used to view a sample of canal/ditch features intersected by the project alternatives (excluding A3 with and without frontage road)and categorized each feature as "Lined," "Unlined," "Indeterminate," or "Other" based on image inspection, as described below:

- "Lined" features were those constructed watercourses with obvious impermeable (e.g., concrete) linings. These features lacked in-channel vegetation.
- "Unlined" features were those lacking an obvious lining as described above, with in-channel vegetation.
- In most cases, "Indeterminate" features were those that were obscured by vegetated cover. As such, "Unlined" and "Indeterminate" categories were combined into a single category, "Unlined/Vegetated," for analysis.
- Features were assigned to "Other" if they could not be assigned to the "Lined," "Unlined," or "Indeterminate" categories.
- Features identified as "Lined" or "Other" were combined into a single group for analysis ("Lined/Other"), as both of these categories lacked vegetation when inspected using April and July 2011 imagery.

Application of Holland Data

Holland vernal pool complex data was included in this analysis, despite the broad scale of reported data (minimum mapping units of 40 acres). This dataset represents coverage of vernal pool habitat in California's Central Valley in 2005. To overcome the potentially confounding influence of large and dated Holland-based vernal pool data (which are reported in 40-acre minimum mapping units), field-collected vernal pool data from A1, A2, and the Hybrid Alternative (with design options) were used and the field abundance of vernal pool resources along A3 (both design options) were estimated. This was accomplished by calculating the proportion of field-collected vernal pool (VP_F) data to Holland-based vernal pool data (VP_H) for all alternative/design option combinations except A3. The mean proportion for these ratios was then calculated, and this mean ratio was multiplied by the Holland-based vernal pool data for both of the A3 design options.

The vernal pool complex features that were considered extirpated were also removed from the Holland dataset.[4] Holland (2009) used aerial photograph interpretation to map the extent of vernal pool habitat in the Central Valley using 2005 imagery, and compared these maps to those previously generated for the period 1976 to 1995, and for 1997. Vernal pool complexes that have been converted to other land uses since the noted baseline work are not included in the current analysis. Both field-estimated (Table 1) and Holland-based vernal pool data (Table 2) are reported in this TM for the reader's reference.

Categories or types of aquatic features (waters of the United States) resulting from queries of these data sources are as follows:

- Vernal pool/swale complexes
- Freshwater emergent wetland
- Freshwater forested/shrub wetland
- Freshwater pond
- Lake
- Riverine
- Canal/ditch
- Other[5]

Analysis Results

Waters of the United States Impact Acreages

Table 1 presents the results of the analysis. A1 with the Mariposa Way design option would affect approximately 110 acres of waters of the United States (22 acres direct, 87 acres indirect). Potential impacts of this alignment are very similar to those for A1 with the Mission Ave design option, with approximately 42 acres of vernal pools, 25 acres of riverine, and 7 acres of freshwater emergent wetland potentially affected. Unlike the Mission Ave design option, the Mariposa Way design option would potentially impact almost 8 acres of freshwater forested/shrub wetland habitat. This alternative has the fewest acres of canal/ditch impacts (less than 30,000 linear feet of canal/ditch features).

The Mission Ave design option of A1 would potentially affect approximately 108 acres of waters of the United States (26 acres direct, 82 acres indirect). This alternative and design option (along with A3) would potentially impact more freshwater emergent wetlands than other alternatives. Like A1 with the Mariposa Way design option, this alternative impacts more lakes and vernal pool complexes than the other alternatives. A1 (both design options) would also impact more acres of riverine features than other alternatives (with the exception of the Hybrid Alternative). No impacts on freshwater forested or freshwater scrub/shrub wetlands would occur with this alternative configuration.

A3 with frontage road would potentially affect 107 acres of waters of the United States (40 acres direct, 67 acres indirect). Most (approximately 58%) impacts on waters of the United States affected with this alternative are canals and ditches, which reflects the rural nature of this alignment, the abundance of farmlands, and the frequency of ditches and canals to serve agricultural land uses. Approximately 90% of the canal/ditch features associated with A3 (and the Hybrid Alternative) are unlined (not lined with concrete) and/or vegetated. Over 4 acres of impacts on vernal pool complexes would potentially occur with implementation of this configuration. There is no substantial difference in the total estimated waters of the United States impact acreages between the A3 configuration with frontage road and without a frontage road (approximately 106 acres potential waters of the United States impacts). As discussed above, A3 with no frontage road and A3 with frontage road scenarios have been separated for the purposes of this analysis to confirm for the reader that the frontage road has a relatively minor contribution to waters of the United States impacts, and that A3 would have greater total impacts on waters of the United States compared to the other alternatives even without construction of the frontage road.

The Hybrid Alternative would potentially impact approximately 100 acres of waters of the United States (24 acres direct, 77 acres indirect). Riverine features and canals/ditches comprise the majority (over 66%) of waters of the United States impacts under this alternative. As noted above, approximately 90% of canal/ditch features crossed

[4] Noted in BIOS (2009) metadata as features with LU_BASE, LU_1997, or LU_2005 attributes = 7.

[5] Within the NWI, "other" includes palustrine, unconsolidated shore, temporarily/seasonally flooded, and diked/impounded waters of the United States

by this alternative are unlined and/or vegetated. Approximately 11 acres of vernal pool complex and less than 3 acres of freshwater emergent wetland impacts would result with implementation of the Hybrid Alternative.

The West Chowchilla design option of A2 would potentially impact 86 acres of waters of the United States (21 acres direct, 64 acres indirect). The waters of the United States types affected most by this alternative are forested wetland (10 acres), freshwater ponds (12 acres), riverine features (16 acres), and canal/ditch features (40 acres). Approximately 50% of the canal/ditch features crossed by this alternative configuration are unlined and/or vegetated. Impacts on vernal pool complexes under this alternative would not be substantial (2.2 acres).

The East Chowchilla design option of A2 would potentially impact approximately 60 acres (13 acres direct, 47 acres indirect) of waters of the United States, which is less than any other alternative/option combination. This alternative/option combination would result in impacts on 2.79 acres of vernal pool complexes. With the exception of A1 (both options), this alignment would impact the fewest number of ditch/canal waters of the United States acres (60% of which are unlined and/or vegetated).

