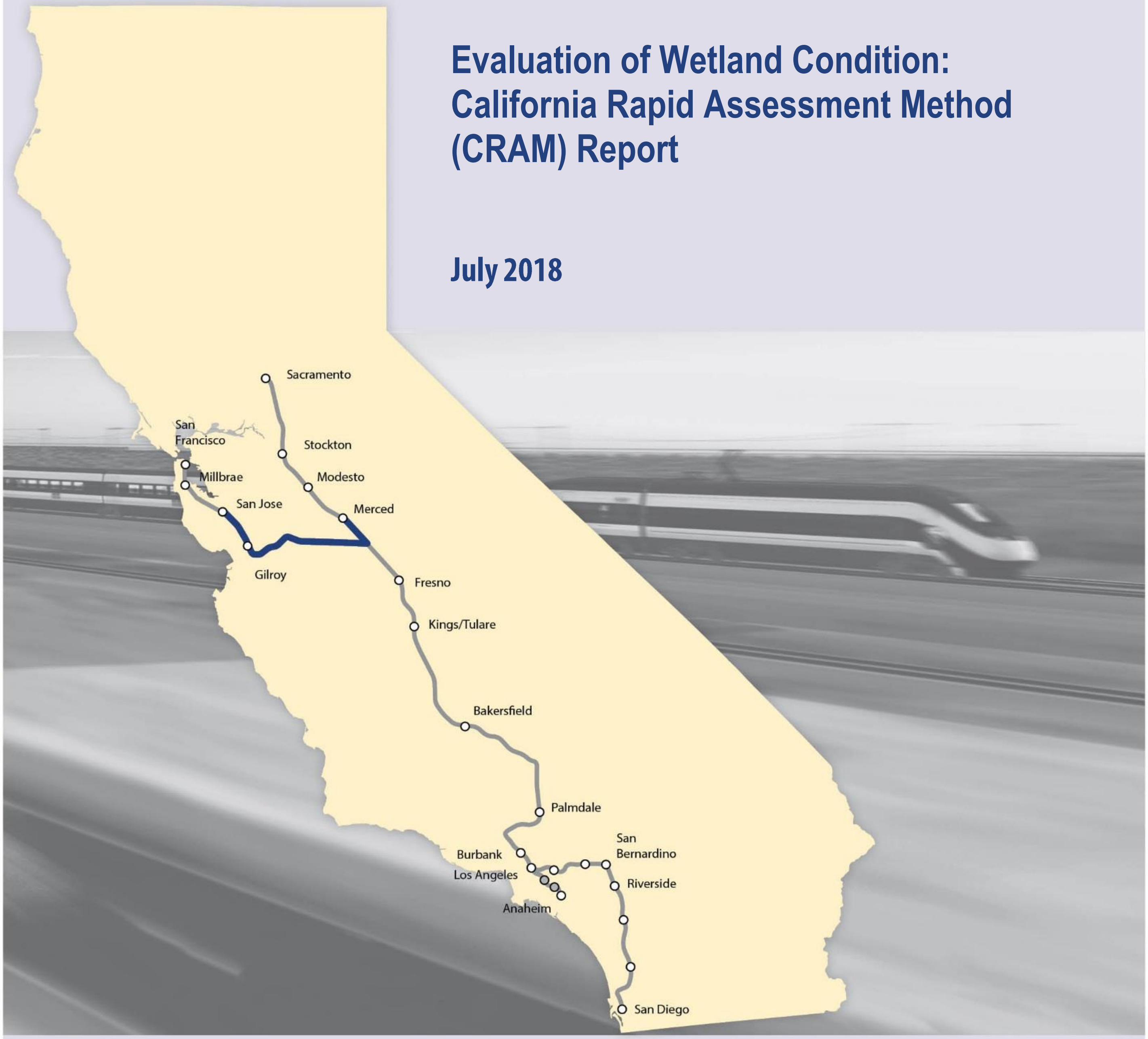
California High-Speed Rail Authority

Merced to Fresno Section: Central Valley Wye



Evaluation of Wetland Condition: California Rapid Assessment Method (CRAM) Report

July 2018

CALIFORNIA
High-Speed Rail Authority

U.S. Department of Transportation
Federal Railroad Administration

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ACRONYMS AND ABBREVIATIONS

AA	assessment area
Authority	California High-Speed Rail Authority
BAAH	breaker-and-a-half
BNSF	BNSF Railway
CAL FIRE	California Department of Forestry and Fire Protection
Caltrans	California Department of Transportation
COG	Council of Governments
CRAM	California Rapid Assessment Method
CWMW	California Wetlands Monitoring Workgroup
EIR	environmental impact report
EIS	environmental impact statement
ESRI	Environmental Systems Research Institute
FRA	Federal Railroad Administration
GIS	geographic information system
HSR	high-speed rail
HUC	hydrologic unit code
LEDPA	Least Environmentally Damaging Practicable Alternative
MOU	NEPA/404/408 Integration Process Memorandum of Understanding
NRCS	Natural Resources Conservation Service
SAR	Special Aquatic Resource
SPCC	spill prevention control and countermeasure
SR	State Route
UPRR	Union Pacific Railroad
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency

1 INTRODUCTION

The *NEPA/404/408 Integration Process Memorandum of Understanding* between the U.S. Environmental Protection Agency (USEPA), U.S. Army Corps of Engineers (USACE), Federal Railroad Administration (FRA), and California High-Speed Rail Authority (Authority), dated November 2010 (referred to as the MOU), outlines the requirements for Checkpoint C: Preliminary Least Environmentally Damaging Practicable Alternative (LEDPA) Determination for the California High-Speed Rail (HSR) project. One of the steps in identifying the LEDPA is to determine the functions and services of the aquatic resources within the different project alternatives. In accordance with the MOU and discussions with the project's technical work group—composed of members from the regulatory agencies, FRA, Authority, and the regional consultants—these determinations will be made by conducting a "detailed (rapid assessment or better) assessment of the functions and services of special aquatic sites and other waters of the U.S." (USEPA et al. 2010). In addition to supporting the LEDPA decision, this data can also be used during the permitting process with the USACE, who requires an evaluation of impact and mitigation sites to determine final mitigation ratios.

For the purposes of this evaluation, the team used the California Rapid Assessment Method (CRAM) as the tool for assessing the condition of aquatic resources (CWMW 2013a). To date CRAM has been the methodology used across all HSR sections, thereby providing a uniform approach for assessing the functions and services (health) of wetlands and other aquatic features. It is also consistent with the USACE and USEPA Mitigation Rule (USEPA and USACE 2008). A detailed description of CRAM is not included in this report, but is available on the CRAM web site (www.cramwetlands.org) and in the *California Rapid Assessment Method for Wetlands and Riparian Areas: User's Manual*, Version 6.1 (CWMW 2013a), which includes background information on the development, application, and implementation of CRAM. Additionally, the *Condition Assessment Technical Work Plan* (Authority and FRA 2011a) describes the methods used to conduct CRAM for the Central Valley Wye of the HSR system and is supplemental to the *Draft Checkpoint C: LEDPA Determination: Methodology for Wetland Condition Assessment Using CRAM* that was prepared for the entire statewide HSR system (Authority and FRA 2011b).

This report summarizes the results of CRAM conducted within the four different Central Valley Wye alternatives during spring 2016 (May 16 through 24). As access to properties and impact areas were limited at the time of the field work, the evaluation included an extrapolation of field collected CRAM scores to the larger study area. The first round of field work assessed aquatic features within the State Route (SR) 152 (North) to Road 13 Wye Alternative, the SR 152 (North) to Road 19 Wye Alternative, and the Avenue 21 to Road 13 Wye Alternative. Organization of this CRAM Report

This CRAM report includes the following sections:

- Section 2, Project Location, describes the location of the Central Valley Wye within California.
- Section 3, Central Valley Wye Description, provides a description of the Central Valley Wye alternatives.
- Section 4, Methods, identifies methodology and procedures for conducting CRAM.
- Section 5, Results, Central Valley Wye CRAM Scores, presents the CRAM scores from the condition assessment conducted in the study area.
- Section 6, Discussion, discusses the sampling and methodological considerations in using CRAM for the Central Valley Wye and in using CRAM to evaluate watershed condition.
- Section 7, References, provides a list of the references cited in this technical report.
- Section 8, Preparer Qualification, lists individuals who assisted in the preparation of this report.

Additional details are provided in:

- Appendix A, Maps of Assessment Areas, provides individual maps of the “assessment areas” (AA) evaluated.
- Appendix B, Summary Table of CRAM, summarizes the results for the AAs.
- Appendix C, Assessment Area Data Forms, provides the data forms for each AA.
- Appendix D, Photo Log, provides site photographs of each AA.

2 PROJECT LOCATION

The Central Valley Wye of the HSR 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 east 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 percent and elevations ranging from 160 to 300 feet above mean sea level. The regional drainage is generally to the west and southwest.

The Central Valley Wye 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 in the east to the crest of the Coast Ranges in the west.

2.1 Watersheds and Waterbodies

The San Joaquin River Basin encompasses approximately 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. Unrestricted flood flows historically occurred between April and June following snow melt in the Sierra Nevada (Authority and FRA 2016a).

The Central Valley Wye lies within two U.S. Geological Survey hydrologic unit code-8 (HUC) watershed subbasins: the Middle San Joaquin–Lower Chowchilla (HUC 18040001) and the Upper Chowchilla-Upper Fresno (HUC 18040007). Significant natural water features in the area include the Ash Slough, Berenda Creek, Berenda Slough, Chowchilla River, Deadman Creek, Dry Creek, Dutchman Creek, Eastside Bypass, Fresno River, Historical Wood Slough, Mariposa Slough, San Joaquin River, Santa Rita Slough, Schmidt Creek, and Wood Slough. 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 (Authority and FRA 2016a). The names of the HUC-8 watersheds, the major surface water features, and the area of each watershed are summarized in Table 2-1.

Table 2-1 Watersheds of Major Waterbodies within the Central Valley Wye

Subbasin (Hydrologic Unit Code-8)	Major Water Features	Watershed Area (acres)
Upper Chowchilla-Upper Fresno (18040007)	Ash Slough, Berenda Creek, Berenda Slough, Dry Creek, Schmidt Creek, Fresno River, Eastside Bypass	68,444.33
Middle San Joaquin-Lower Chowchilla (18040001)	Chowchilla River, Wood Slough, San Joaquin River, West San Juan Drain No.1, Santa Rita Slough, Eastside Bypass	45,143.79
Total	-	**113,588.12**

Source: NRCS, 2007

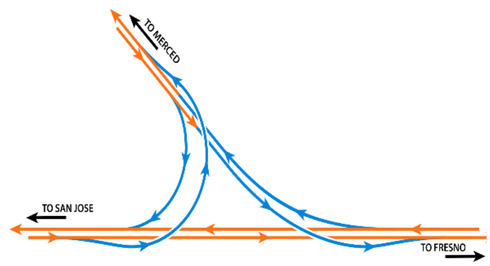
3 CENTRAL VALLEY WYE

The Central Valley Wye would create the east-west HSR connection between the San Jose to Merced Section to the west and the north-south Merced to Fresno Section to the east.[1] The four Central Valley Wye alternatives addressed in the *Merced to Fresno Section: Central Valley Wye Supplemental Environmental Impact Report (EIR)/Supplemental Environmental Impact Statement (EIS)* (Supplemental EIR/EIS) (Figures 3-1 to 3-4) are:

- SR 152 (North) to Road 13 Wye Alternative
- SR 152 (North) to Road 19 Wye Alternative
- Avenue 21 to Road 13 Wye Alternative
- SR 152 (North) to Road 11 Wye Alternative

This section describes the common design features of the four alternatives, followed by descriptions of each alternative.

Central Valley Wye Schematic



3.1 Common Features

The Central Valley Wye alternatives would cross rural areas in unincorporated Merced and Madera Counties, and would travel through the southern portion of Chowchilla and the rural-residential community of Fairmead. Volume 3 of the Supplemental EIR/EIS provides detailed design drawings that support the descriptions of the Central Valley Wye alternatives.

The HSR alignment would be entirely grade-separated, meaning that crossings of roads, railroads, and other transport facilities would use overpasses or underpasses so that the HSR would operate independently of other modes of transport. The HSR right-of-way would also be fenced to prevent public or vehicle access. The Central Valley Wye project footprint would primarily consist of the train right-of-way, which would accommodate two sets of tracks in an area with a minimum width of 100 feet. Additional right-of-way would be required to accommodate grade separations, embankments, traction power facilities, and transitional portions of the Central Valley Wye that allow for bidirectional interface between north-south and east-west trending alignments.

The Central Valley Wye alternatives would include at-grade, below-grade, and above-grade (elevated) track segments. The at-grade track would be laid on an earthen railbed raised 6–10 feet (embankment heights are in excess of 35 feet) off the ground level, set on ties with rock ballast; fill and ballast for the railbed would be obtained from permitted borrow sites and quarries. Below-grade track would be laid in open cut, trench, or cut-and-cover tunnel at a depth that would allow roadway and other grade-level uses above the track. Elevated track segments would span some waterways, roadways, railroad, and other HSR tracks, and would consist of precast, prestressed concrete box girders, cast-in-place concrete box girders, or steel box girders. The height of elevated track sections would depend on the height of existing structures below, or clearances to existing roads or other HSR facilities, and would range from 35 to 90 feet above grade. Columns would be spaced approximately 100–120 feet apart on average.

