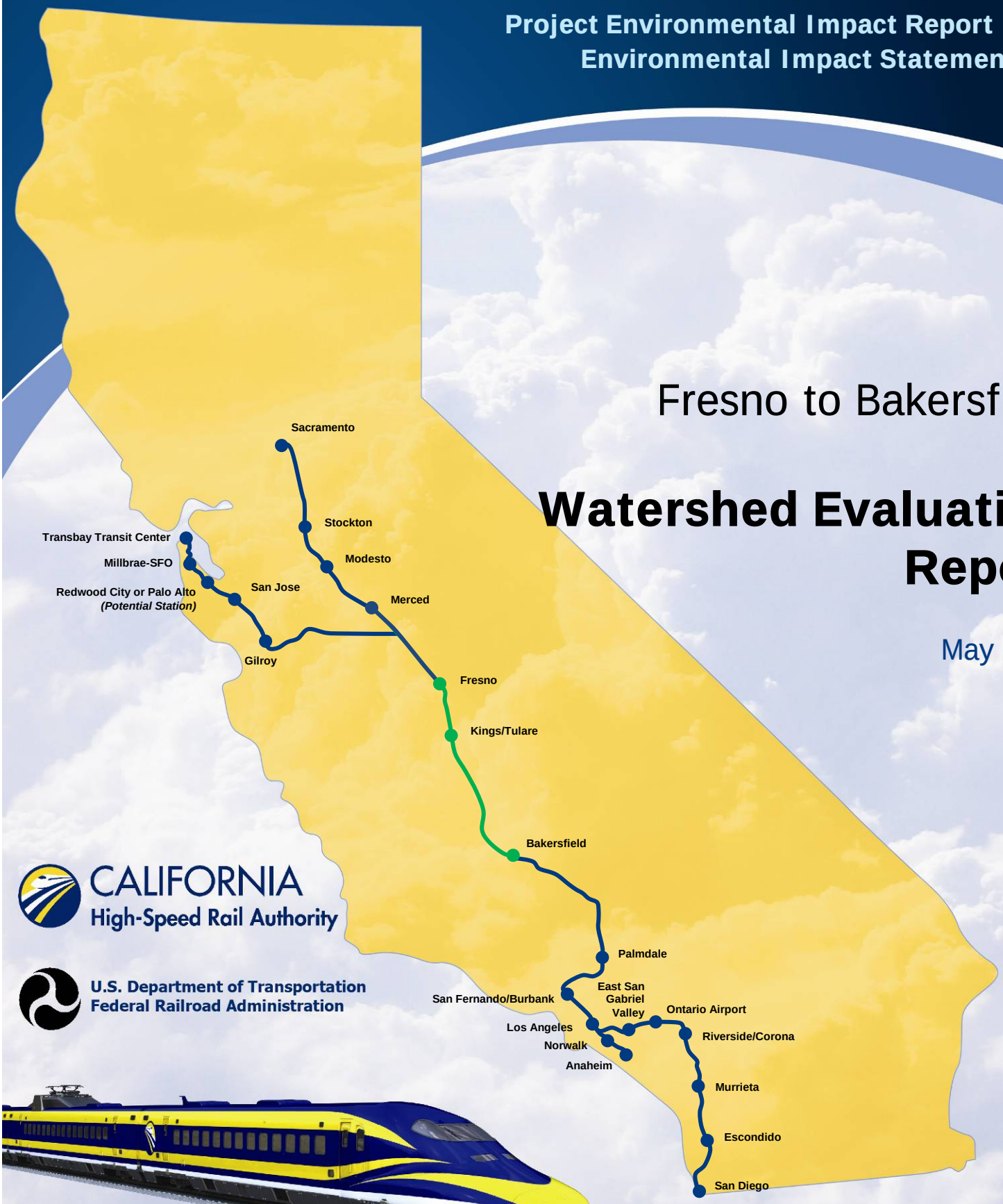
CALIFORNIA HIGH-SPEED TRAIN

Project Environmental Impact Report / Environmental Impact Statement

Fresno to Bakersfield

Watershed Evaluation Report

May 2013



CALIFORNIA High-Speed Rail Authority

U.S. Department of Transportation
Federal Railroad Administration

CALIFORNIA HIGH-SPEED TRAIN PROJECT

Watershed Evaluation Report

Prepared by:

URS/HMM/Arup Joint Venture

May 2013

Please Note: The wetland delineation data referenced in this report is consistent with the data presented in *Fresno to Bakersfield Revised Draft EIR / Supplemental Draft EIS.* Since the preparation of this report, minor changes to the wetland delineation have been made, resulting in small changes to the extent (acreages) and types of special aquatic resources occurring in the Fresno to Bakersfield Wetland Study Area. These changes are based on recommendations and guidance from the U.S. Army Corps of Engineers (USACE) and were included in interim deliverables to USACE in August and October 2012. A final wetland delineation revision package including additional changes was submitted to USACE in January 2013 and resulted in the issuance of a Preliminary Jurisdictional Determination by the USACE on February 5, 2013. A summary of the modifications to special aquatic resources since the publication of the Revised Draft EIR/Supplemental Draft EIS is provided in Table A.

Changes to special aquatic resources since the preparation of the Revised Draft EIR/Supplemental Draft EIS include the following:

- Revised the extent of ditches, canals, retention/detention basins, a small portion of the Kings River, and vernal pools along the Fresno to Bakersfield alignment based on updated aerial imagery.
- Added ditches, canals, seasonal wetlands and ditches along the Fresno to Bakersfield alignment based on updated aerial imagery.
- Added vernal pools in the Allensworth area, along the BNSF Alternative and the Allensworth Bypass Alternative.
- Removed ditches, retention/detention basins, and seasonal wetlands along the Fresno to Bakersfield alignment that no longer exist based on updated aerial imagery.
- Changed large, linear vernal pools and vernal swales and one ditch to seasonal wetlands and changed one vernal swale to a ditch. These changes generally occurred in the BNSF right-of-way between Corcoran and Allensworth.

Because these changes were made after the preparation of this report and the associated Evaluation of Wetland Conditions Using the California Rapid Assessment Method (CRAM) Report, they are not reflected in this document. Revisions to the wetland delineation as covered by the Preliminary Jurisdictional Delineation may occur as a result of additional engineering changes to the Fresno to Bakersfield alignment. Any such changes will be incorporated into the Final EIR/EIS.

Table A
Modifications to Fresno-Bakersfield Special Aquatic Resources in the Wetland Study Area[a]

Special Aquatic Resource	RDEIR/SDEIS[b] (June 2012)	Interim Deliverable (Aug 2012)	Interim Deliverable (Oct 2012)	PJD (Feb 2013)
Emergent Wetland	0.92	0.92	0.92	0.92
Seasonal Wetland	43.56	43.44	73.05	74.46
Vernal Pool	77.90	72.05	52.46	68.00
Vernal Swale	17.96	16.40	5.71	4.86
Total Wetlands	*140.34*	*132.81*	*132.14*	*148.24*
Canal/Ditch	199.55	206.21	205.92	207.53
Reservoir	117.58	117.58	117.58	117.58
Retention/detention Basin	160.75	159.71	159.24	156.00
Seasonal Riverine	58.33	56.73	56.73	56.26
Total Other Waters of the U.S.	*536.20*	*540.23*	*539.47*	*537.36*
Special Aquatic Resources Total[c]	**676.54**	**673.04**	**671.61**	**685.60**

Notes:

[a] Wetland Study Area includes linear and auxiliary project construction features (i.e., TPSS, switching stations, paralleling stations, road overcrossings, heavy maintenance facilities) plus a 250-foot buffer.

[b] Based on the Supplemental PJWWDR (June 2012)

[c] This total is derived from raw GIS data. As a result, it may not exactly equal the sum of the rounded values presented in the table.

Acronym:
TPSS = traction power supply station

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Acronyms

2008 Mitigation Rule	"Compensatory Mitigation for Losses of Aquatic Resources" (Final rule) (33 C.F.R. Parts 325 and 332 and 40 C.F.R. Part 230)
AA	assessment area
Allensworth ER	Allensworth Ecological Reserve
Authority	California High-Speed Rail Authority
CDFG	California Department of Fish and Game
C.F.R.	Code of Federal Regulations
cfs	cubic feet per second
CRAM	California Rapid Assessment Method
EIR/EIS	Environmental Impact Report/Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
ESA	federal Endangered Species Act
F.R.	Federal Register
FRA	Federal Railroad Administration
GIS	Geographic Information System
HST	high-speed train
HUC-8	Hydrologic Unit Code 8
Kern NWR	Kern National Wildlife Refuge
LEDPA	Least Environmentally Damaging Practicable Alternative
MOU	*NEPA/404/408 Memorandum of Understanding*
NHD	National Hydrography Dataset
NRCS	Natural Resources Conservation Service
Pixley NWR	Pixley National Wildlife Refuge
SR	State Route
TWG	Technical Working Group
USACE	U.S. Army Corps of Engineers
U.S.C.	United States Code
USGS	U.S. Geological Survey
USFWS	U.S. Fish and Wildlife Service