Table 2 presents unconverted Holland-based vernal pool complex results. It is interesting to note two points regarding the Holland data. First, the Holland-based data overestimates by approximately 5 to 18 times the field-collected vernal pool data for A1, A2, and the Hybrid Alternative. Specifically, field efforts reported approximately 18% (VP_F/VP_H ratio) of Holland vernal pool acreage in association with A1 and design options, approximately 6% to 7% along A2 and design options, and approximately 13% along the Hybrid Alternative (Table 2). The disparity between Holland data and field data is related to the broadness of the mapping units of 40 acres used in the Holland work to record groups (complexes) of vernal pools and may also reflect regional development, particularly along the UPRR/SR 99 corridor, since the Holland data were last updated in 2005, and the commensurate reduction in vernal pool resources in the San Joaquin Valley.

The average computed VP_F/VP_H ratio was 12.4% (Table 2). As such, it was assumed that approximately 12% of the vernal pool acreage reported by Holland in association with the Western Madera Alternative (A3) (both configurations) was extant. The 12.4% factor was applied to the A3 Holland data shown in Table 2 to calculate the vernal pool data values reported in Table 1 for A3.

Waters of the United States Functions and Services

Assessing impacts on aquatic resource functions and services of waters of the United States features within the A3 direct and indirect impact footprints is challenging at the landscape level. Identifying the types of features (e.g., vernal pool versus lined irrigation ditch) provides some information. However, the condition of identified features may vary considerably from a pristine to highly degraded condition depending on a variety of factors related to onsite and adjacent land use practices.

For the purpose of this analysis, aquatic resource functional assessments previously conducted for the HST Merced to Fresno Section were reviewed and, where applicable, used as references to qualitatively assess functions and services of waters of the United States features within the A3 direct and indirect impact footprints.

The wetland delineation report (WDR) prepared for the Merced to Fresno Section characterized feature-specific functions and services for those resources that field crews were able to access with permission. Because so few resources were evaluated, WDR function/services results were not used for reference in this analysis.

Reference Functions and Services of Natural Watercourses Potentially Affected

Attachment 3 of the Checkpoint B deliverable (dated April 2011) assessed the relative functions and services of natural watercourses crossed by A1, A2, Hybrid Alternative, A3, and UPRR/BNSF Crossover Alternative (not analyzed in this A3 TM) alternatives. The following text and Tables 3 through 6 are taken from the noted report.

UPRR/SR 99 Alternative (A2). A2 and its related design options cross a total of 18 natural watercourses (streams, creeks, sloughs, and rivers) at 19 to 26 locations (Table 3). With the exception of the perennial Bear Creek and the San Joaquin River, all of these watercourses are seasonally intermittent or ephemeral. Intact, expansive riparian habitat is relatively rare among all San Joaquin Valley drainages, as most are managed for flood flow conveyance by removing vegetation and grooming channel contours, and many are used by off-highway vehicles for recreation (or both). Land use along A2 is dominantly agricultural, with some associated urban development (see Table 3), and land use encroachment at natural drainage bank tops has resulted in reduced riparian corridor widths.

No designated federal Critical Habitat intersects natural drainage crossings within A2, but Essential Fish Habitat (EFH) for Chinook salmon is designated within the San Joaquin River at the A2 crossing. See the *Biological Resources and Wetlands Technical Report* (Authority and FRA 2011a) for a discussion of EFH and how it is regulated. A2 crossings of Deadman and Dutchman creeks would be located within the Eastman Lake-Bear Creek Essential Connectivity Area (ECA), described in the EIR/EIS. Camp Pashayan would be intersected by this alternative at its crossing of the San Joaquin River.

As shown in Table 1, waters of the United States and vernal pool habitats are less abundant along A2 than along A1. Urban land uses along the existing UPRR corridor have decreased the abundance and functional value of aquatic resources at many locations.

BNSF Alternative (A1). A1 and its related design options cross a total of 18 natural watercourses (streams, creeks, sloughs, and rivers) at 23 to 29 locations (see Table 4). Similar to A1, most of these watercourses are seasonally intermittent or ephemeral, and most have degraded riparian corridors from intensive agricultural land uses.

Designated federal Critical Habitat for several vernal pool invertebrates intersects the A1 crossings of Deadman Creek and the Chowchilla River, and EFH for Chinook salmon is crossed by A1 at the San Joaquin River (as with all alternatives). Camp Pashayan would be intersected by this alternative at its crossing of the San Joaquin River, and the California Department of Fish and Game (CDFG) Le Grand Unit would be intersected by two crossings of Mariposa Creek. The A1 crossings of Mariposa Creek, Deadman Creek, Dutchman Creek, Chowchilla River, Ash Slough, and Berenda Slough would be located within the Eastman Lake-Bear Creek ECA.

As shown in Table 1, vernal pools are more abundant along A1 than along the other alternatives, in part because the BNSF railroad has created barriers for water movement. This alternative would be located downstream from, but adjacent to, the BNSF line. In general, fewer row crop agricultural fields, more grazed grasslands, and more natural resources of higher value exist along A1 than the other alternatives.

Hybrid Alternative. The Hybrid Alternative and its related design options cross a total of 19 natural watercourses (streams, creeks, sloughs, and rivers) at 22 locations (Table 5), most of which are seasonally intermittent or ephemeral. Riparian corridors are moderately intact for approximately 50% of these drainages.

Drainage crossing locations within the Hybrid Alternative will not intersect designated federal Critical Habitat, but EFH for Chinook salmon would be crossed by the Hybrid Alternative at the San Joaquin River. Camp Pashayan would be intersected by this alternative at its crossing of the San Joaquin River. Similar to A2, crossings of Deadman and Dutchman creeks would intersect with the Eastman Lake-Bear Creek ECA.

Wetlands and water features along the Hybrid Alternative are similar in abundance to those found associated with A2, and the overall functional assessment of resources associated with natural water crossing locations along the Hybrid Alternative is similar to A2.