3.2 SR 152 (North) to Road 13 Wye Alternative

The SR 152 (North) to Road 13 Wye Alternative (Figure 3-1) follows the existing Henry Miller Road and SR 152 rights-of-way as closely as possible in the east-west direction, and the Road 13, SR 99, and BNSF Railway (BNSF) rights-of-way in the north-south direction. Deviations from

[1] The term *wye* refers to the Y-like formation created at the point where train tracks branch off the mainline to continue in different directions. The transition of mainline track to a wye requires splitting two tracks into four tracks that cross over one another before the wye "legs" (segments) can diverge in opposite directions to allow two-way travel. For the Merced to Fresno Section of the HSR system, the two tracks traveling east-west from the San Jose to Merced Section must become four tracks—a set of two tracks branching toward Merced to the north and a set of two tracks branching toward Fresno to the south.

these existing transportation routes or corridors are necessary to accommodate design requirements; specifically, wider curves are necessary to accommodate the speed of the HSR compared to lower-speed roadway alignments. The SR 152 (North) to Road 13 Wye Alternative would not follow existing transportation rights-of-way where it transitions from following one transportation corridor to another.

3.2.1 Alignment and Ancillary Features

The SR 152 (North) to Road 13 Wye Alternative would extend approximately 52 miles, mostly at-grade on raised embankment, although it would also have aerial structures and a segment of retained cut (depressed alignment). The wye configuration of this alternative would be located southwest of the city of Chowchilla, with the east-west axis along the north side of SR 152 and the north-south axis on the east side of Road 13.

As shown on Figure 3-1, this alternative would begin in Merced County at the intersection of Henry Miller Road and Carlucci Road, and would continue at-grade on embankment due east toward Elgin Avenue, where it would curve southeast toward the San Joaquin River and Eastside Bypass. Approaching Willis Road, the alignment would cross the San Joaquin River on an aerial structure, then would return to embankment. It would then cross the Eastside Bypass on an aerial structure. After crossing the Eastside Bypass, the alignment would continue east and cross SR 59 at-grade just north of the existing SR 152/SR 59 interchange, entering Madera County. The SR 152/SR 59 interchange would be reconstructed a little to the south and SR 59 would be grade-separated to pass above the HSR on an aerial structure. The alignment would continue east at-grade along the north side of SR 152 toward Chowchilla, splitting into two legs (four tracks) near Road 11 to transition to the Merced to Fresno Section: Hybrid Alignment, and would cross Ash Slough on an aerial structure. All but the northbound track of the San Jose to Merced section of the alignment (leg) would then return to at-grade embankment. The northbound track would rise to cross over the tracks of the San Jose to Fresno leg on aerial structure as it curves north toward Merced. The SR 152 (North) to Road 13 Wye Alternative legs would be routed as described subsequently and as shown on Figure 3-1:

- The southbound track of the San Jose to Merced leg[2] would be at-grade. This split (where tracks separate) would be west of Chowchilla, at approximately Road 11. The two San Jose to Merced tracks would continue north on the eastern side of Road 13, crossing Ash Slough and the Chowchilla River, and then would cross over Road 13 to its west side. As the tracks return to grade, they would curve northwest, crossing Dutchman Creek on an aerial structure, and follow the west side of the Union Pacific Railroad (UPRR)/SR 99 corridor. At Sandy Mush Road, the alignment would descend into a shallow cut (depressed) section for approximately 0.5 mile, with a retained cut-and-cover undercrossing[3] at the California Department of Transportation's (Caltrans) Sandy Mush Road overhead. The alignment would return to grade and continue along the west side of the UPRR/SR 99 corridor, connecting to the Merced to Fresno Section: Hybrid Alignment at Ranch Road.
- The San Jose to Fresno leg of this alternative would continue east from the split near Road 11 and along the north side of SR 152 toward Chowchilla. It would be predominantly at-grade, crossing several roads and Berenda Slough on aerial structures. The alignment would pass south of Chowchilla at-grade then would rise to cross over the UPRR/SR 99 corridor and Fairmead Boulevard on an aerial structure. East of the UPRR/SR 99 corridor, the alternative would extend at-grade through Fairmead, north of Avenue 23. At approximately Road 20, the alignment would curve southeast toward the BNSF corridor and cross Dry Creek on a short aerial structure. The San Jose to Fresno leg would align parallel to the west side of the BNSF corridor as it meets the Merced to Fresno Section: Hybrid Alignment at Avenue 19.

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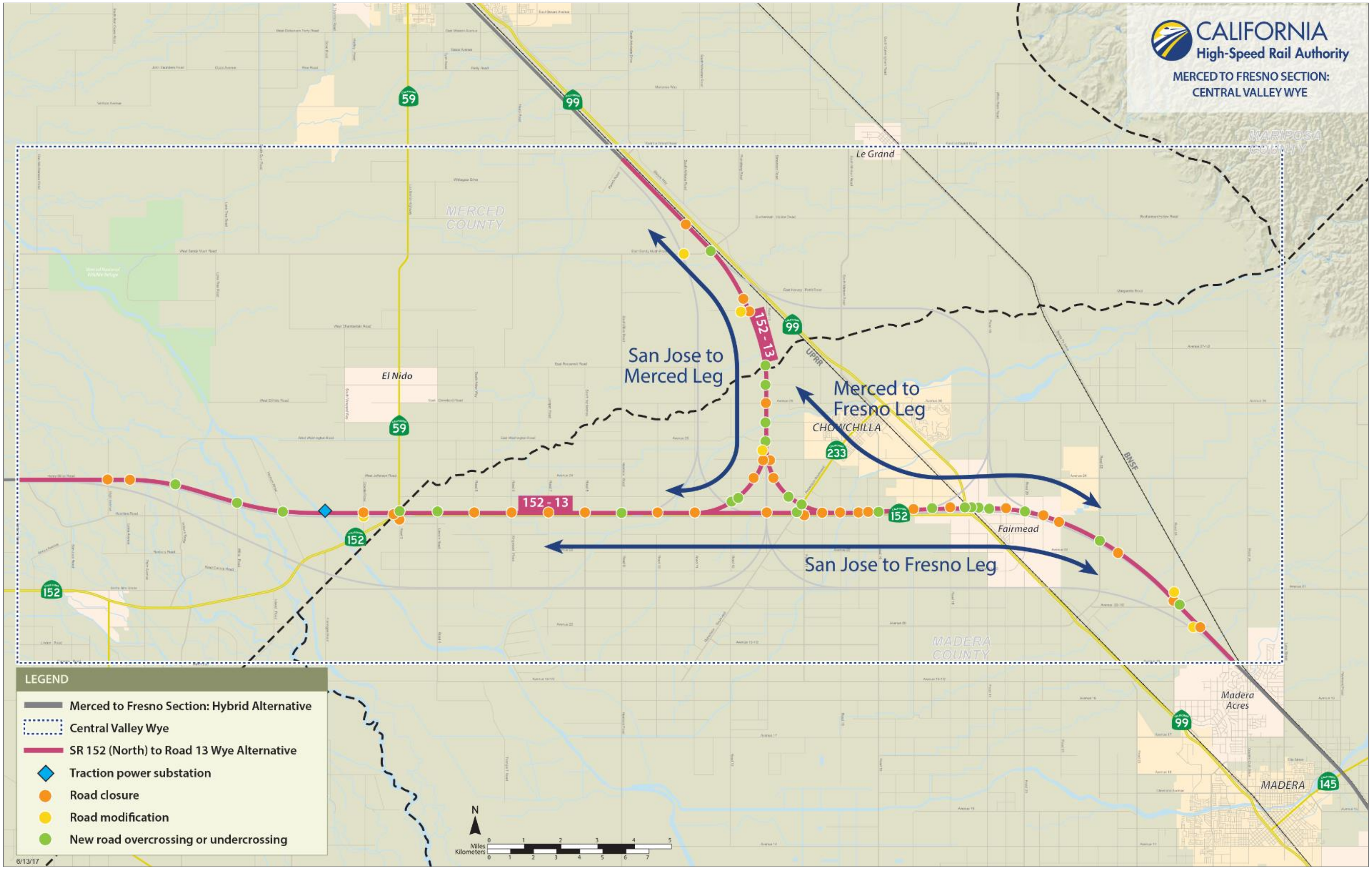
[2] A track is included within a leg; e.g., southbound track of the San Jose to Merced leg.

[3] An undercrossing is a road or track crossing under an existing road or track.



Source: ESRI, 2013; CAL FIRE, 2004; ESRI/National Geographic, 2015; Authority, 2016

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Figure 3-1 SR 152 (North) to Road 13 Wye Alternative Alignment and Key Design Features

- The Merced to Fresno leg of the alternative would split from the San Jose to Fresno leg near Road 14, where the southbound track of the Merced to Fresno leg would ascend on aerial structure, crossing over the tracks of the San Jose to Fresno leg. The northbound track would curve northwest, rise on a high embankment crossing over several roads, and continue on an at-grade embankment until joining the San Jose to Merced leg near Avenue 25.

Wildlife undercrossing structures would be installed in at-grade embankments along this alternative where the alignment intersects wildlife corridors.

3.2.2 Electrical Interconnections

For Site 6—El Nido, interconnection facilities would include a 115 kV TPSS and switching station located immediately east of where the SR 152 (North) to Road 13 Wye Alternative crosses the Eastside Bypass. This new switching station would connect to the Wilson–Oro Loma 115 kV Power Line.

For Site 7—Wilson, interconnection facilities would include a 230 kV TPSS and an approximately 2.3-mile double-circuit 230 kV transmission line (230 kV Tie-Line) to the Wilson Substation. The TPSS and approximately 0.5 mile of the 230 kV Tie-Line were previously analyzed in the Merced to Fresno Final EIR/EIS. To support this interconnection, PG&E would need to rebuild the existing Wilson 230 kV Substation to a 4-Bay Breaker-And-A-Half (BAAH) configuration within the existing fence line.

Backup electrical power would be supplied by an emergency standby generator for select electrical loads, including fire protection systems, ventilation systems, emergency lights and signage, communication systems, train controls systems, and low-voltage direct-current battery supply systems to support emergency lighting and communications.

3.2.3 State Highway or Local Roadway Modifications

The SR 152 (North) to Road 13 Wye Alternative would require the permanent closure of 38 public roadways at selected locations and the construction of 24 overcrossings[4] or undercrossings in lieu of closure. Figure 3-1 shows the anticipated state highway and local roadway closures and modifications. Fourteen of these permanent road closures would be located at SR 152, where roads currently cross at-grade but need to be closed to convert SR 152 to a fully access-controlled corridor. The 14 proposed closures are Road 5, Road 6, Road 7, Road 8, Road 10, Road 11, Road 13, Road 14, Road 14 1/2, Road 15, Road 15 1/2, Road 15 3/4, Road 17, and Road 18. Planned new grade separations along SR 152 at the SR 59/SR 152 Interchange, Road 4/Lincoln Road, Road 12, and Road 17 1/2 would maintain access to, and across, SR 152. These roadways would be reconfigured to two 12-foot lanes with two 8-foot shoulders. Each of the new interchanges would require realigning SR 152. Three new interchanges are proposed between SR 59 and SR 99 to provide access to SR 152: at Road 9/Hemlock Road, SR 233/Robertson Boulevard, and Road 16.

The distance between over- or undercrossings would vary from less than 2 miles to approximately 5 miles where other roads are perpendicular to the proposed HSR. Between these over- or undercrossings, 24 additional roads would be closed, as shown on Figure 3-1. Local roads paralleling the proposed HSR alignment and used by small communities and farm operations may be shifted and reconstructed to maintain their function. Access easements would be provided to maintain access to properties severed by HSR.

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[4] An overcrossing is a road or track crossing over an existing road or track.

3.2.4 Freight or Passenger Railroad Modifications

The SR 152 (North) to Road 13 Wye Alternative would cross over the UPRR right-of-way south of Chowchilla. This alternative would maintain required vertical (at least 23.3 feet) clearance over UPRR operational right-of-way to avoid or minimize effects on UPRR rights-of-way, spurs, and facilities (BNSF and UPRR 2007). In areas where the SR 152 (North) to Road 13 Wye Alternative parallels the UPRR right-of-way, the alternative maintains a minimum horizontal clearance of 102 feet from the centerline to the UPRR right-of-way.

3.2.5 Summary

Table 3-1 summarizes the design features for the SR 152 (North) to Road 13 Wye Alternative.