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Executive Summary

Executive Summary

A watershed-level analysis of aquatic resources for the Fresno to Bakersfield Section of the California High-Speed Train (HST) System (project) has been developed in conformance with the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (EPA) April 10, 2008 "Compensatory Mitigation for Losses of Aquatic Resources" (Final rule) (2008 Mitigation Rule) (33 Code of Federal Regulations [C.F.R.] Parts 325 and 332 and 40 C.F.R. Part 230) and California's Level 1-2-3 framework for wetland monitoring and assessment. Also, as required by the *NEPA/404/408 Memorandum of Understanding* (MOU) between the Federal Railroad Administration (FRA), California High-Speed Rail Authority (Authority), EPA, and USACE, dated November 2010 (FRA et al. 2010), a "detailed (rapid assessment or better) assessment of the functions and services of special aquatic sites and other waters of the U.S." has been conducted to assist in the analysis of impacts. The goal of the MOU is to facilitate compliance with the National Environmental Policy Act (42 United States Code [U.S.C.] Section 4321 *et seq.),* Section 404 of the Clean Water Act (33 U.S.C. Section 1344), and Section 14 of the Rivers and Harbors Act (33 U.S.C. Section 408) process for the project-level (Tier 2) Environmental Impact Statement for the project. The integration process comprises three "checkpoints," which punctuate ongoing coordination efforts. The three checkpoints are:

A. Definition of purpose and need for the Tier 2 HST project.

B. Identification of the Range of Alternatives to be studied in the project (Tier 2) Environmental Impact Report / Environmental Impact Statement (EIR/EIS).

C. Preliminary Least Environmentally Damaging Practicable Alternative (LEDPA) Determination; USACE Section 408 Draft Response; and Draft Mitigation Plan consistent with 33 Code of Federal Regulations (C.F.R.) Part 332 and 40 C.F.R. Part 230 (73 Federal Register [F.R.] 19,593, dated April 10, 2008).

This document provides information in support of the Checkpoint C Preliminary LEDPA Determination as it relates to Section 404 of the Clean Water Act. Several Technical Working Group (TWG) meetings occurred to coordinate and communicate technical issues and clarifications regarding the application of the watershed approach, including the Level 1-2-3 assignment of condition values to aquatic features and identification of direct impacts, indirect impacts, and post-project conditions and their application in determining the LEDPA. Two notable directives were produced from the Technical Working Group meetings, one referring to the concept of developing watershed profiles for each particular watershed unit that would be affected by the Fresno to Bakersfield Section and the other referring to the impact assessment framework for the MOU Checkpoint C Preliminary LEDPA Determination and the Section 404(b)(1) determination process.

This report is designed to provide an analysis for the USACE of the extent and quality of wetlands and other jurisdictional features present within the watersheds in which the Fresno to Bakersfield Section of the HST System occurs. The purpose of this evaluation is to provide the USACE information regarding the extent and quality of aquatic resources present in the study areas and the extent to which these features would be affected by the construction and operation of the Fresno to Bakersfield Section. The effect on existing functions and services is analyzed by alignment alternative and design option so that the USACE and can use the data in their determination of the LEDPA.

The proposed project is to construct and operate an HST rail line from Fresno to Bakersfield. The *Fresno to Bakersfield Revised Draft EIR / Supplemental Draft EIS* evaluates 10 alternatives, including the No Project Alternative, the BNSF Alternative and the Hanford West Bypass 1, Hanford West Bypass 2, Corcoran Elevated, Corcoran Bypass, Allensworth Bypass, Wasco-Shafter

Bypass, Bakersfield South, and Bakersfield Hybrid alternatives. Of the nine Fresno to Bakersfield HST Alternatives (excluding the No Project Alternative), one alternative, the BNSF Alternative, spans the entire project length, from Fresno to Bakersfield. The remaining eight alternative alignments deviate from the BNSF Alternative for portions of the route to avoid environmental, land use, or community impacts.