Western Madera Alternative (A3). A3 and its related design options cross a total of 17 natural watercourses (streams, creeks, sloughs, and rivers) at 22 to 28 locations (Table 6). Similar to other San Joaquin Valley natural drainages, most A3-intersected drainages are seasonally intermittent or ephemeral. Riparian corridors are moderately intact for approximately 50% of these drainages, similar to the Hybrid Alternative. Due to the departure from the UPRR corridor, this alternative crosses the farmlands at a diagonal; therefore, the crossings at these waterways are not aligned or near existing roadway crossings.

Drainage crossing locations within A3 will not intersect designated federal Critical Habitat, but EFH for Chinook salmon and Camp Pashayan would be crossed by A3 at the San Joaquin River. Similar to A1, the A3 crossings of Deadman Creek, Dutchman Creek, Chowchilla River, Ash Slough, and Berenda Slough would intersect with the Eastman Lake-Bear Creek ECA.

Constructed drains and canals comprise a larger portion of the total wetlands and water features along A3 relative to the other alternatives, reflecting the agricultural land use west of Madera. The overall functional value of resources associated with natural water crossing locations along this alternative is similar to the A1.

Qualitative Functions and Services Assessment of Waters of the United States Reported in Table 1

Table 7 presents a qualitative assessment of functions and services of waters of the United States types shown in Table 1. Function and services categories are taken from the Wetland Evaluation Technique (WET) established and updated by Adamus (1983, 1988).

Functions and services are defined generally by the WET as follows.

- Groundwater recharge is accomplished by waters of the United States when the volume of surface water percolation or seepage to groundwater resources exceeds the volume of groundwater discharge to surface waters (e.g., springs). A "high" value is assigned to this function for those waters of the United States features lacking hardpans or liners. A "low" value is assigned to features with liners or those typically with hardpans. The reverse is true for groundwater discharge function, but features are ranked similarly to those under the recharge function.

- Flood-flow alteration is accomplished in association with features that store or slow surface water movement to a greater extent than would be accomplished in a terrestrial environment. A rank of "high" is assigned to waters of the United States features that slow or store surface waters. No judgment is made with respect to the magnitude of such function. All other waters of the United States features are ranked "low."

- Sediment stabilization is performed by waters of the United States features to a "high" level when erosive soils are bound to an extent that exceeds the function that would be expected by a terrestrial system. Otherwise, the function is rated as "low." For purposes of this analysis, closed/isolated features are ranked "high" in this function, while open systems (e.g., canals) are ranked "low."

- Vegetated, open features are assumed to rank "high" in sediment/toxicant retention. High-ranking features (e.g., vegetated swales and canals/ditches) physically (or chemically in the case of toxicants) may trap and retain on a net annual basis the inorganic sediments and/or chemical substances generally toxic to aquatic life. It is assumed that open systems are exposed to sediment/toxicants more frequently than are closed systems, and may therefore perform this function. Low-ranking features are those that are closed and/or unvegetated.

- Nutrient removal/transformation function is ranked "high" for those features which retain or transform inorganic phosphorus and /or nitrogen into organic forms or transform (remove) nitrogen in its gaseous form, on either a net annual basis or during the growing season, and which are generally more effective at doing so than typical upland environments. For purposes of this analysis, features are ranked similarly for this function as they are for sediment/toxicant retention ("high" for open, vegetated features).

- A feature ranking "high" in production export function is one that flushes relatively large amounts of organic plant material from a watershed into down-slope waters. Open vegetated systems rank "high" in this function.

Wildlife diversity/abundance function is performed at a "high" level by features that support a diversity of wildlife species, and particularly birds. For this analysis, vegetated features are considered to rank higher than are unvegetated features. Features that rank "high" in aquatic diversity/abundance function are those that, at least seasonally, support a diversity of fish or invertebrates (i.e., most trophic groups of secondary consumers with complex food webs). This function is ranked similarly to wildlife diversity/abundance.

Recreation function is accomplished at those features that are regularly used for recreational or consumptive activities, or as a major public access point to a recreational waterway. This function is largely limited to lakes and rivers.

Uniqueness/heritage function is realized at those features that 1) are regularly used by federal or state endangered or threatened species; 2) owned by an organized conservation group; 3) are included in a statewide listing of historical or archaeological sites; 4) are known to have ecological or geological features consistently considered by regional scientists to be unusual or rare for wetlands in the region; 5) represent most or all of this wetland type in the locality; 6) are the closest wetland with parking to a nature center; 7) are essential to ongoing, long-term environmental research; and/or 8) are within an pristine watershed natural area. Within the study are, vernal pools and vernal swales are ranked "high" in this function.

The greatest difference in waters of the United States impacts associated with A3 as compared to the other alternatives is in the canal/ditch category. These features provide an important service not captured by the WET definitions. In addition to the aquatic resource functions associated with canal and ditch features in the project area, these features provide an important irrigation service to the agricultural community and the public at large. The network of agricultural irrigation facilities that comprise the waters of the United States in the canal/ditch impact category is necessary to support farming operations that provide produce to a widespread market of consumers. Consequently, the irrigation service provided by the features in the canal/ditch category is a regionally important factor in assessing aquatic resource functions and services for the purpose of this analysis.

As shown in Table 1, A3 would impact a measurably greater acreage of constructed ditches and canals relative to the other alternatives. To gain a better understanding of the functions and services of these constructed watercourses, an analysis was conducted to estimate the percentage of lined versus unlined ditches and canals. Lined watercourses move water more efficiently than do unlined watercourses, but the latter have a greater potential to function as sparsely vegetated natural watercourses, particularly when they are infrequently maintained. Unlined canal/ditch features in the project region can generally be characterized as having higher overall aquatic resource functions than lined channels. Consequently, by separating lined and unlined ditch and canal features, a slightly different ordering of the relative impacts of each alternative/design option on waters of the United States may be inferred.