Table 3-1 Design Features of the SR 152 (North) to Road 13 Wye Alternative

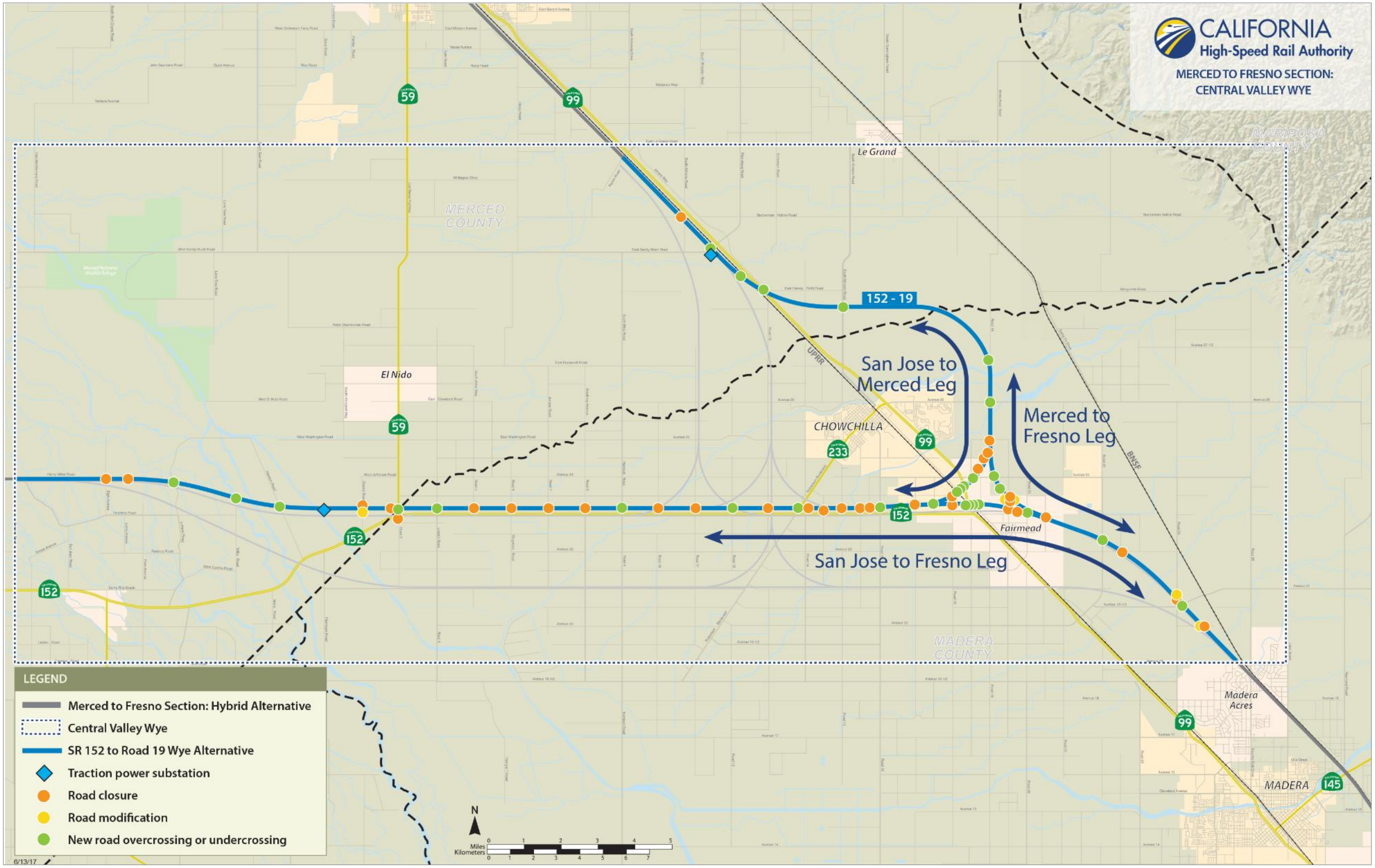
Feature	SR 152 (North) to Road 13 Wye
Total length (linear miles)[1]	52
At-grade profile (linear miles)[1]	48.5
Elevated profile (linear miles)[1]	3
Below-grade profile (linear miles)[1]	0.5
Number of straddle bents	32
Number of railroad crossings	1
Number of major water crossings	12
Number of road crossings	62
Approximate number of public roadway closures	38
Number of roadway overcrossings and undercrossings	24
Traction power substation sites	1
Switching and paralleling stations	1 switching station, 8 paralleling stations
Signaling and train-control elements	18
Communication towers	9
Wildlife crossing structures	39

Source: Authority and FRA, 2016b

[1] Lengths shown are based on equivalent dual-track alignments and are one-way mileages. For example, the length of single-track elevated structure will be divided by a factor of 2 to convert to dual-track equivalents.

3.3 SR 152 (North) to Road 19 Wye Alternative

The SR 152 (North) to Road 19 Wye Alternative (Figure 3-2) is designed to follow the existing Henry Miller Road and SR 152 rights-of-way as closely as practicable in the east-west direction and Road 19, SR 99, and BNSF rights-of-way in the north-south direction. Deviations from these existing transportation corridors would be necessary to accommodate design requirements; specifically, larger curves would be necessary to accommodate the high speed of the HSR compared to lower-speed roadway alignments. The SR 152 (North) to Road 19 Wye Alternative would not follow existing transportation rights-of-way as it transitions from following one transportation corridor to another.



Source: ESRI, 2013; CAL FIRE, 2004; ESRI/National Geographic, 2015; Authority, 2016

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Figure 3-2 SR 152 (North) to Road 19 Wye Alternative Alignment and Key Design Features

3.3.1 Alignment and Ancillary Features

The SR 152 (North) to Road 19 Wye Alternative would extend approximately 55 miles, mostly at-grade on embankment, although it would also have aerial structures, retained cut (depressed alignment), and depressed tunnel undercrossings of major railroad and highway corridors. The wye configuration of this alternative would be located southeast of the city of Chowchilla and north of Fairmead, with the east-west axis along the north side of SR 152 and the north-south axis on the east side of Road 19.

Beginning at the intersection of Henry Miller Road and Carlucci Road (at the same point in Merced County as the SR 152 [North] to Road 13 Wye Alternative), this alternative would continue east toward Elgin Avenue, where it would curve southeast toward the San Joaquin River. It would cross the river on an aerial structure, returning to an at-grade embankment, then onto another aerial structure to cross the Eastside Bypass. After crossing the Eastside Bypass, the alignment would continue east and cross SR 59 at-grade just north of the existing SR 152/SR 59 interchange, where it would enter Madera County. It would continue east at-grade along the north side of SR 152 toward Chowchilla, crossing Ash Slough and Berenda Slough on aerial structures. As it crosses Road 16, the alignment would split into two legs (four tracks) to transition to the Merced to Fresno Section: Hybrid Alignment. East of Road 17, the San Jose to Merced leg would curve northeast, rising to cross the UPRR/SR 99 corridor on an aerial structure, and then would continue north along the east side of Road 19.

As the alignment approaches Avenue 25, the San Jose to Merced and Merced to Fresno legs would converge, requiring the northbound track of the San Jose to Merced leg to rise on an aerial structure and cross over the tracks of the Merced to Fresno leg.

- The San Jose to Merced leg would continue north to just south of Ash Slough, where it would curve west, cross Ash Slough and the Chowchilla River on aerial structures, and continue west approximately 0.5 mile south of Harvey Pettit Road. West of South Minturn Road, the leg would curve northwest and descend below-grade into a series of three tunnels crossing under the SR 99 and UPRR corridors and the Caltrans Sandy Mush Road overhead. The UPRR tracks would be reconstructed on the roof of the HSR cut-and-cover tunnels, while maintaining the same horizontal and vertical alignment. Construction of this type of below-grade crossing would require temporarily realigning the UPRR tracks. Approximately 0.6 mile north of Sandy Mush Road, the alternative would ascend to grade and continue along the UPRR/SR 99 corridor to connect with the Merced to Fresno Section: Hybrid Alignment at Ranch Road.
- The San Jose to Fresno leg would continue east from Road 16 and, east of Road 18, ascend on an aerial structure to cross SR 99 north of the SR 99/SR 152 interchange. East of the UPRR/SR 99 corridor, the leg would continue north of Avenue 23 through Fairmead, descending to grade east of Road 18 ¾. The alternative would then curve southeast toward the BNSF corridor, crossing Dry Creek on a short aerial structure, and continuing along the west side of the BNSF corridor to join the Merced to Fresno Section: Hybrid Alignment at Avenue 19.
- The Merced to Fresno leg would split from the San Jose to Fresno leg near Road 20 ½. The southbound track of the Merced to Fresno leg would ascend on an aerial structure and cross over the tracks of the San Jose to Fresno leg. The Merced to Fresno leg would curve northwest, rise on aerial structures over several road crossings, and then continue at-grade to join the San Jose to Merced leg near Avenue 25.

Wildlife undercrossing structures would be provided in at-grade embankments where the alignment intersects wildlife corridors.

3.3.2 Electrical Interconnections

For Site 6—El Nido, interconnection facilities would include a 115 kV TPSS and switching station located immediately east of where the SR 152 (North) to Road 19 Wye Alternative crosses the Eastside Bypass. This new switching station would connect to the existing Wilson–Oro Loma 115 kV power line.

For Site 7—Le Grand Junction/Sandy Mush Road, interconnection facilities would include a 115 kV TPSS connected to a new switching station located on the east side of the UPRR/SR 99 corridor at the corner of East Sandy Mush Road and South Bliss Road via a new approximately 2.6-mile double-circuit 115 kV power line (115 kV Tie-Line). The new switching station would connect to the Wilson–Oro Loma, Wilson–Le Grand and Wilson–Dairyland (idle) 115 kV lines.

Backup electrical power would be supplied by an emergency standby generator for select electrical loads, including fire protection systems, ventilation systems, emergency lights and signage, communication systems, train controls systems, and low-voltage direct-current battery supply systems to support emergency lighting and communications.

3.3.3 State Highway or Local Roadway Modifications

The SR 152 (North) to Road 19 Wye Alternative would require the permanent closure of 36 public roadways at selected locations and the construction of 29 overcrossings or undercrossings. Table 3-2 and Figure 3-2 show the anticipated state highway and local roadway closures and modifications. Fourteen of these permanent road closures would be located at SR 152 where roads currently cross at-grade but must be closed to convert SR 152 to a fully access-controlled corridor. The proposed 14 closures are Road 5, Road 6, Road 7, Road 8, Road 10, Road 11, Road 13, Road 14, Road 14 ½, Road 15, Road 15 ½, Road 15 ¾, Road 17, and Road 18. New grade separations are planned along SR 152 at the SR 59/SR 152 interchange, Road 4/Lincoln Road, Road 12, SR and Road 17 ½. These roadways would be reconfigured to two 12-foot lanes with two 8-foot shoulders, and several of these interchanges would require realigning SR 152. Interchanges between SR 59 and SR 99 that would provide access to SR 152 are Road 9/Hemlock Road, SR 233/Robertson Boulevard, and Road 16.

The distance between over- or undercrossings would vary from less than 2 miles to approximately 5 miles where roads would be perpendicular to the proposed HSR. Between these over- or undercrossings, 22 additional roads would be closed (Figure 3-2). Local roads paralleling the proposed HSR alignment and used by small communities and farm operations may be shifted and reconstructed to maintain their function. Access easements would be provided to maintain access to properties severed by HSR.

The SR 152 (North) to Road 19 Wye Alternative would cross over SR 99 at three locations. South of Chowchilla, both the San Jose to Merced and the San Jose to Fresno legs would rise on aerial structures to cross SR 99. Another crossing of SR 99 would be at the northern end of the alternative, where it descends below-grade into an undercrossing tunnel segment. SR 99 would be temporarily realigned during construction, and would be reconstructed on the roof of the undercrossing tunnel.

3.3.4 Freight or Passenger Railroad Modifications

The SR 152 (North) to Road 19 Wye Alternative would cross over the UPRR corridor at three separate locations. South of Chowchilla, both the San Jose to Merced and the San Jose to Fresno legs would rise on aerial structures to cross the UPRR operational right-of-way. In these instances, the alternative would maintain required vertical (at least 23.3 feet) clearance over UPRR operational right-of-way to avoid or minimize effects on UPRR rights-of-way, spurs, and facilities (BNSF and UPRR 2007). The third crossing of the UPRR corridor would be at the northern end of the alternative, where the alignment would descend into an undercrossing tunnel. The UPRR tracks would be reconstructed on the roof of the HSR tunnel, maintaining the same vertical alignment. Construction of this crossing would require the temporary detour (shoofly)[5] of the UPRR tracks. In areas where the SR 152 (North) to Road 19 Wye Alternative parallels the UPRR right-of-way, the alternative maintains a minimum horizontal clearance of 102 feet from the centerline to the UPRR right-of-way

3.3.5 Summary

Table 3-2 summarizes the design features for the SR 152 (North) to Road 19 Wye Alternative.

Table 3-2 Design Features of the SR 152 (North) to Road 19 Wye Alternative

Feature	SR 152 (North) to Road 19 Wye
Total length (linear miles)[1]	55
At-grade profile (linear miles)[1]	48.5
Elevated profile (linear miles)[1]	3.5
Below-grade profile (linear miles)[1]	3
Number of straddle bents	31
Number of railroad crossings	3
Number of major water crossings	13
Number of road crossings	65
Approximate number of public roadway closures	36
Number of roadway overcrossings and undercrossings	29
Traction power substation sites	2
Switching and paralleling stations	2 switching stations, 7 paralleling stations
Signaling and train-control elements	21
Communication towers	6
Wildlife crossing structures	41

Source: Authority and FRA, 2016b

[1] Lengths shown are based on equivalent dual-track alignments and are one-way mileages. For example, the length of single-track elevated structure will be divided by a factor of 2 to convert to dual-track equivalents.