ES1.0 Methods

This Watershed Evaluation Report for the Fresno to Bakersfield Section discusses the methods and analysis used to develop a watershed profile, identifies the existing conditions of the aquatic resources, quantifies direct and indirect impacts on aquatic resources, and estimates the post-project condition of aquatic resources. In some instances, the data used were developed in part at a national or statewide level by others (e.g., the U.S. Fish and Wildlife Service, the U.S. Geological Survey). The Level 1 Watershed Profile uses a number of national and statewide or regional databases to estimate the type, distribution, extent (quantity), and condition of the aquatic resources in each watershed. This information helps identify the regional setting of the aquatic resource impacts expected to occur as part of the implementation of the project.

Direct and indirect impacts are conservatively estimated by overlaying the construction and project footprints on the results of the wetland delineation (Authority and FRA 2012g). The construction and project footprints were used to identify direct impacts, and a 250-foot buffer around the footprints (study area) was used to calculate indirect impacts to adjacent aquatic resources. The existing conditions of the aquatic resources were determined by a two-step process: (1) conducting a site-specific assessment using the California Rapid Assessment Method (CRAM) on a sample of aquatic features that are representative of the types of features found in the study area; and (2) extrapolating the results of the CRAM assessment and assigning a relative condition (i.e., poor, fair, good, or excellent) to all aquatic features. Quantifying impacts, assessing the condition of aquatic resources, and extrapolating the conditions of aquatic features constitute the Level 2 Impact Evaluation.

The model for estimating the post-project conditions of the aquatic resources affected by implementation of the project was developed based on a set of generated projections. The projections used and extrapolated post-project conditions based on the type of aquatic resource affected, the location within the construction or project footprints, the type of impact (direct or indirect), and the existing relative condition. A similar set of projections were generated to assess the risk (low, moderate, or high) of loss or change to aquatic resources as a result of indirect impacts.

ES2.0 Aquatic Resources

A number of aquatic resources were identified in the study area, including federal-jurisdictional wetlands, other waters of the U.S., and riparian areas. Identified wetland features include seasonal wetlands, emergent wetlands, and vernal pools and swales. Other waters of the U.S. identified in the study area include canals/ditches, lacustrine, and seasonal riverine. Additionally, riparian areas, that are generally found in association with seasonal riverine features, were identified and are discussed with aquatic resources because of the important functions they provide that affect water quality, including groundwater recharge, surface water supply, nutrient cycling, water filtration, temperature control, maintenance of plant and animal communities, sediment transport and storage, stream channel dynamic equilibrium, and streambank stabilization. Many of the jurisdictional waters in the study area have been leveled, drained, and/or leveed for agricultural purposes (to prevent flooding).

The physical and biological characteristics of the various features are largely dictated by whether the feature is manipulated or natural. Manipulated features include all jurisdictional water

features except vernal pools and swales. Manipulated features contain substrates that have been altered through excavation, filling, dredging, or accretion of sediments; these substrates typically range from sandy and coarse-loamy to fine-silty, fine-loamy, and fines (depending on location in the study area). Natural features such as vernal pools and swales have substrates composed of natural alkaline soils, which are harsh environments for microbes and plants and contain low levels of organic matter.

ES3.0 Level 1 Watershed Profile

The Fresno to Bakersfield Section is located in the Tulare Lake Basin; specifically the project is located in seven U.S. Geological Survey HUC-8 sub watersheds basins:

- Upper Dry Watershed (18030009)
- Tulare–Buena Vista Lakes Watershed (18030012)
- Upper Kaweah Watershed (18030007)
- Upper Tule Watershed (18030006)
- Upper Deer–Upper White Watershed (18030005)
- Upper Poso Watershed (1803004)
- Middle Kern–Upper Tehachapi–Grapevine Watershed (1803003)

All of these watersheds are in the Tulare Lake Basin, which covers a large and diverse area in California. The profiles of each of the watersheds within the areas of the Fresno to Bakersfield Section alternatives share many similarities across the Tulare Lake Basin. All of the watersheds are characterized by mostly protected headwaters. In the Sierra Nevada Foothills and the Mountains and the Coast Ranges ecological sections, the impacts that degrade the quality of the aquatic features are mostly dams and associated reservoirs. Proportionally within each watershed, these ecological sections do not contribute nearly as much acreage and linear feet of aquatic features as does the Great Valley ecological section.