As discussed above, assessing the aquatic resource functions and services of waters of the United States features within the direct and indirect impact footprints of A3 is challenging at the landscape level. Because so few aquatic resources in the project area were observed in the field (most identification and delineation work was done through inspection of high resolution imagery, potential impacts on waters of the United States features within the direct and indirect footprints of the alternative alignments cannot be readily assessed and ranked with respect to functions or services. Broad conclusions could potentially be derived based on the abundance of feature types by alternative, but this would also require assumptions as to the condition (e.g., degraded versus pristine) of mapped features. It was challenging to devise a process that would adequately consider the wide variation in land development and land use within the Merced to Fresno Section and how this variation might affect aquatic resource functions and services. Consequently, we relied on the abundance of waters of the United States by feature type by alternative (i.e., Table 1) as a more objective metric for assessing the relative functions and services of waters of the United States resources among alternatives.

Conclusions

Based on the results presented in the Point 1 analysis, A3 would directly impact more waters of the United States than the other alternatives being considered. A3 would also result in total (direct plus indirect) impacts on more waters of the United States than the Hybrid Alternative and the A2 with West Chowchilla and A2 with East Chowchilla design options. In addition, based on the rationale presented below A3 would have greater effects on the comparative functions and services of the aquatic environment when compared to the A1, A2 and Hybrid alternatives. Based on these results it can be concluded that A3 does not warrant further consideration for detailed analysis in the EIR/EIS.

The results of the Point 1 Analysis indicate that construction of A3 without the associated frontage road would result in direct impacts to approximately 39 total acres of Waters of the United States. This is at least 13 acres greater than the direct impacts to waters of the United States associated with A1 and A2, and approximately 15 acres greater than the Hybrid alternative. A summary of the direct, indirect and total impact acreages is provided below (Summary Table S-1), which is the sum of all features included in Table 1 located at the end of this memorandum.

Summary Table S-1
Summary of Waters of the U.S. (in Acres)

	Impact Type	Alternative/Design Option Combination						
		A1 with Mariposa Way Design Option	A1 with Mission Ave Design Option	A2 with West Chowchilla Design Option	A2 with East Chowchilla Design Option	Hybrid	A3 without frontage Road	A3 with frontage Road
Waters of the United States Impact Acreage (sum of all features in Table 1)	Direct	22.30	25.53	21.47	13.08	23.56	39.23	39.94
	Indirect	87.37	82.19	64.26	47.42	76.59	66.55	66.65
	Total	**109.67**	**107.72**	**85.73**	**60.50**	**100.15**	**105.78**	**106.59**

The analysis assumes that impacts on all features within the indirect impact zone would be complete (i.e., the entire feature would be lost) and permanent. Based on this assumption, the results of this analysis indicate that construction of A3 without the associated frontage road would result in permanent impacts on a measurably greater total acreage of impacts to waters of the United States as compared to the Hybrid Alternative and A2 with the West and East Chowchilla design options. A3 would result in total impacts on approximately 106 acres of waters of the United States This is an additional 6 acres of total waters of the United States impacts greater than the Hybrid Alternative, and an additional 20 and 45 acres of total waters of the United States impacts greater than A2 with the West Chowchilla and the East Chowchilla design options, respectively. A3 would result in approximately 4 and 2 acres less total waters of the United States impacts as compared to A1 with the Mariposa Way and Mission Ave design options, respectively. Construction of a frontage road adjacent to A3 is anticipated to result in additional total impacts on 0.81 acre of waters of the United States

A3 would have greater impact acreages as compared to the other alternatives on freshwater emergent wetlands, "other" wetlands (palustrine, unconsolidated shore, temporarily/seasonally flooded, diked/impounded), and irrigation canals/ditches, and a greater impact acreage on vernal pool complexes than (A2 and design options.

The greatest differences in waters of the United States impact acreages between A3 and the other proposed alignments are on vernal pool complex features. Although A3 would have similar total impacts on vernal pool complexes compared to A2 design options, A3 would have approximately 7 acres less total impacts than the Hybrid, and 36 to 38 acres less total impacts than the A1 design options on vernal pool complexes. Next to the difference between the A3 and A2 vernal pool complex impact acreages, the greatest difference in waters of the United States impacts associated with A3 as compared to the other alternatives is in the canal/ditch category. A3 would result in direct impacts on approximately 61 acres of agricultural irrigation canals and ditches. This is approximately 20 acres more than the other alternatives.

For A3 and the Hybrid Alternative, approximately 90% of the canal and ditch features within the direct and indirect impacts zones are categorized as unlined/vegetated. For A1 and A2, 50% to 70% of the canal and ditch features are unlined or vegetated. This analysis recognizes unlined canal/ditch features in the project region as generally having higher overall aquatic resource functions than lined features. A3 and the Hybrid Alternative would, therefore, have potentially greater impacts on aquatic resource functions in this category of features than would A1 and A2.

Although A3 would have less total impacts on vernal pool complexes than A1 and the Hybrid Alternative, A3 would have substantially greater total impacts on irrigation canal and ditch features than all of the other proposed alternatives. Based on the local and regional importance of the irrigation service provided by the canal and ditch features in the project area, this service may be equally weighted with the ecological functions provided by the aquatic resources in the waters of the United States categories that would be affected to a lesser degree by A3. Consequently, A3 would have measurably greater total direct impact acreages as well as greater effects on the comparative functions and services of the aquatic environment when compared to A1, A2, and the Hybrid Alternative.

In addition to the aquatic resource functions associated with canal and ditch features in the project area, these features provide an important irrigation service to the agricultural community and the public at large. The network of agricultural irrigation facilities that comprise the waters of the United States in the canal/ditch impact category is necessary to support farming operations that provide produce to a widespread market of consumers. The U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (EPA) 2008 Mitigation Rule (Department of Defense regulations at 33 CFR Parts 325 and 332; EPA regulations at 40 CFR Part 230) acknowledges the importance of recognizing the services provided by aquatic resources. The rule emphasizes that the concept of 'services' allows the USACE and EPA to "focus on how the general population benefits from ecological functions, instead of whether potentially affected parties may or may not 'value' a particular aquatic resource and the functions it provides." The rule maintains that "the concept of ecosystem services provides a more objective measure than 'values' of the importance of the functions performed by the ecosystem to human populations," and that "ecosystem services is a useful concept for assessing the public interest, an important consideration in the Corps Regulatory Program." On the topic of aquatic resource services, the mitigation rule concludes that, "... the [USACE's] regulatory program is appropriately focused on protecting "functions" (the physical, chemical and biological processes that occur in aquatic resources) and "services" (the benefits to humans that result from these functions)."