3.4 Avenue 21 to Road 13 Wye Alternative

The Avenue 21 to Road 13 Wye Alternative (Figure 3-3) is designed to follow the existing Henry Miller Road and Avenue 21 rights-of-way as closely as practicable in the east-west direction and the Road 13, SR 99, and BNSF rights-of-way in the north-south direction. Deviations from these existing transportation corridors would be necessary to accommodate design requirements; specifically, larger curves would be necessary to accommodate the high speeds of the HSR compared to lower-speed roadway alignments. The Avenue 21 to Road 13 Wye Alternative would not follow existing transportation rights-of-way as it transitions from following one transportation corridor to another.

[5] A shoofly is a temporary track alignment that detours trains around a construction site.

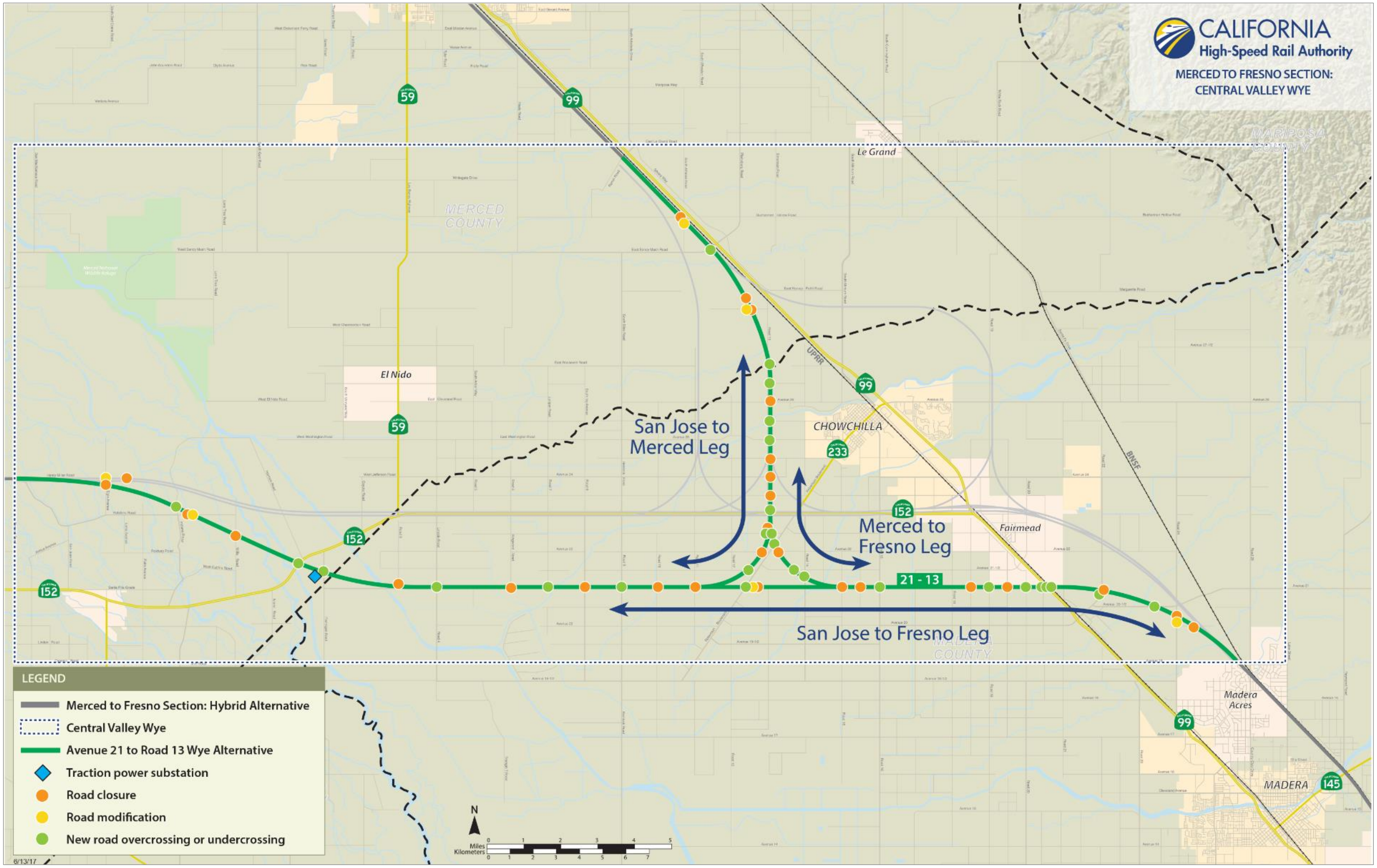
3.4.1 Alignment and Ancillary Features

The Avenue 21 to Road 13 Wye Alternative would extend approximately 53 miles, mostly at-grade on embankment, although it would also have aerial structures and a short segment of retained cut (depressed alignment). The wye configuration of this alternative would be located approximately 4 miles southwest of the city of Chowchilla, with the east-west axis along the north side of Avenue 21 and the north-south axis on the east side of Road 13.

Beginning at the intersection of Henry Miller Road and Carlucci Road (at the same point in Merced County as the SR 152 [North] to Road 13 Wye Alternative), west of Elgin Avenue this alternative would curve southeast toward the San Joaquin River and Eastside Bypass. East of Willis Road, the alignment would rise to an aerial structure to cross the river, SR 152, and the Eastside Bypass. The alignment would continue east along the north side of Avenue 21, crossing Ash Slough on an aerial structure. Southwest of Chowchilla, near Road 11, the alignment would split into two legs (four tracks) for transition to the Merced to Fresno Section: Hybrid Alignment. The San Jose to Merced leg would curve northeast, cross Road 13, and continue north along the east side of Road 13. At the beginning of the San Jose to Merced leg, the northbound track alternative would rise onto an aerial structure to cross over the tracks of the San Jose to Fresno leg. The Avenue 21 to Road 13 Wye Alternative legs would be routed as described subsequently and shown on Figure 3-3:

- As the San Jose to Merced leg approaches SR 152, it would converge with the Merced to Fresno leg, requiring the northbound track of the San Jose to Merced leg to rise on an aerial structure and cross over the tracks of the Merced to Fresno leg. The San Jose to Merced leg would continue north on an elevated alignment crossing Ash Slough, the Chowchilla River, and Road 13 on aerial structures. As the leg returns to grade, it would curve northwest, cross Dutchman Creek on an aerial structure, and follow along the west side of the UPRR/SR 99 corridor. At Sandy Mush Road, the alternative would descend into a shallow cut (depressed) section for approximately 0.5 mile, with a retained cut-and-cover undercrossing tunnel segment at the Caltrans Sandy Mush Road Overhead. The alternative would return to grade and continue along the UPRR/SR 99 corridor, connecting to the Merced to Fresno Section: Hybrid Alignment at Ranch Road.
- The San Jose to Fresno leg would continue east from the split near Road 11 along the north side of Avenue 21 toward Chowchilla. It would be predominantly at-grade on embankment, ascending to cross Berenda Slough on an aerial structure. East of the wye configuration, the alignment would extend south of Chowchilla, ascend on an aerial structure east of Road 19 1/2, and cross the UPRR/SR 99 corridor. The alternative would extend south of Fairmead and curve southeast toward the BNSF corridor, cross Dry Creek on an aerial structure, and run adjacent to the west side of the BNSF corridor to its meeting with the Merced to Fresno Section: Hybrid Alignment at Avenue 19.
- The Merced to Fresno leg would split from the San Jose to Fresno leg near Road 15. The southbound track of the Merced to Fresno leg would ascend on an aerial structure and cross over the tracks of the San Jose to Fresno leg. The Merced to Fresno leg would curve northwest, rise on aerial structures over several road crossings, and then continue on an at-grade embankment to join the San Jose to Merced leg near SR 152.

Wildlife undercrossing structures would be provided along this alternative in at-grade embankment portions of the HSR corridor where the alignment intersects wildlife corridors.



Source: ESRI, 2013; CAL FIRE, 2004; ESRI/National Geographic, 2015; Authority, 2016

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Figure 3-3 Avenue 21 to Road 13 Wye Alternative Alignment and Key Design Features

3.4.2 Electrical Interconnections

For Site 6—El Nido, interconnection facilities would include a 115 kV TPSS and switching station located on the west side of Flanagan Road. This new switching station would connect to the Wilson–Oro Loma 115 kV Power Line. Section 3.1.1 further describes the interconnection facilities associated with Site 7—Wilson.

In addition, the Avenue 21 to Road 13 Wye Alternative would require the Authority to relocate the existing PG&E Dairyland Substation. It is estimated that relocation would take approximately 18 months to complete and specific construction related activities would include the following:

- **Below-Grade Components**—Foundations, a stormwater detention and Spill Prevention Control and Countermeasure (SPCC) basin, raceways, and underground conduit would be constructed. Reinforced concrete subsurface footings and concrete slabs would be installed along with the ground grid. Substation equipment foundations would be approximately 5–16 feet deep.
- **Above-ground Structures**—These would include steel structures, circuit breakers, transformers, switchgears, buses, and other electrical equipment. These elements would be installed once the below-grade construction is complete. Equipment would be bolted or welded to slabs and footings and connected to the ground grid. The maximum height of substation equipment would be approximately 35 feet for the dead-end structures supporting the 115-kV power line interconnection. The transformers, switches, and buswork would be approximately 15 feet tall. Substation structures and equipment would be neutral gray.
- **Perimeter Fencing**—A perimeter enclosure with two access gates would be constructed around the substation perimeter for security. An 8- to 10-foot-high chain-link fence with barbed wire would be installed around the substation.
- **Security Lighting**—Security lighting would consist of sodium vapor lamps, and all exterior lighting would use non-glare light bulbs, designed and positioned to minimize casting light or glare to off-site locations. Light poles placed at each corner of the substation would be approximately 10 feet high and constructed of galvanized steel. The lights would be controlled by a photocell that automatically turns the lights off during the day and on at night.
- **Access Roads**—Access roads leading to the substation would be dirt, and roads within the substation would be paved. Generally, access roads would be 20 feet wide.

Backup electrical power will be supplied by an emergency standby generator for select electrical loads including fire protection systems, ventilation systems, emergency lights and signage, communication systems; train controls systems, and low-voltage direct-current battery supply systems to support emergency lighting and communications.

3.4.3 State Highway or Local Roadway Modifications

The Avenue 21 to Road 13 Wye Alternative would require the permanent closure of 30 public roadways at selected locations and the construction of 28 overcrossings or undercrossings. Table 3-3 and Figure 3-3 show the anticipated state highway and local roadway closures. This alternative would require the fewest roadway and state highway modifications.

The Avenue 21 to Road 13 Wye Alternative would rise on aerial structures and cross over state highway facilities in three locations: SR 59 at Harmon Road, SR 152 at Road 13, and SR 99 at Avenue 21. Where other roads would be perpendicular to the proposed HSR, over- or undercrossings are planned at distances from less than 2 miles to 5 miles. Between these over- and undercrossings, some roads may be closed. Local roads paralleling the HSR alignment and used by small communities and farm operations may be shifted and reconstructed to maintain their function. Access easements would be provided to maintain access to properties severed by HSR.

3.4.4 Freight or Passenger Railroad Modifications

The Avenue 21 to Road 13 Wye Alternative would cross the UPRR operational right-of-way on an aerial structure south of Fairmead and maintain a vertical (at least 23.3 feet) clearance over UPRR operational right-of-way to avoid or minimize effects on other UPRR rights-of-way, spurs, and facilities. In areas where the Avenue 21 to Road 13 Wye Alternative parallels the UPRR right-of-way, the alternative maintains a minimum horizontal clearance of 102 feet from the centerline to the UPRR right-of-way.

3.4.5 Summary

Table 3-3 summarizes the design features for the Avenue 21 to Road 13 Wye Alternative.