Throughout the Tulare Lake Basin and across all the watersheds in the study area, the valley has largely been manipulated through agriculture, transportation and urban development. These conversions have resulted in the loss, manipulation, and degradation of aquatic resources through upper watershed impoundments, removal of riparian vegetation, and other hydrological manipulations. These activities have largely resulted in the extensive reduction of riparian habitat, the accretion of streams, and the loss of Tulare Lake, Buena Vista Lake, and Kern Lake as well as an extensive loss of other sensitive aquatic features (i.e., vernal pools and swales).

Furthermore, the historical and current land use patterns have blurred the boundaries of the watersheds through the construction of an extensive network of irrigation canals and ditches. Due to the north-south orientation and linear nature of the Fresno to Bakersfield Section, impacts to aquatic features occur across all seven watersheds. However, most of the Fresno to Bakersfield alternatives have relatively small footprints within a few different watersheds.

The Fresno to Bakersfield Section occurs entirely within the Great Valley ecological section. The project impact profile and the subsequent compensatory mitigation are similar across all seven watersheds, except perhaps the Upper Deer–Upper White Watershed. The Upper Deer–Upper White Watershed contains a significantly greater area of vernal pool landscapes and should be a focus of compensatory mitigation efforts.

The 2008 Mitigation Rule states a preference for mitigation using a watershed approach, but acknowledges that for linear projects, where impacts are distributed across multiple watersheds, more ecological functions and values may be created, enhanced, or restored in fewer consolidated mitigation projects. Because of the degraded condition of aquatic resources in the region, the focus of compensatory mitigation will be on consolidated mitigation projects because

they provide the best opportunity to benefit the region. The mitigation may also be consolidated in the watersheds that would experience significant ecological loss of aquatic resources in excellent or good condition.

ES4.0 Level 2 Impact Evaluation

The Level 2 Impact Evaluation describes the impacts to aquatic resources, identifies the existing conditions of those resources, estimates their post-project condition, summarizes the details of a Compensatory Mitigation Plan to offset the negative effects, and discusses the overall net condition of the associated watersheds. The evaluation is conducted for each of the proposed Fresno to Bakersfield alternatives. The impact profile has three components: direct-permanent impacts, direct-temporary impacts (in areas where the impact would occur only during construction), and indirect (and indirect-bisected) permanent impacts adjacent to the construction and project footprint (within a 250-foot buffer).

Impacts are presented in a manner that allows for a comparison of the HST alternative alignments (Table ES-1). Under the BNSF Alternative, the acreage reflects the total impact that would occur along the only end-to-end alternative. To compare the other project alternatives and design options, the table contains two numbers for each of these other alternatives: the first number is the impact acreage anticipated for the given alternative; the second number is the change (or delta) when compared against the corresponding segment of the BNSF Alternative: positive (+) differences indicate that the alternative alignment results in more impact acres than its corresponding segment of the BNSF Alternative; negative (-) differences indicate that the alternative alignment results in fewer impact acres than its corresponding segment of the BNSF Alternative.

The impact evaluation provides an analysis of the project impacts based on watershed and alternative alignment. The data suggest that certain alignment alternatives will either reduce or increase the project's impacts to aquatic resources. In some instances, one alternative may increase impacts to one type of feature, but reduce impacts to another type of feature or condition classification. These evaluations primarily focus on direct-permanent impacts to aquatic features that are natural, are hard to replace, or are in fair to excellent condition. The information provided in the main body of the report provides an evaluation for all features, in all condition classifications (poor, fair, good, and excellent), for all types of impacts (direct-permanent, direct-temporary, indirect-bisected, and indirect). However, for the purpose of the Executive Summary, the evaluation only covers the total impacts based on the type of impact and the total impacts based on the condition.

In general, the focus is first and foremost on impacts to aquatic resources that are in excellent or good condition, secondarily on impacts to aquatic resources in fair condition, and lastly on impacts to aquatic resources in poor condition. Similarly, impacts that are direct-permanent are more severe than those that are direct-temporary, indirect-bisected, or indirect. Additional analysis of other environmental resources and impacts (e.g., other biological resources, cultural resources, important farmland) and evaluation with respect to cost, logistics, and technology should be conducted when evaluating and selecting the LEDPA.