Although A3 would have lesser impacts on vernal pool complexes than A1 and the Hybrid Alternative, A3 would have substantially greater impacts on irrigation canal and ditch features than all of the other proposed alternatives. Based on the local and regional importance of the irrigation service provided by the canal and ditch features in the project area, this service may be equally weighted with the ecological functions provided by the aquatic resources in the waters of the United States categories that would be affected to a lesser degree by A3. Consequently, A3 would have measurably greater total direct impact acreages as well as greater effects on the comparative functions and services of the aquatic environment when compared to A1, A2 and the Hybrid Alternatives.

References Cited

Adamus, P.R. 1983. FHWA Assessment Method, v. 2 of Method for Wetland Functional Assessment: Washington, DC, U.S. Department of Transportation, Federal Highway Administration Report No. FHWA-IP-82-24. 134 pp.

Adamus, P.R. 1988. "The FHWA/Adamus (WET) Method for Wetland Functional Assessment." In Hook, D.D., McKee, W.H., Jr., Smith, H.K., Gregory, James, Burrell, V.G., Jr., DeVoe, M.R., Sojka, R.E., Gilbert, Stephen, Banks, Roger, Stolzy, L.H., Brooks, Chris, Mathews, T.D., and Shear, T.H., Management, use, and value of wetlands, v. 2 of *The Ecology and Management of Wetlands*. Portland, OR. Timber Press, p. 128-133.

Biogeographic Information and Observation System (BIOS). 2009. *Pool Distribution - Central Valley, 2005* [ds650]. Available at ftp://ftp.dfg.ca.gov/BDB/GIS/BIOS/Public_Datasets. Accessed on January 17, 2012.

California High-Speed Rail Authority and Federal Railroad Administration (Authority and FRA). 2011a. *Draft Biological Resources and Wetlands Technical Report, Draft California High-Speed Train Project EIR/EIS, Merced to Fresno Section.* Prepared by AECOM and CH2M HILL. Sacramento, CA, and Washington, DC. August 2011.

California High-Speed Rail Authority and Federal Railroad Administration (Authority and FRA). 2011b. *Wetland Delineation Report, Draft California High-Speed Train Project EIR/EIS, Merced to Fresno Section.* Prepared by AECOM and CH2M HILL. Sacramento, CA, and Washington, DC.

California High-Speed Rail Authority and Federal Railroad Administration (Authority and FRA). 2011b. *Draft Hydrology and Water Resources Technical Report, Draft California High-Speed Train Project EIR/EIS, Merced to Fresno Section.* Prepared by AECOM and CH2M HILL. Sacramento, CA, and Washington, DC. August 2011.

Cowardin, L.M., V. Carter, F.C. Golet, and E.T. LaRoe. 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. U.S. Department of the Interior, Fish and Wildlife Service, Washington, DC.

Holland, Robert F. 2009. *Great Valley Vernal Pool Habitat Status and Loss: Rephotorevised 2005*. Prepared for Placer Land Trust, Auburn, CA. December. 23 p.

U.S. Fish and Wildlife Service (USFWS). 2012. *National Wetland Inventory (NWI).* Available at http://www.fws.gov/Wetlands/Data/DataDownload.html. Accessed January 2012. Washington, DC.

U.S. Geological Survey (USGS). 2010a. *Subregion 1803.* High Resolution National Hydrography Dataset home page. GIS Data. Available at http://nhd.usgs.gov/. Updated April 11, 2010. Accessed April 12, 2010. Reston, VA.

U.S. Geological Survey (USGS). 2010b. *Subregion 1804.* High Resolution National Hydrography Dataset home page. GIS Data. Available at http://nhd.usgs.gov/. Updated January 27, 2010. Accessed April 12, 2010. Reston, VA.

Table 1

Direct, Indirect, and Total Potential Impacts (in acres) on Waters of the United States Types, by Alternative/Design Option Combination

Waters of the United States Type (per NWI, NHD, and Holland)	Impact Type	Alternative/Design Option Combination						
		A1 with Mariposa Way Design Option	A1 with Mission Ave Design Option	A2 with West Chowchilla Design Option	A2 with East Chowchilla Design Option	Hybrid	A3 without Frontage Road	A3 with Frontage Road
Freshwater Emergent Wetland	Direct	1.37	1.25	0.00	0.33	0.00	0.85	1.06
	Indirect	5.85	6.87	4.68	5.46	2.57	7.69	7.89
	Total	7.23	8.12	4.68	5.79	2.57	8.54	8.94
Freshwater Forested/Shrub Wetland	Direct	0.57	0.00	2.49	2.50	2.28	2.47	2.47
	Indirect	7.09	0.00	7.86	7.38	6.50	6.98	6.98
	Total	7.67	0.00	10.36	9.88	8.77	9.46	9.46
Freshwater Pond	Direct	0.12	0.27	1.86	0.82	1.49	0.54	0.54
	Indirect	4.62	5.99	9.88	4.47	8.43	4.94	4.94
	Total	4.74	6.26	11.74	5.29	9.91	5.48	5.48
Lake	Direct	0.71	0.71	0.00	0.00	0.00	0.00	0.00
	Indirect	3.61	3.61	0.00	0.00	0.00	0.00	0.00
	Total	4.32	4.32	0.00	0.00	0.00	0.00	0.00
Riverine	Direct	2.55	2.58	2.44	1.50	2.71	2.66	2.66
	Indirect	22.32	20.86	13.74	8.54	21.39	8.89	8.89
	Total	24.87	23.44	16.18	10.04	24.10	11.55	11.55
Vernal Pool Complex	Direct	10.23	12.59	0.98	0.88	3.10	0.82	0.82
	Indirect	31.36	26.99	1.22	1.91	7.58	3.42	3.42
	Total	41.59	39.58	2.20	2.79	10.68	4.24	4.24

Table 1

Direct, Indirect, and Total Potential Impacts (in acres) on Waters of the United States Types, by Alternative/Design Option Combination