Table 3-3 Design Features of the Avenue 21 to Road 13 Wye Alternative

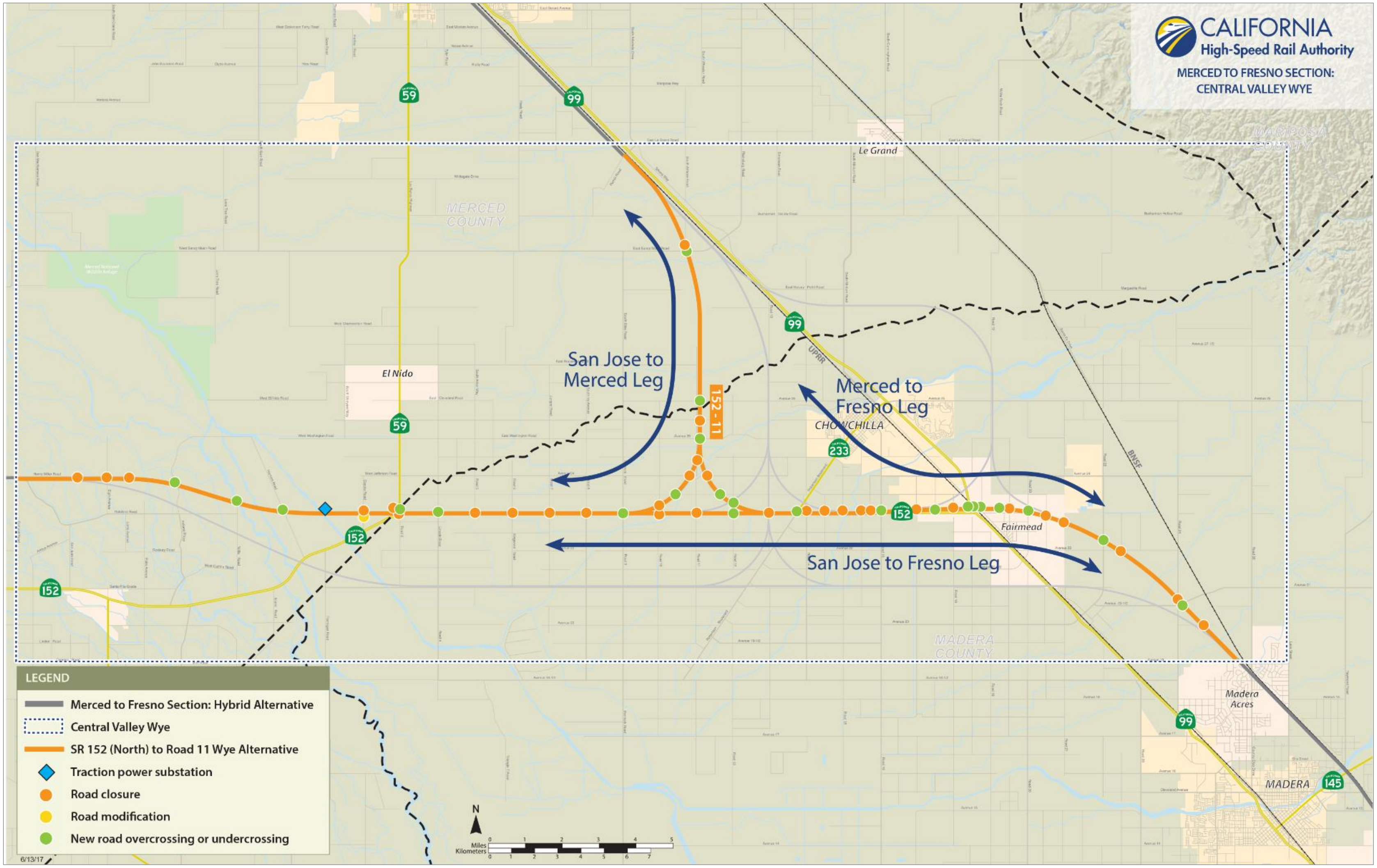
Feature	Avenue 21 to Road 13 Wye
Total length (linear miles)[1]	53
At-grade profile (linear miles)[1]	48.5
Elevated profile (linear miles)[1]	4
Below-grade profile (linear miles)[1]	0.5
Number of straddle bents	32
Number of railroad crossings	1
Number of major water crossings	11
Number of road crossings	58
Approximate number of public roadway closures	30
Number of roadway overcrossings and undercrossings	28
Traction power substation sites	1
Switching and paralleling stations	1 switching station, 7 paralleling stations
Signaling and train-control elements	15
Communication towers	6
Wildlife crossing structures	44

Source: Authority and FRA, 2016b

[1] Lengths shown are based on equivalent dual-track alignments and are one-way mileages. For example, the length of single-track elevated structure will be divided by a factor of 2 to convert to dual-track equivalents.

3.5 SR 152 (North) to Road 11 Wye Alternative

The SR 152 (North) to Road 11 Wye Alternative (Figure 3-4) follows the existing Henry Miller Road and SR 152 rights-of-way as closely as practicable in the east-west direction, and the Road 11, SR 99, and BNSF rights-of-way in the north-south direction. Deviations from these existing transportation corridors are necessary to accommodate design requirements; specifically, wider curves are necessary to accommodate the speed of the HSR compared to lower-speed roadway alignments. The SR 152 (North) to Road 11 Wye Alternative would not follow existing transportation rights-of-way where it transitions from following one transportation corridor to another.



Source: ESRI, 2013; CAL FIRE, 2004; ESRI/National Geographic, 2015; Authority, 2016

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Figure 3-4 SR 152 (North) to Road 11 Wye Alternative Alignment and Key Design Features

3.5.1 Alignment and Ancillary Features

The SR 152 (North) to Road 11 Wye Alternative would extend approximately 51 miles, mostly at-grade on raised embankment, although it would also have aerial structures. The wye configuration of this alternative would be located west-southwest of the city of Chowchilla, with the east-west axis along the north side of SR 152 and the north-south axis on the east side of Road 11.

Like the other three alternatives, this alternative would begin in Merced County at the intersection of Henry Miller Road and Carlucci Road, and would continue at-grade on embankment east toward Elgin Avenue, where it would curve southeast toward the San Joaquin River and Eastside Bypass. Approaching Willis Road, the alignment would rise to cross the San Joaquin River on an aerial structure, return to embankment, then cross the Eastside Bypass on an aerial structure. After crossing the Eastside Bypass, this alternative would continue east, crossing SR 59 at-grade just north of the existing SR 152/SR 59 interchange, entering Madera County. To accommodate the SR 152 (North) to Road 11 Wye Alternative, the SR 152/SR 59 interchange would be reconstructed slightly to the south, and SR 59 would be grade-separated to pass above the HSR on an aerial structure. The alignment would continue east at-grade along the north side of SR 152 toward Chowchilla, splitting into two legs (four tracks) near Road 10 to transition to the Merced to Fresno Section: Hybrid Alignment, and would cross Ash Slough on an aerial structure. All but the northbound track of the San Jose to Merced leg of the alternative would then return to at-grade embankment; the northbound track would rise to cross over the tracks of the San Jose to Fresno leg on an aerial structure as it curves north toward Merced. The SR 152 (North) to Road 11 Wye Alternative legs would be routed as described in this section and shown on Figure 3-4:

- The southbound track of the San Jose to Merced leg would turn north at-grade. This split would be west of Chowchilla, at approximately Road 10. The two San Jose to Merced tracks would continue north on the eastern side of Road 11, crossing the Chowchilla River, and then would cross over Road 11 to follow its west side. As the tracks return to grade, they would curve northwest, crossing Dutchman Creek on an aerial structure, following the west side of the UPRR/SR 99 corridor. The alignment would continue north, crossing over Sandy Mush Road on an aerial structure. The alignment would return to grade and continue along the west side of the UPRR/SR 99 corridor, connecting to the Merced to Fresno Section: Hybrid Alignment at Ranch Road.
- The San Jose to Fresno leg would continue east from the wye split near Road 10, along the north side of SR 152 toward Chowchilla. It would be predominantly at-grade, ascending on aerial structures at several road crossings and Berenda Slough. The leg would pass south of Chowchilla at-grade then rise to cross over the UPRR/SR 99 corridor and Fairmead Boulevard on an aerial structure. East of the UPRR/SR 99 corridor, the alignment would extend at-grade through Fairmead, north of Avenue 23. At approximately Road 20, the leg would curve southeast toward the BNSF corridor and cross Dry Creek on a short aerial structure. The SR 152 (North) to Road 11 Wye Alternative would align parallel to the west side of the BNSF corridor as it meets the Merced to Fresno Section: Hybrid Alignment at Avenue 19.
- The Merced to Fresno leg would split from the San Jose to Fresno leg near Road 13. The southbound track of the Merced to Fresno leg would ascend on an aerial structure and cross over the tracks of the San Jose to Fresno leg. The Merced to Fresno leg would curve northwest, rise on a high embankment crossing over several roads, and continue at-grade on embankment to join the San Jose to Merced leg near Avenue 25.

Wildlife undercrossing structures would be installed in at-grade embankments along this alternative where the alignment intersects wildlife corridors.

3.5.2 Electrical Interconnections

The electrical interconnections for the SR 152 (North) to Road 11 Wye Alternative would be the same as those described for the SR 152 (North) to Road 13 Wye Alternative (Section 3.1.2).

3.5.3 State Highway or Local Roadway Modifications

The SR 152 (North) to Road 11 Wye Alternative would require the permanent closure of 33 public roadways at selected locations and the construction of 24 overcrossings or undercrossings in lieu of closure. Table 3-4 and Figure 3-4 show the anticipated state highway and local roadway closures and modifications. Fourteen of these permanent road closures would be located at SR 152 where roads currently cross at-grade but need to be closed in order to convert SR 152 to a fully access-controlled corridor. The 14 proposed closures are Road 5, Road 6, Road 7, Road 8, Road 10, Road 11, Road 13, Road 14, Road 14 1/2, Road 15, Road 15 1/2, Road 15 3/4, Road 17, and Road 18. Planned new grade separations along SR 152 at the SR 59/SR 152 Interchange, Road 4/Lincoln Road, Road 12, and Road 17 1/2 would maintain access to SR 152. These roadways would be reconfigured to two 12-foot lanes with two 8-foot shoulders. Several of these new interchanges would require realigning SR 152. Three new interchanges are proposed between SR 59 and SR 99 to provide access to SR 152: at Road 9/Hemlock Road, SR 233/Robertson Boulevard, and Road 16.

The distance between over- or undercrossings would vary from less than 2 miles to approximately 5 miles where other roads are perpendicular to the proposed HSR Between these over- or undercrossings, 19 additional roads would be closed. Local roads paralleling the proposed HSR alignment and used by small communities and farm operations may be shifted and reconstructed to maintain their function. Access easements would be provided to maintain access to properties severed by HSR.

3.5.4 Freight or Passenger Railroad Modifications

The SR 152 (North) to Road 11 Wye Alter native would cross over the UPRR right-of-way as it passes south of Chowchilla. This alternative would maintain required vertical (at least 23.3 feet) clearance over UPRR operational right-of-way to avoid or minimize effects on UPRR rights-of-way, spurs, and facilities (BNSF and UPRR 2007). In areas where the SR 152 (North) to Road 11 Wye Alternative parallels the UPRR right-of-way, the alternative maintains a minimum horizontal clearance of 102 feet from the centerline to the UPRR right-of-way.

3.5.5 Summary

Table 3-4 summarizes the design features for the SR 152 (North) to Road 11 Wye Alternative.

Table 3-4 Design Features of the SR 152 (North) to Road 11 Wye Alternative

Feature	SR 152 (North) to Road 11 Wye
Total length (linear miles)[1]	51
At-grade profile (linear miles)[1]	46.5
Elevated profile (linear miles)[1]	4.5
Below-grade profile (linear miles)[1]	0
Number of straddle bents	27
Number of railroad crossings	1
Number of major water crossings	13
Number of road crossings	57
Approximate number of public roadway closures	33

Feature	SR 152 (North) to Road 11 Wye
Number of roadway overcrossings and undercrossings	24
Traction power substation sites	1
Switching and paralleling stations	1 switching station, 7 paralleling stations
Signaling and train-control elements	19
Communication towers	9
Wildlife crossing structures	37

Source: Authority, 2016
[1] Lengths shown are based on equivalent dual-track alignments and are one-way mileages. For example, the length of single-track elevated structure will be divided by a factor of 2 to convert to dual-track equivalents.

4 METHODS

The methodology for conducting CRAM is described in the California Rapid Assessment Method for Wetlands: User's Manual, Version 6.1 (CWMW 2013a). This section provides details on pre-field preparations, the CRAM team for the Central Valley Wye, and field methods and limitations particular to this section of the HSR.

4.1 Wetland Classification

CRAM uses a wetland classification derived primarily from the functional classification described in the Hydrogeomorphic Method (Brinson 1993). The CRAM typology includes five wetland types: riverine wetlands, depressional wetlands, estuarine wetlands, lacustrine wetlands, and slope wetlands. All but lacustrine wetlands have been divided into subtypes. Based on the resources within the study area, riverine wetlands and depressional wetlands and their subtypes were used in the CRAM assessment for the Central Valley Wye.

The *Merced to Fresno: Central Valley Wye, Second Supplemental Wetlands Delineation Report* (Authority and FRA 2016c) submitted for the Central Valley Wye described Special Aquatic Resource (SAR) types identified in the study area using the Cowardin system. This system is similar but not equivalent to the standard CRAM typology. A "crosswalk" was used to standardize the aquatic feature terms to standard wetland classification in accordance with CRAM (Table 4-1).