Waters of the United States Type (per NWI, NHD, and Holland)	Impact Type	Alternative/Design Option Combination						
		A1 with Mariposa Way Design Option	A1 with Mission Ave Design Option	A2 with West Chowchilla Design Option	A2 with East Chowchilla Design Option	Hybrid	A3 without Frontage Road	A3 with Frontage Road
Canal/Ditch in Acres (Total)	Direct	5.76	7.14	13.48	6.83	13.27	30.94	31.44
	Indirect	11.29	16.64	26.52	19.3	29.14	29.92	29.82
	Total	17.05	23.77	40.00	26.12	42.41	60.86	61.26
Other	Direct	0.99	0.99	0.22	0.22	0.71	0.95	0.95
	Indirect	1.23	1.23	0.36	0.36	0.98	4.71	4.71
	Total	2.22	2.22	0.58	0.58	1.69	5.66	5.66
Total Waters of the United States (= sum of features above)	Direct	22.30	25.53	21.47	13.08	23.56	39.23	39.94
	Indirect	87.37	82.19	64.26	47.42	76.59	66.55	66.65
	Total	**109.67**	**107.72**	**85.73**	**60.50**	**100.15**	**105.78**	**106.59**
Additional Information								
Canal/Ditch in Linear Feet (all types)	Direct	10,031	12,439	23,485	11,895	23,128	53,910	54,781
	Indirect	19,669	28,985	46,209	33,624	50,775	52,129	51,952
	Total	29,700	41,424	69,693	45,518	73,903	106,039	106,733
Canal/Ditch in Acres (Unlined/Vegetated)	Direct	3.46	5.00	6.74	4.10	11.94	27.85	28.30
	Indirect	6.77	11.65	13.26	11.58	26.23	26.93	26.84
	Total	10.23	16.64	20.00	15.67	38.17	54.77	55.13
Canal/Ditch in Acres (Lined/Other)	Direct	2.30	2.14	6.74	2.73	1.33	3.09	3.14
	Indirect	4.52	4.99	13.26	7.72	2.91	2.99	2.98
	Total	6.82	7.13	20.00	10.45	4.24	6.09	6.13

Table 2
Unconverted* Vernal Pool Complex Data from Holland (in acres)

Waters of the United States Type (Holland)	Impact Type	Alternative/Design Option Combination						
		A1 with Mariposa Way Design Option	A1 with Mission Ave Design Option	A2 with West Chowchilla Design Option	A2 with East Chowchilla Design Option	Hybrid	A3 without Frontage Road	A3 with Frontage Road
Vernal Pool Complex	Direct	38.67	36.16	8.02	8.1	16.67	6.66	6.66
	Indirect	188.35	185.83	31.88	31.84	64.29	27.65	27.65
	Total	227.02	221.99	39.9	39.94	80.96	34.31	34.31
	Ratio (VP_F/VP_H)	18.3%	17.8%	5.5%	7.0%	13.2%	n/a	n/a
	Grand Ratio**						12.4%	12.4%

* Extirpated resources (as reported by BIOS [2009]) not included in acreages.
**Grand ratio is the average of VP_F/VP_H ratios from five alternative configurations reported above. Approximately 12% of the acreage of Holland-mapped vernal pool complex resources are estimated to currently exist.

Note: Table values are rounded, and column totals may therefore show rounding errors.

Table 3

Natural Watercourse Crossings and Landscape-Level Functional Assessment: UPRR/SR 99 Alternative (A2)

Natural Water Body Name	Alternative/Project Component								
	A2								
	# Crossings	Hydrology	Water Quality	Habitat Integrity	Land Use	Habitat Connectivity	Natural Areas	Riparian	Crit. Hab./ Spp
Bear Creek	1	P	L	L	DEV	N	N	L	N
Miles Creek Overflow	1	I	M	M	AGR	N	N	M	N
Miles Creek	1	I	M	M	AGR	N	N	M	N
Owens Creek	1	E	M	M	AGR/DEV	N	N	M	N
Duck Slough Overflow	1	I	M	M	AGR/DEV	N	N	M	N
Duck Slough	3	I	M	M	AGR/DEV	N	N	M	N
Mariposa Creek	N/A								
Deadman Creek	1	E	M	M	AGR	Y	N	M	N
Dutchman Creek	1 or 2	I	L	L	AGR	Y	N	L	N
Chowchilla River	1 or 2	I/E	M	M	AGR	N	N	M	M
Ash Slough	1 or 4	E	L	L	AGR	N	N	M	N
Berenda Slough	1 or 2	I/E	M	M	DEV	N	N	L	N
Berenda Creek	1 or 2	I	M	M	AGR	N	N	M	N
Dry Creek	1	I	M	L	AGR	N	N	H	N
Schmidt Creek	1	E	L	L	DEV/AGR	N	N	L	N
Fresno River	1	E	L	L	DEV	N	N	L	N
Cottonwood Creek	1	I	M	M	AGR/DEV	N	N	H	N
San Joaquin River	1	P	H	M	NAT	N	CP	H	Y
Total	19 to 26								

Table 3

Natural Watercourse Crossings and Landscape-Level Functional Assessment: UPRR/SR 99 Alternative (A2)

Natural Water Body Name	Alternative/Project Component								
	A2								
	# Crossings	Hydrology	Water Quality	Habitat Integrity	Land Use	Habitat Connectivity	Natural Areas	Riparian	Crit. Hab./ Spp

Sources:

Hydrology, Water Quality, Habitat Integrity, and Riparian ranks from Merced to Fresno Section Wetlands Delineation Report and Hydrology and Floodplains Report Attachments (Fact Sheets) (Authority and Federal Railroad Administration [FRA] 2011b, 2011c).

Hydrology: P= perennial, I=intermittent, E=ephemeral.
WQ: H=high, M=moderate, L=Low functioning.
Habitat Integrity: H=relatively undisturbed with intact riparian habitat, M=moderate level of disturbance, L=highly disturbed/maintained.
Riparian: H=intact, broad riparian habitat, M=narrow band of riparian habitat, L=little to no riparian habitat present.

Land Use, Habitat Connectivity, and Critical Habitat from GIS and Natural Diversity Database (NDDB) queries.

Land Use: AGR=agriculture, DEV=developed, NAT=natural/relatively undisturbed lands.
Habitat Connectivity: Y=feature crossing is within Eastman Lake-Bear Creek ECA, N=not within noted ECA.
Critical Habitat: Y= feature crossing location intersects designated federal Critical Habitat, N=feature does not intersect Critical Habitat.

Natural Areas from Merced to Fresno Section Draft Environmental Impact Report/Environmental Impact Statement and Biological Resources Technical Report (Authority and FRA 2011a).

Natural Areas: N=no water crossings in natural areas, CP=Camp Pashayan.

N/A = Not applicable.

Table 4

Natural Watercourse Crossings and Landscape-Level Functional Assessment: BNSF Alternative (A1)

Natural Water Body Name	Alternative/Project Component								
	A1								
	# Crossings	Hydrology	Water Quality	Habitat Integrity	Land Use	Habitat Connectivity	Natural Areas	Riparian	Crit. Hab./ Spp
Bear Creek	1	P	L	L	DEV	N	N	L	N
Miles Creek Overflow	N/A								
Miles Creek	0 or 1	I	M	M	AGR	N	N	L	N
Owens Creek	1	E	M	M	AGR	N	N	M	N
Duck Slough Overflow	N/A								
Duck Slough	0 or 1	I	M	M	AGR	N	N	L	N
Mariposa Creek	2 or 3	P?	H	H	AGR	Y	LG	M	N
Unnamed Creek	1	I	L	L	AGR	N	N	L	N
Deadman Creek	1	E	M	M	AGR	Y	N	L	Y
Dutchman Creek	1 or 2	I	L	L	AGR	Y	N	L	N
Unnamed Creeks	4 or 5	I	L	L	AGR	N	N	L	N
Chowchilla River	1	I/E	M	M	AGR	Y	N	L	Y
Ash Slough	1 or 2	E	L	L	AGR	Y	N	L	N
Berenda Slough	2	I/E	M	M	AGR	Y	N	L	N
Berenda Creek	2	I	M	M	AGR	N	N	L	N
Dry Creek	2	I	M	L	AGR	N	N	M	N
Schmidt Creek	1	E	L	L	DEV/AGR	N	N	L	N
Fresno River	1	E	L	L	DEV	N	N	L	N
Cottonwood Creek	1	I	M	M	AGR	N	N	L	N
San Joaquin River	1	P	H	M	NAT	N	CP	H	Y

Table 4

Natural Watercourse Crossings and Landscape-Level Functional Assessment: BNSF Alternative (A1)

Natural Water Body Name	Alternative/Project Component								
	A1								
	# Crossings	Hydrology	Water Quality	Habitat Integrity	Land Use	Habitat Connectivity	Natural Areas	Riparian	Crit. Hab./ Spp
Total	23 to 29								

Sources:

Hydrology, Water Quality, Habitat Integrity, and Riparian ranks from Merced to Fresno Section Wetlands Delineation Report and Hydrology and Floodplains Report Attachments (Fact Sheets) (Authority and FRA 2011b, 2011c).

Hydrology: P= perennial, I=intermittent, E=ephemeral.
WQ: H=high, M=moderate, L=Low functioning.
Habitat Integrity: H=relatively undisturbed with intact riparian habitat, M=moderate level of disturbance, L=highly disturbed/maintained.
Riparian: H=intact, broad riparian habitat, M=narrow band of riparian habitat, L=little to no riparian habitat present.

Land Use, Habitat Connectivity, and Critical Habitat from GIS and Natural Diversity Database (NDDB) queries.

Land Use: AGR=agriculture, DEV=developed, NAT=natural/relatively undisturbed lands.
Habitat Connectivity: Y=feature crossing is within Eastman Lake-Bear Creek ECA, N=not within noted ECA.
Critical Habitat: Y= feature crossing location intersects designated federal Critical Habitat, N=feature does not intersect Critical Habitat.

Natural Areas from Merced to Fresno Section Draft Environmental Impact Report/Environmental Impact Statement and Biological Resources Technical Report (Authority and FRA 2011a).

Natural Areas: N=no water crossings in natural areas, CP=Camp Pashayan, LG=CDFG Le Grand Unit.

N/A = Not applicable.

Table 5
Natural Watercourse Crossings and Landscape-Level Functional Assessment: Hybrid Alternative

Natural Water Body Name	Alternative/Project Component								
	Hybrid								
	# Crossings	Hydrology	Water Quality	Habitat Integrity	Land Use	Habitat Connectivity	Natural Areas	Riparian	Crit. Hab./ Spp
Bear Creek	1	P	L	L				L	
Miles Creek Overflow	1	I	M	M	AGR	N	N	M	N
Miles Creek	1	I	M	M	AGR	N	N	M	N
Owens Creek	1	E	M	M	AGR/DEV	N	N	M	N
Duck Slough Overflow	N/A								
Duck Slough	3	I	M	M	AGR/DEV	N	N	M	N
Mariposa Creek	N/A								
Deadman Creek	1	E	M	M	AGR	Y	N	M	N
Dutchman Creek	1	I	L	L	AGR	Y	N	L	N
Chowchilla River	1	I/E	M	M	AGR	N	N	M	M
Ash Slough	4	E	L	L	AGR	N	N	M	N
Berenda Slough	1	I/E	M	M	DEV	N	N	L	N
Berenda Creek	1	I	M	M	AGR	N	N	L	N
Dry Creek	1	I	M	L	AGR	N	N	M	N
Schmidt Creek	1	E	L	L	DEV/AGR	N	N	L	N
Unnamed Creek	1	I	L	L	AGR	N	N	L	N
Fresno River	1	E	L	L	DEV	N	N	L	N
Cottonwood Creek	1	I	M	M	AGR	N	N	L	N
San Joaquin River	1	P	H	M	NAT	N	CP	H	Y

Table 5

Natural Watercourse Crossings and Landscape-Level Functional Assessment: Hybrid Alternative

Natural Water Body Name	Alternative/Project Component								
	Hybrid								
	# Crossings	Hydrology	Water Quality	Habitat Integrity	Land Use	Habitat Connectivity	Natural Areas	Riparian	Crit. Hab./ Spp
Total	22								

Sources:

Hydrology, Water Quality, Habitat Integrity, and Riparian ranks from Merced to Fresno Section Wetlands Delineation Report and Hydrology and Floodplains Report Attachments (Fact Sheets) (Authority and FRA 2011b, 2011c).