Table 4-1 Crosswalk of Standard Terms Used for Wetland Condition Assessment

Second Supplemental Wetlands Delineation Report	CRAM Type
Constructed Basin	Depressional wetlands (subtype: depressional)
Constructed Watercourse	Riverine wetlands (subtype: confined and non-confined riverine)
Freshwater Marsh	Depressional wetlands (subtype: depressional)
Mixed Riparian	Riverine wetlands (subtype: confined and non-confined riverine)
Other Riparian	Riverine wetlands (subtype: confined and non-confined riverine)
Palustrine Forested Wetland	Riverine wetlands (subtype: confined and non-confined riverine)
Seasonal wetland	Depressional wetlands (subtype: depressional)
Vernal pool	Depressional wetlands (subtypes: individual vernal pools and vernal pool systems)

Source: Authority and FRA, 2016c
CRAM = California Rapid Assessment Method
SAR= special aquatic feature

4.2 CRAM Team Members

The team that prepared this report and performed field investigations was led by John Markham and Lindsay Teunis. Mr. Markham was selected as the regulatory task manager/team leader because of his experience as a former USACE regulatory senior project manager and policy compliance specialist, and experience as a CRAM trainer. Mrs. Teunis was selected as the CRAM coordinator because of her involvement in development of CRAM as a member of the CRAM North Coast Regional Team and her experience as a CRAM trainer. All other team members were all previously trained in CRAM and have experience and knowledge of aquatic features and wetland vegetation. Individuals involved in the preparation of this report and field aspects of this study are listed in Table 4-2.

Table 4-2 CRAM Certified Staff for Central Valley Wye

Name	Education	CRAM Certification Dates	Project Role
John Markham	M.P.H, Environmental Health Science, University of California, Los Angeles, 2001. B.A., Biological Sciences, Colorado College, 1994.	Riverine South Coast—April 20–22, 2009 Estuarine South Coast—October 22–23, 2009 Depressional South Coast—September 23-24, 2013	Author CRAM Coordinator and Regulatory Task Manager—Week 1
Lindsay Teunis	M.A., Biology (Ecology), Humboldt State University, 2010 B.S., Environmental Science (Landscape Ecosystems), Humboldt State University, 2003	Riverine North Coast—April 15–17, 2008	Author CRAM Coordinator—Week 2
Kristen Klinefelter	M.S., Applied Environmental Science, University College Dublin, Ireland, 2012 B.A., Biology, University of California, Santa Barbara, 2011	Riverine and Depressional South Coast—April 7–11, 2014 Vernal Pool South Coast—April 20–22, 2015	Author CRAM field and office support—Weeks 1 and 2
Lanika Cervantes	M.S., Biological Sciences, California State University San Marcos, 2013 B.A., Biological Sciences (Emphasis in Ecology), California State University San Marcos, 2009	Riverine South Coast—March 21-23, 2012 Depressional—September 23-24, 2013 Vernal Pools—April 5-19, 2016 All in South Coast.	CRAM field support—Week 1
Robert Preston	Ph.D., Botany, University of California, Davis, 1990 M.A., Botany, California State University, Chico, 1983 B.A., Biological Sciences and Chemistry, California State University, Chico, 1981	Riverine Northern California—February 28-March 2, 2011 Wet Meadows Northern California—February 28-March 2, 2011 Vernal Pools South Coast—April 18-19, 2016	CRAM field support—Week 2
Eric Christensen	B.S., University of California, Davis. Evolution and Ecology, 2004	Riverine and Estuarine Central Coast—May 2–6, 2011	CRAM field support—Week 2
Donna Maniscalco	B.A., University of California, Davis. Wildlife, Fish, and Conservation Biology,	Riverine and Estuarine Central Coast—May 2–6, 2011	CRAM field support—Week 2

Source: Authority and FRA, 2018
CRAM = California Rapid Assessment Method

4.3 Procedures for Using CRAM

CRAM evaluates wetlands by scoring four key attributes: buffer and landscape context, hydrology, physical structure, and biotic structure. All CRAM modules assess these four attributes using various metrics and submetrics to address wetland class-specific relationships. In all modules, the CRAM "Index Score," or overall score, is calculated as the average of the four attribute scores. The condition assessment of wetlands for the Central Valley Wye used CRAM according to the most recent field books for the four modules: riverine; depressional; individual vernal pool; and vernal pool systems (CWMW 2013b, c, d, e).

4.3.1 Assessment Areas

In CRAM, the conditions attributed to wetland areas in a site or region are based on the conditions sampled in AAs, which are chosen to represent the wetlands within the site or region. The AAs in the Central Valley Wye study area were identified by the CRAM team and geographic information system (GIS) staff in areas without site access constraints (see Section 4.3.3), and were reviewed by John Markham and Lindsay Teunis, the CRAM coordinators. The features being assessed were assigned a CRAM wetland type and sub-type to determine the CRAM module to be used in the field for each AA. Previously mapped land use and wetland categories were helpful in the assignment of the CRAM wetland type but these exact boundaries were not used in the CRAM assessment. For example, a natural watercourse surrounded by other riparian would have been combined into one riparian CRAM feature and assessed as a whole. Before conducting CRAM fieldwork, a field packet was created for each prospective AA, which included maps at necessary scales that showed a preliminary boundary for each AA, as well as a field book with necessary text and work tables for conducting CRAM.

Figure 4-1 shows the location of all the AAs within the study area. Appendix A provides individual maps of all the AAs evaluated for this report.

4.3.2 Field Assessment

Field assessments were conducted during May 16 through 24, 2016, for the HSR alignments associated with the SR 152 (North) to Road 13 Wye Alternative, SR 152 (North) to Road 19 Wye Alternative, and Avenue 21 to Road 13 Wye Alternative.

As required by CRAM, the field team modified AA boundaries during fieldwork to better capture the conditions present in the AAs at the time of the assessment. Additionally, some AAs were shifted during the field investigations to more appropriate locations that better represented the wetlands present. The revisions to AA boundaries made in the field were used by the GIS staff to update the CRAM maps. The results and maps provided in this report reflect the AAs and field conditions identified by the field team at the times that CRAM fieldwork was conducted. Any deviations from standard CRAM methodology are described in Section 4.3.3.

4.3.3 Field Conditions and Limitations

With the exception of the SR 152 (North) to Road 11 Wye Alternative and electrical interconnection components, CRAM field assessments occurred within the appropriate assessment window for all wetland classes, which corresponds with the growing season. For riverine wetlands, the appropriate assessment window extends from March to October. For depressional wetlands, the appropriate assessment window extends from March to September. For vernal pool wetlands, the appropriate assessment window extends from March to July (CWMW 2009).

Two depressional sites and eight riverine sites were based on road-side assessments due to a lack of permission to enter the site. These sites were assessed to the best of the team's ability based on observation with binoculars, aerial photographs, and knowledge of the surrounding area. These sites are noted as "road-side assessments" in their respective CRAM forms.

4.3.4 Extrapolation Methodology

Data from the 28 surveyed sites were used to extrapolate the evaluations to all wetlands that fell within affected areas of the four Central Valley Wye alternatives. Wetland types surveyed included seasonal wetland (7 sites), constructed basin (2 sites), constructed watercourse (7sites), natural watercourse (11 sites), and individual vernal pool (1 site) (Table 5-1).

CRAM Index scores for the nine depressional features and 18 riverine features (both natural and constructed) assessed in the Central Valley Wye study area were averaged, ordered, and plotted from low to high on Figures 5-1 and 5-2, respectively. CRAM scores for depressional and riverine features displayed an intuitive division between natural and constructed features, with natural watercourses consistently scoring higher than constructed watercourses and seasonal wetlands consistently scoring higher than constructed basins. Data was further reviewed within each wetland type to note any distinct breaks that would justify multiple condition classes (i.e., low, medium, and high). Whether a result of the low sample size or the small geographic area, no unique condition classes were identified. The CRAM Index scores were averaged for each wetland type and the average score was then applied to the remaining un-surveyed wetland features of each wetland type.

Due to the limited sample size of one for vernal pools in the Central Valley Wye study area, fifteen vernal pools, assessed in a previous CRAM assessment of the Merced to Fresno Section, were used to extrapolate to the Central Valley Wye vernal pool features. The Merced to Fresno Section overlaps geographically with the Central Valley Wye and the scores are expected to be representative of the Central Valley Wye vernal pools. Scores in the Merced to Fresno Section ranged from a low of 33 to a high of 72. In the Technical Memorandum, *Revised Justification for Vernal Pool CRAM Scores and Documentation of CRAM Score Revisions – Merced to Fresno Section Permitting Phase 1 of the California High Speed Train Project* (Authority 2013a) a natural break could not be found in the scores. However, a simple average was not recommended as the range in scores was so large, there was concern that the resource would be undervalued and subsequently under mitigated. Through discussions with the USACE, two pools thought to be uncharacteristic for the Merced to Fresno Section were removed from consideration and then the average of the remaining two highest scoring vernal pool AAs (65) were used to extrapolate across vernal pool features (CH2M Hill 2013). It is our recommendation to continue to use an extrapolated score of 65 for the Central Valley Wye vernal pool features until additional data supports an alternative score for the Central Valley Wye.

4.3.5 Post-Field Data Evaluation

After completion of each round of fieldwork, the scoring results were entered into an Excel spreadsheet by the CRAM team and reviewed by the CRAM coordinators. The spreadsheet was compared with the field data forms for quality assurance purposes (for data entry and computational errors). The Excel spreadsheet is the basis for this summary report. The spreadsheet and the original field data forms are provided as Appendix B and C, respectively. Additionally, AA boundary maps and site photographs are provided in Appendix A and D, respectively.

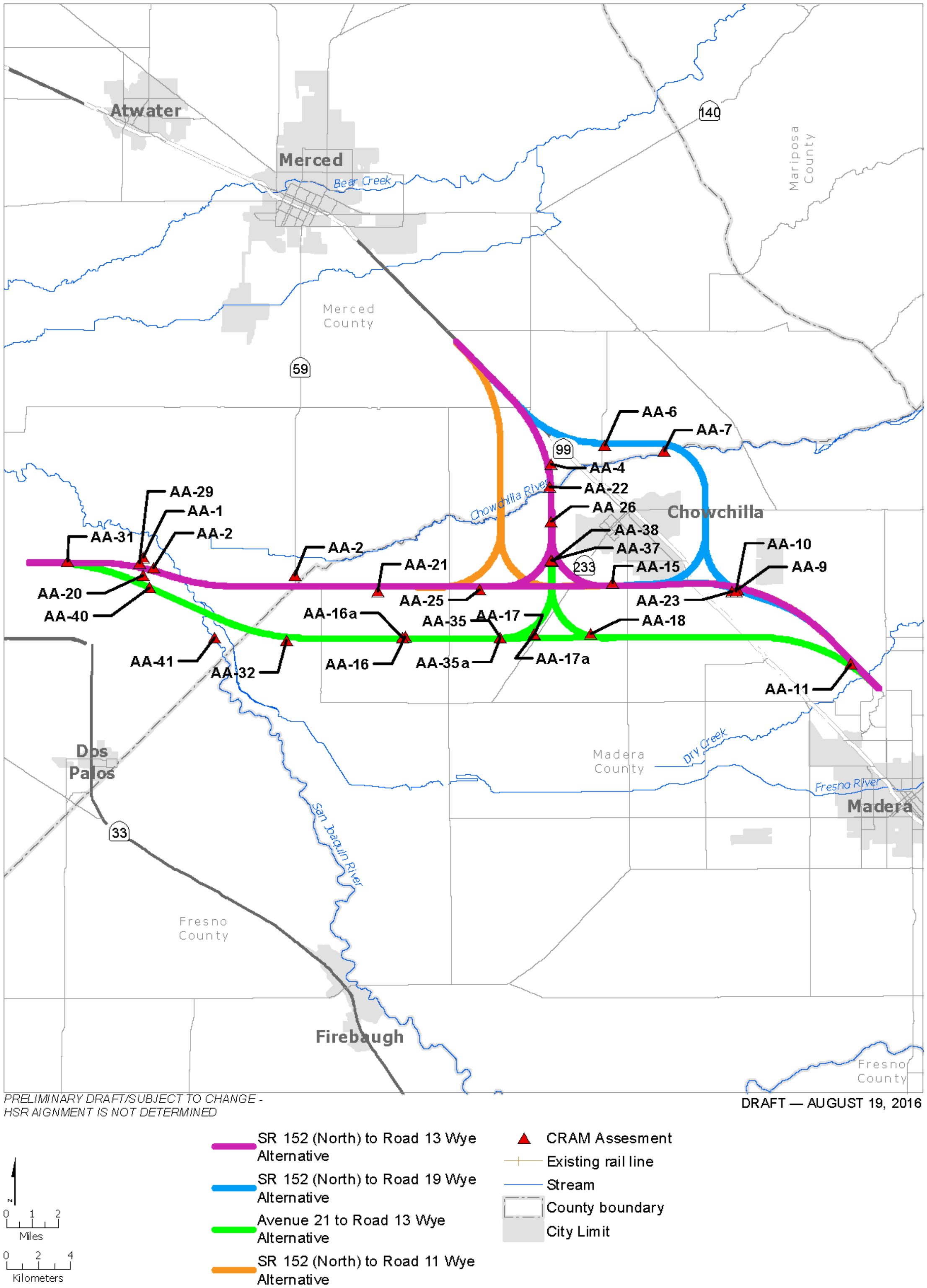


Figure 4-1 CRAM Assessment Locations

5 RESULTS: MERCED TO FRESNO SECTION: CENTRAL VALLEY WYE CRAM SCORES

This section presents the CRAM scores from the condition assessment conducted in the study area of the Central Valley Wye. A total of 28 AAs were assessed; a table summarizing the results for all of the AAs is provided in Appendix B and data forms are provided in Appendix C.

Three CRAM wetland types were identified within the Central Valley Wye: (1) depressional wetlands; (2) riverine wetlands; and (3) individual vernal pools. Each of these wetland types have corresponding CRAM field books, which were used to assess the AAs. A summary of the average CRAM scores for each CRAM wetland type is presented in Table 5-1. Possible CRAM scores range from 25 to 100 with 100 representing the maximum reference conditions within a given wetland type and 25 representing the lowest possible score. CRAM Index scores within the Central Valley Wye study area ranged from 31 to 75 (see Appendix C for individual CRAM index scores).

Table 5-1 Average Index and Attribute Scores by CRAM Type, by Wetland Type

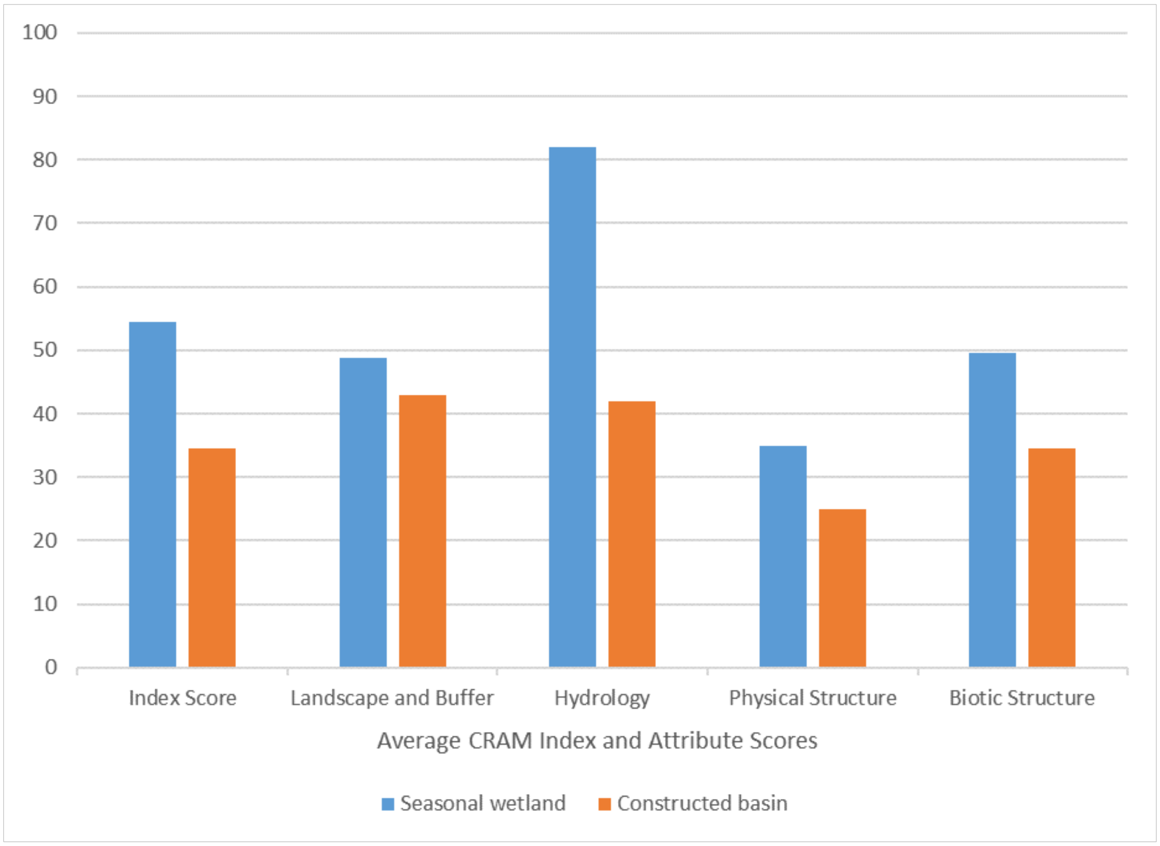
CRAM Type	Wetland Type	Number of AAs	Average CRAM Index Score	Average CRAM Attribute Scores			
				Buffer and Landscape Context	Hydrology	Physical Structure	Biotic Structure
Depressional Wetland		9	50	47.6	73.1	32.7	46.2
	Seasonal Wetland	7	55.2	51.2	89.9	33.6	42.8
	Constructed Basin	2	43.5	43	52.25	31.5	50.5
Riverine Wetland		18	52	45	83	25	54
	Natural Watercourse	11	56.7	68.1	62.5	45	44.7
	Constructed Watercourse	7	50.7	75	49.9	28.4	33.6
Individual Vernal Pool	Vernal Pool	1	52	45	83	25	54

Source: Authority and FRA, 2018
AA = Assessment Area
CRAM = California Rapid Assessment Method

5.1 Depressional

Depressional wetlands include constructed basins and seasonal wetlands. The field team evaluated nine AAs across the project study area using the depressional wetlands module. The scores were based on the assessment of five seasonal wetlands and four constructed basins. There was a clear break between wetland types, with natural depressions (seasonal wetlands) scoring above the average for index and attribute scores while the constructed basins scored below all averages. Constructed basin hydrology attribute scores differed the most from natural depressions due to their manipulated hydrologic regimes. All depressional wetlands sampled were primarily surrounded by agricultural land, resulting in low buffer and landscape context attribute scores.

AA2 is a section of the San Joaquin River that was assessed as a depressional wetland because surrounding agricultural development had cut off the natural flow of water and isolated the feature into a single seasonal wetland. Due to the historical riverine condition of AA2, it not surprisingly scored higher in the physical structure attribute (50) compared to the other depressional wetlands. This was attributed to the increased topographic complexity relative to other depressional wetlands. Figure 5-1 shows the average CRAM index scores and attribute scores for constructed basins and seasonal wetlands evaluated using the depressional wetland module.



Source: Authority and FRA, 2018

Figure 5-1 Comparison of Average CRAM Index Scores and Attribute Scores for Depressional Wetland AAs

The constructed basins surveyed are commonly used for retention/detention of stored water for agricultural water conveyances within individual properties. Constructed basins all received low buffer and landscape context attribute scores because they are immediately surrounded by agricultural land. Most of the surveyed features were sparsely vegetated and representative plants included barnyardgrass (*Echinochloa crus-galli)* and Johnsongrass (*Sorghum halepense*), both of which are common non-native species. Because constructed basins exist to store water, they exhibited very few patch types, with the most common one being open water.

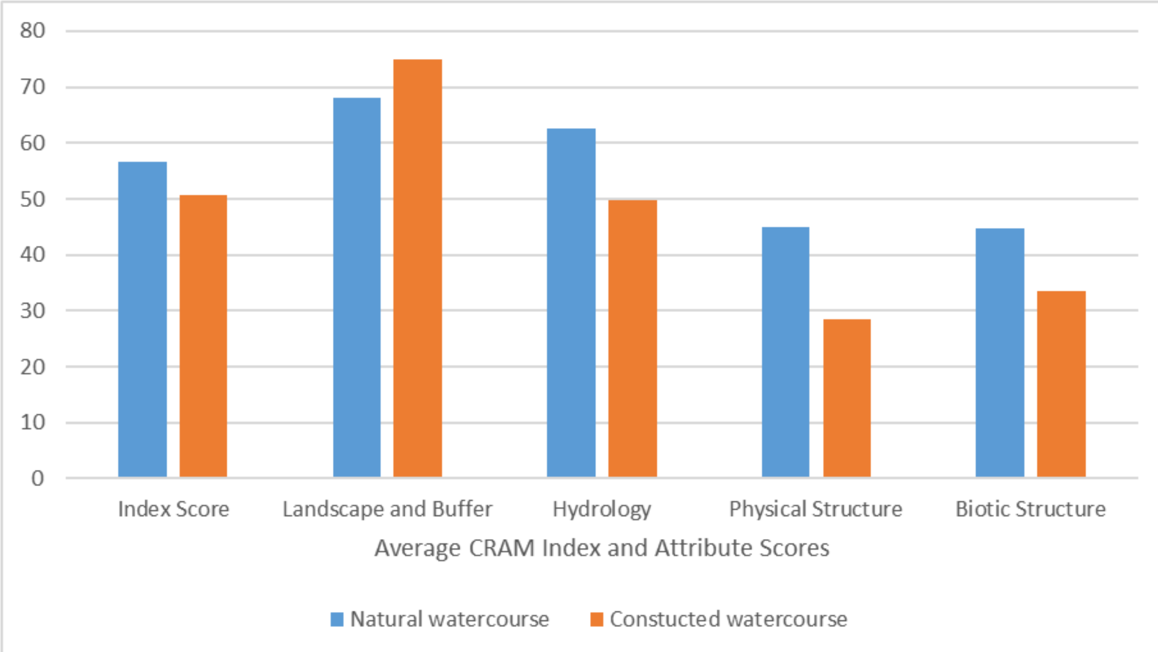
Seasonal wetlands are natural depressions that are hydrologically closed off from a flow-through system. They may have a distinct inlet and outlet but no obvious flow path exists. Two types of natural depressions were observed. The first type consists of areas where water has pooled to create a shallow natural depression; these features are often sparsely vegetated and located along paved and unpaved roads. The second type consists of remnant riverine features that have been closed off by surrounding agricultural developments and thus have more established riparian vegetation. Most of the dominant species in these wetlands were non-native, likely a result of their proximity to unnatural agricultural land and highly disturbed soils. These species included poison hemlock (*Conium maculatum*) and a variety of nonnative grasses (Johnsongrass, Italian rye grass [*Festuca perennis*], and farmer's foxtail [*Hordeum murinum*]). These features had on average slightly more patch types than constructed basins, with the most common patch types being animal mounds and burrows, abundant wrack or organic debris, large woody debris, and non-vegetated flats or bare ground.

5.2 Riverine

The field team evaluated 18 AAs using the riverine module for two wetland types, natural watercourses and constructed watercourses. Scores were based on the assessment of 11 natural watercourses and seven constructed watercourses. The constructed watercourses were generally the lowest-scoring features across all attributes except for the buffer and landscape context attribute. Most of the constructed watercourses were adjacent to agricultural developments, lacked physical and biotic complexity, and had hydrologic regimes controlled by weirs, gates, and pumping systems. Although some of these features may have historically been natural features, most appear to be built for the purpose of water conveyance at a regional level or at a small scale within a property. Figure 5-2 shows the average CRAM index scores for both constructed and natural watercourses evaluated using the riverine module.

Natural watercourses are natural riverine features that still exist amongst the highly manipulated agricultural land within the study area. These features consistently supported a greater number of dominant plant species than constructed watercourses. The most common plant species included Baltic rush (*Juncus balticus*) willows (*Salix goodingii*, *Salix laevigata*, *Salix exigua*), and the non-native prickly lettuce (*Lactuca serriola*). Natural watercourses exhibited twice as many patch types as non-natural constructed watercourses with the most common patch types including abundant wrackline or organic debris, pools or depressions in channels, standing snags, and variegated, convoluted, or crenulated foreshore.

Two types of constructed watercourses were observed in the Central Valley Wye: canals and agricultural ditches. Canals are part of the larger water conveyance system for surrounding agricultural land, usually made from earthen material, uniform in width, sparsely vegetated and are often inundated year round. Agricultural ditches are features that develop on or near agricultural land as a result of water delivery within individual properties and are often manipulated as part of the land management. These are also sparsely vegetated, but are usually smaller in width than canals and more frequently dry. The most common plant species in constructed watercourses were cattails (*Typha* species) and non-native grasses. The number of patch types exhibited by each feature was half that of natural watercourses, with the most common patch types including abundant wrackline or organic debris and cobbles or boulders (which were often built patches, such as revetment).



Source: Authority and FRA, 2018

Figure 5-2 Comparison of Average CRAM Index Scores and Attribute Scores for Riverine Wetland AAs by Wetland Type

5.3 Individual Vernal Pools

Due to limited access only one vernal pool (AA 11) was assessed in the field using the individual vernal pool module. This is an inadequate sample size for extrapolation and as such the historical dataset used for the entire Merced to Fresno Section was considered as the geographic extent included a larger area within the Central Valley between Merced and Fresno (including the Central Valley Wye) (CH2M Hill 2013). If additional opportunities for on the ground access become available this data can be revised to be specific to the Central Valley Wye.

As only one vernal pool was surveyed within the Central Valley Wye study area the following description applies to vernal pools in general within this geography. Common plant species observed in vernal pools within the Central Valley often include woolly marbles (*Psilocarphus brevissimus*), popcorn flower (*Plagiobothrys* spp.), water pygmy-stonecrop (*Crassula aquatica*), annual hairgrass (*Deschampsia danthonioides*), purslane speedwell (*Veronica peregrina*), and toad rush (*Juncus bufonius*). Shallow vernal pools, such as those observed within the study area, are often characterized by an abundance of nonnative grasses and forbs such as Mediterranean barley (*Hordeum marinum*) and hyssop-loosestrife (*Lythrum hyssopifolium*), but these areas also typically contain relatively high cover of native vernal pool plants such as coyote thistle (*Eryngium* spp.).