Hydrology: P= perennial, I=intermittent, E=ephemeral.
WQ: H=high, M=moderate, L=Low functioning.
Habitat Integrity: H=relatively undisturbed with intact riparian habitat, M=moderate level of disturbance, L=highly disturbed/maintained.
Riparian: H=intact, broad riparian habitat, M=narrow band of riparian habitat, L=little to no riparian habitat present.

Land Use, Habitat Connectivity, and Critical Habitat from GIS and Natural Diversity Database (NDDB) queries.

Land Use: AGR=agriculture, DEV=developed, NAT=natural/relatively undisturbed lands.
Habitat Connectivity: Y=feature crossing is within Eastman Lake-Bear Creek ECA, N=not within noted ECA.
Critical Habitat: Y= feature crossing location intersects designated federal Critical Habitat, N=feature does not intersect Critical Habitat.

Natural Areas from Merced to Fresno Section Draft Environmental Impact Report/Environmental Impact Statement and Biological Resources Technical Report (Authority and FRA 2011a).

Natural Areas: N=no water crossings in natural areas, CP=Camp Pashayan.

N/A = Not applicable.

Table 6

Natural Watercourse Crossings and Landscape-Level Functional Assessment: Western Madera Alternative (A3)

Natural Water Body Name	Alternative/Project Component								
	A3								
	# Crossings	Hydrology	Water Quality	Habitat Integrity	Land Use	Habitat Connectivity	Natural Areas	Riparian	Crit. Hab./ Spp
Bear Creek	1	P	L	L	DEV	N	N	L	N
Miles Creek Overflow	N/A								
Miles Creek	1	I	M	M	AGR	N	N	M	N
Owens Creek	1	E	M	M	AGR/DEV	N	N	M	N
Duck Slough Overflow	1	I	M	M	AGR/DEV	N	N	M	N
Duck Slough	1	I	M	M	AGR/DEV	N	N	M	N
Mariposa Creek	N/A								
Deadman Creek	1	E	M	M	AGR	Y	N	M	N
Dutchman Creek	1	I	M	M	AGR	Y	N	M	N
Chowchilla River	1	I/E	L	L	AGR	Y	N	L	N
Ash Slough	2 to 3	E	L	L	AGR	Y	N	L	N
Berenda Slough	2	I/E	M	M	AGR	Y	N	M	N
Berenda Creek	1	I	L	L	AGR	N	N	L	N
Dry Creek	1	I	L	L	AGR	N	N	L	N
Schmidt Creek	1	E	L	L	DEV/AGR	N	N	L	N
Fresno River	1	E	L	L	AGR	N	N	L	N
Cottonwood Creek	1	I	M	M	AGR	N	N	M	N
San Joaquin River	1	P	H	M	NAT	N	CP	H	Y
Unnamed Creeks	4 to 9	I	L	L	AGR	N	N	L	N
Total	22 to 28								

Table 6

Natural Watercourse Crossings and Landscape-Level Functional Assessment: Western Madera Alternative (A3)

Natural Water Body Name	Alternative/Project Component								
	A3								
	# Crossings	Hydrology	Water Quality	Habitat Integrity	Land Use	Habitat Connectivity	Natural Areas	Riparian	Crit. Hab./ Spp

Sources:

Hydrology, Water Quality, Habitat Integrity, and Riparian ranks from Merced to Fresno Section Wetlands Delineation Report and Hydrology and Floodplains Report Attachments (Fact Sheets) (Authority and FRA 2011b, 2011c).

Hydrology: P= perennial, I=intermittent, E=ephemeral.
WQ: H=high, M=moderate, L=Low functioning.
Habitat Integrity: H=relatively undisturbed with intact riparian habitat, M=moderate level of disturbance, L=highly disturbed/maintained.
Riparian: H=intact, broad riparian habitat, M=narrow band of riparian habitat, L=little to no riparian habitat present.

Land Use, Habitat Connectivity, and Critical Habitat from GIS and Natural Diversity Database (NDDB) queries.

Land Use: AGR=agriculture, DEV=developed, NAT=natural/relatively undisturbed lands.
Habitat Connectivity: Y=feature crossing is within Eastman Lake-Bear Creek ECA, N=not within noted ECA.
Critical Habitat: Y= feature crossing location intersects designated federal Critical Habitat, N=feature does not intersect Critical Habitat.

Natural Areas from Merced to Fresno Section Draft Environmental Impact Report/Environmental Impact Statement and Biological Resources Technical Report (Authority and FRA 2011a).

Natural Areas: N=no water crossings in natural areas, CP=Camp Pashayan.

N/A = Not applicable.

Table 7

Wetland Evaluation Technique (WET) Functions and Services Assessment by Waters of the United States Type

Waters of the United States	WET Function/Service										
	Ground-water Recharge	Ground-water Discharge	Flood-flow Alteration	Sediment Stabiliza-tion	Sediment/ toxicant Retention	Nutrient Removal/ trans-formation	Production Export	Wildlife Diversity/ abundance	Aquatic Diversity/ abundance	Recreation	Uniqueness/ heritage
Freshwater Emergent Wetland	High	High	High	High	High	High	High	High	High	Low	Low
Freshwater Forested/ Shrub Wetland	High	High	High	High	High	Mod	High	High	High	Low	Low
Freshwater Pond	High	High	High	High	Low	Low	Low	Low	Low	Low	Low
Lake	High	High	High	High	Low	Low	Low	Low	Low	Low	Low
Other	High	High	High	Low	High	High	Low	High	High	Low	Low
Riverine	High	High	Low	Low	Low	Low	High	Low	Low	Low	Low
Vernal Pool	Low	Low	High	High	Low	Low	Low	High	High	High	High
Vernal Swale	Low	Low	Low	Low	High	High	Low	High	High	High	High
Canal/Ditch (Unlined and/or Vegetated)	High	High	Low	Low	High	High	High	High	High	Low	Low
Canal/Ditch (Lined or Other)	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low	Low