6 DISCUSSION

This section discusses the sampling and methodological considerations of using CRAM for the Central Valley Wye and of using CRAM to evaluate watershed condition. This section also provides some discussion on the effects of stressors on CRAM scores and using CRAM to extrapolate existing conditions for all the aquatic features in the study area.

6.1 Consistency with CRAM Requirements and Implementation Guidelines

With the guidance of the CRAM coordinators the field portion of this study was conducted in accordance with published CRAM technical requirements, except as indicated later in this section. However, these differences from the published requirements do not affect the validity of this assessment. The results reported in this document stem from a valid application of CRAM.

6.1.1 Sample Frame and Sample Size

The 2009 Technical Bulletin; Using CRAM to Assess Wetlands Projects (CWMW 2009) describes the process for establishing a project-based sampling protocol to: (1) establish a separate map of the study area showing all of the aquatic features of each wetland type (the sample frame for that type); (2) identify possible AAs within each sample frame for the study area; and (3) sample a subset of AAs. To be sure the sample size accurately describes the real variation in condition in each sample frame, randomly select one AA and compare to the average index score of the other AAs. If the randomly selected AA's index score differs from the average index score of the other AAs by more than 10 CRAM points, additional samples should be added and the process repeated until the difference is less than 10 CRAM points

For the Central Valley Wye, the sample frames (the set of wetlands of each type from which the sample of AAs is drawn) were determined by the locations of aquatic features of each type within a given distance of the Central Valley Wye alternative alignments. The set of sites that were sampled was further restricted based on the team's permission to access the features. It is an unavoidable consequence of the arrangement of aquatic features that the combination of proximity and property access permission limited the locations and numbers of AAs that could be sampled. Moreover, due to the timing of project definition, wetlands within the Wetland Study Area of the electrical interconnection components were not part of the original sample frame. However, these wetlands have similar characteristics to the wetlands within the Wetland Study Area of the Central Valley Wye alternative alignments (including land-use, size, management activities, etc.); therefore, the sample frames described here are adequate from which to extrapolate the electrical interconnection component scores as well.

Based on access limitations, the resulting samples for each aquatic features (Table 5-1) were nine (combined) for depressional features, 18 (combined) for riverine features, and one for individual vernal pools. The project team made an effort to distribute the AAs in each module throughout the four Central Valley Wye alternative alignments according to the sample frame; that is, to sample the aquatic features where they occurred throughout the study area to confirm that the range of variability in these features was captured in the results. The sample size analysis described earlier was performed on each wetland type except for individual vernal pool. This analysis was performed after surveying was complete in an attempt to confirm that the sample size was adequate to describe the aquatic resources. One AA was selected for riverine and depressional features using a random number generator. The overall CRAM score of the selected AA was compared to the average overall score of the remaining AAs in that wetland type. The randomly chosen AA was less than 10 points different than the average overall CRAM score for constructed basin, seasonal wetland, natural watercourse, and constructed watercourse. This indicates that although sampling was limited based on access, an adequate sampling was achieved to capture the variability in wetland condition in each of these wetland types.

This type of analysis could not be performed for individual vernal pools which had a sample size of one. Vernal pools are the only wetland type to have a less than desired sample size.

6.1.2 Methodology Considerations

A minor deviation in CRAM methodology occurred in conducting assessments on two depressional sites and eight riverine sites. Because the team did not have permission to enter these sites, they were assessed as "roadside assessments" from the side of the road or nearest viewing point using binoculars where necessary. These sites consisted of one seasonal wetland, one constructed basin, four constructed watercourses, and four natural watercourses. In the case of riverine sites, bankfull width across the feature had to be estimated by sight instead of being measured. This effort was easier for the four constructed waterways because they were generally more uniform in width and less vegetated than the natural waterways, thus providing a more accurate score.

6.2 Watershed Condition

The arrays of CRAM scores reported in Section 5.0 provide a snapshot of watershed condition in the vicinity of the four Central Valley Wye alternatives. Table 5-1 presents the relevant CRAM Index and Attribute Scores for features assessed, by feature subtype.

6.2.1 Depressional Sites

Depressional sites across all four alternatives were divided into two wetland types: constructed basins and seasonal wetlands. Constructed basins exhibited much lower CRAM scores, reflected by the fact that these features are constructed (i.e., unnatural) and work in conjunction with other unnatural, built watercourses such as canals and ditches. Most are vegetated, but have little topographic complexity. These basins temporarily store groundwater and are the primary water source for the agricultural irrigation systems they are a part of, often found directly adjacent to constructed canals. They may provide water that flows through the canal systems that still exhibit "remnant" watershed characteristics and contribute rainfall to a watershed low point.

Seasonal wetlands are common throughout the study area, occurring as low points in un-used agricultural fields or fragments of past natural riverine features. These natural features provide much better conditions than those of constructed features, which is exhibited by their higher CRAM attribute scores.

6.2.2 Riverine Sites

Both constructed and natural watercourses were assessed in CRAM using the riverine module, which allows for comparison of constructed features with respect to natural riverine conditions in the study area. The constructed watercourses assessed throughout the study area yielded scores that on average were only somewhat lower (approximately six CRAM points) than scores for the natural watercourses. This indicates that the natural features in the study area are of low condition, scoring only slightly better than those of constructed features.

The constructed irrigation canals and ditches form an alternative hydrological network to the natural drainage system that existed before most of the study area became devoted to agriculture. Both types of riverine features shared similar functions; natural channels could be used for irrigation water flow as well as conveying water runoff and constructed canals could convey stormwater in addition to delivering irrigation flows.

The low condition scores for constructed waterways are primarily because they are constructed, artificial features in the setting of an already modified watershed. Similarly, the modified watershed and surrounding agricultural use are responsible for lowering the condition of the natural watercourses in the study area and the resulting lower overall CRAM scores. Overall, both wetland types do not provide the same aquatic benefits as riverine systems in a natural, less-altered setting.

6.2.3 Individual Vernal Pool Sites

As described earlier, only one vernal pool was surveyed within the Central Valley Wye study area as a result of limited property access. As such, this discussion applies to vernal pools in general within this geography and is based on the broader dataset associated with the Merced to Fresno

Section. The quality of vernal pools identified within the Merced to Fresno Section ranged from low quality in areas of inactive farmland to moderate quality in grazed California annual grassland. Based on qualitative observations during the field effort for the Central Valley Wye, most of the pools were dominated by nonnative grasses, with minimal vernal pool dependent species present. This is likely an indication of disturbance but also strongly related to historical drought conditions and the timing of the field visit. No high quality undisturbed vernal pools were identified within the study area.

6.3 Effects of Stressors on CRAM Scores

In addition to calculating an overall CRAM index score and attribute Scores, CRAM includes a stressor checklist. A stressor is defined in the CRAM User's Manual as "the consequence of anthropogenic events or actions that measurably affect conditions in the field" (CWMW 2013a). The stressor checklist is used to account for low CRAM scores by identifying specific effects on the landscape, hydrology, physical, or biotic structure of an AA. In some cases, a single stressor may be the primary cause of low-scoring conditions, though conditions are usually caused by interactions among multiple stressors (USEPA 2002). The stressor checklist was completed for each AA assessed. Constructed basin had the highest average number of stressors (13) of any of the wetland types (Table 6-1). The most common type of stressors observed were hydrology and physical stressors such as non-point source discharge (farm runoff), ditches (agricultural drainage), grading/compaction, and plowing/discing. The high occurrence of stressors are not unexpected given the intense agricultural land uses in this area and further supports the observations of overall moderate to low scores for all wetland types.

Table 6-1 Average Number of Stressors by Attribute and Wetland Type

Wetland Type	Average Number of Stressors	Attribute Stressors			
		Buffer and Landscape Stressors	Hydrology Stressors	Physical Stressors	Biotic Stressors
Constructed Basin	13	4	4	3	2
Seasonal Wetland	9	3	2	2	2
Constructed Watercourse	10	2	4	3	1
Natural Watercourse	10	3	3	3	2
Vernal Pool	11	3	3	3	2

Source: Authority and FRA, 2018

6.4 Existing Condition Extrapolation

CRAM data reflect snapshots in time of the condition of the assessed aquatic features, although the condition data identified in CRAM assessments represent an integration of the landscape, hydrological, physical, and biological factors affecting these features over time. To the extent that the underlying physical, hydrological, biotic, and land use conditions for the assessed features are represented elsewhere in the watersheds that contain the project elements, the CRAM scores may be used to infer condition (and functions provided) in other parts of those watersheds. However, making such extrapolations is not included within the CRAM methodology per se, and care is warranted in verifying the reach of the factors underlying CRAM scores if the object is to extrapolate condition scores from a sampled area to a larger area.

Because of the internal CRAM standard, the condition data for a feature of a given type (e.g., a vernal pool) near one project element can be compared directly to the condition data for another feature of the same type near a different element. This means that CRAM assessment results are directly applicable for comparing the conditions of similar elements across alternatives. The relative similarity of the important geological, ecological, and land use conditions throughout the

Central Valley Wye merely reinforce the conclusion that differences in CRAM scores among alternatives reflect actual differences among the sites. Consequently, these data are applicable in considering the relative effects of project alternative elements on these features; in other words, in identifying the LEDPA.

6.5 Alternative Comparison

Tables 6-2 through 6-5 show the CRAM results for each of the four alternatives, including wetland type, the number of times a wetland type is intersected by an alignment, the number of features that were directly surveyed (assessed with CRAM), the number of features that have been assigned an extrapolated CRAM scores, and the average CRAM score for each wetland type. The tables also display the total number of intersections with all wetland features and the overall CRAM score for each alternative. The average overall CRAM score is essentially the same for each alternative (1 point apart) as a result of the homogenous landscape and the level of extrapolation that was necessary. The apparent lack of difference in overall CRAM score between the alternatives implies there is no obvious choice for the alternative based on simple overall condition of wetlands. With an increased sample size the ability to distinguish may be improved. The alternatives could also be compared by considering the number of intersections to wetland features by alternative, which would better discern differences between the alternatives. This comparison method does not take into account acreage, but rather the frequency of interactions between a given alternative and the wetland features. Avenue 21 to Road 13 Wye Alternative and SR 152 (North) to Road 11 Wye Alternative have the lowest number of total intersections (162 and 156 respectively) when compared to SR 152 (North) to Road 13 Wye Alternative, which crosses 187 features. In addition, Avenue 21 to Road 13 Wye Alternative and SR 152 (North) to Road 11 Wye Alternative have the lowest number of intersections with the higher scoring, natural wetland features such as natural watercourses (18 and 21 respectively) compared to 29 natural features crossing SR 152 (North) to Road 13 Wye Alternative.

Table 6-2 Summary of CRAM Results for SR 152 (North) to Road 13 Wye Alternative

Wetland Type	Number of Intersections	Surveyed Features	Extrapolated Features	Average CRAM Score
Constructed Basin	37	2	35	45
Constructed Watercourse	107	5	102	51
Natural Watercourse	29	3	26	58
Seasonal Wetland	8	1	7	52
Vernal Pool	6	0	6	65
TOTAL	**187**	**11**	**176**	**51**

Source: Authority and FRA, 2018
CRAM = California Rapid Assessment Method

Table 6-3 Summary of CRAM Results for Avenue 21 to Road 13 Wye Alternative

Wetland Type	Number of Intersections	Surveyed Features	Extrapolated Features	Average CRAM Score
Constructed Basin	29	2	27	44
Constructed Watercourse	98	11	87	51
Natural Watercourse	18	3	15	59
Seasonal Wetland	7	0	7	52
Vernal Pool	10	0	10	65
TOTAL	**162**	**16**	**146**	**52**

Source: Authority and FRA, 2018
CRAM = California Rapid Assessment Method

Table 6-4 Summary of CRAM Results for SR 152 (North) to Road 19 Wye Alternative

Wetland Type	Number of Intersections	Surveyed Features	Extrapolated Features	Average CRAM Score
Constructed Basin	27	4	23	45
Constructed Watercourse	93	5	88	51
Natural Watercourse	25	1	24	58
Seasonal Wetland	16	1	15	52
Vernal Pool	5	0	5	65
TOTAL	**166**	**11**	**155**	**52**

Source: Authority and FRA, 2018
CRAM = California Rapid Assessment Method

Table 6-5 Summary of CRAM Results for SR 152 (North) to Road 11 Wye Alternative

Wetland Type	Number of Intersections	Surveyed Features	Extrapolated Features	Average CRAM Score
Constructed Basin	30	4	26	45
Constructed Watercourse	97	3	94	51
Natural Watercourse	21	1	20	58
Seasonal Wetland	3	1	2	53
Vernal Pool	5	0	5	65
TOTAL	**156**	**9**	**147**	**51**

Source: Authority and FRA, 2018
CRAM = California Rapid Assessment Method

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Authority	California High-Speed Rail Authority
BNSF	BNSF Railway
CAL FIRE	California Department of Forestry and Fire Protection
CWMW	California Wetlands Monitoring Workgroup
ESRI	Environmental Systems Research Institute
FRA	Federal Railroad Administration
NRCS	Natural Resources Conservation Service
UPRR	Union Pacific Railroad
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

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8 PREPARER QUALIFICATIONS

This section lists individuals who assisted in the preparation of this report and provides a summary of their qualifications, roles, and responsibilities.

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