Table ES-1
Summary Comparison of Direct-Permanent and Other Impacts on Aquatic Resources by Alternative

Wetlands and Other Waters (TYPE/HST water type)	Impact Type /Feature Type [a]	Alternative										
		BNSF Impact Acreage	Hanford West Bypass 1—At-Grade Option	Hanford West Bypass 1—Below-Grade Option	Hanford West Bypass 2—At-Grade Option	Hanford West Bypass 2—Below-Grade Option	Corcoran Elevated	Corcoran Bypass	Allensworth Bypass	Wasco-Shafter Bypass	Bakersfield South	Bakersfield Hybrid
			Impact Acreage / Difference Compared with Corresponding BNSF Area [b]									
Total Impacts by Impact Type and Alternative												
Total Impacts	Direct-Permanent	100.95	16.47 / +2.20	15.02 / +0.75	13.03 / -1.24	11.57 / -2.70	15.04 / -6.13	14.00 / -7.17	23.70 / -15.01	4.78 / -3.28	5.39 / -0.18	6.08 / +0.52
	Direct-Temporary	13.01	1.44 / +0.85	1.44 / +0.85	1.54 / +0.96	1.54 / +0.96	0.90 / +0.02	5.18 / +4.31	2.72 / +1.20	1.16 / -1.46	3.92 / -0.22	3.89 / -0.25
	Indirect-Bisected	23.88	—	—	—	—	4.76 / -0.73	— / -5.49	1.73 / -15.52	—	—	—
	Indirect	361.16	43.41 / -5.66	36.47 / -12.61	55.01 / +5.93	48.06 / -1.01	36.27 / +9.21	28.47 / +1.41	154.68 / -31.78	12.34 / -7.21	32.87 / -14.05	32.28 / -14.64
Total Impacts to Poor Aquatic Resources		274.84	44.15 / +14.77	36.71 / +7.32	41.40 / +12.01	33.95 / +4.57	44.56 / +2.54	38.64 / -3.38	102.47 / -8.74	18.28 / -11.94	23.83 / -2.18	23.90 / -2.11
Total Impacts to Fair Aquatic Resources		128.37	7.17 / +2.45	6.22 / +1.49	18.18 / +13.46	17.23 / +12.50	12.39 / -0.17	8.99 / -3.57	71.53 / -25.01	—	— / -0.86	— / -0.86
Total Impacts to Good Aquatic Resources		94.26	10.00 / -19.82	10.00 / -19.82	10.00 / -19.82	10.00 / -19.82	0.01 / 0.00	0.01 / 0.00	8.83 / -25.84	—	18.35 / -11.41	18.35 / -11.41
Total Impacts to Excellent Aquatic Resources		1.53	—	—	—	—	—	—	— / -1.53	—	—	—

Table ES-1
Summary Comparison of Direct-Permanent and Other Impacts on Aquatic Resources by Alternative

Wetlands and Other Waters (TYPE/HST water type)	Impact Type /Feature Type [a]	Alternative										
		BNSF Impact Acreage	Hanford West Bypass 1—At-Grade Option	Hanford West Bypass 1—Below-Grade Option	Hanford West Bypass 2—At-Grade Option	Hanford West Bypass 2—Below-Grade Option	Corcoran Elevated	Corcoran Bypass	Allensworth Bypass	Wasco-Shafter Bypass	Bakersfield South	Bakersfield Hybrid
			Impact Acreage / Difference Compared with Corresponding BNSF Area [b]									

Notes:

— = No impact or not applicable

[a] Indirect impacts are calculated within a 250-foot buffer of the project footprint, which includes areas of permanent and temporary impacts.

[b] The "Difference Compared with Corresponding BNSF Area" represents the difference in impact acreages between an alternative alignment and its corresponding segment in the BNSF Alternative: positive (+) differences indicate that the alternative alignment results in more impact acres than its corresponding segment in the BNSF Alternative; negative (-) differences indicate that the alternative alignment results in fewer impact acres than its corresponding segment in the BNSF Alternative.

Impact calculations in this table include alignment alternatives and station alternatives, but do not include the heavy maintenance facility (HMF) site alternatives.

All impacts were calculated based on the 15% engineering design construction footprint.

ES5.0 Compensatory Mitigation

Compensatory mitigation for adverse impacts to aquatic resources will be determined in consultation with the USACE and in part through the assessment of aquatic resource conditions that would be lost or impaired through construction and operation of the Fresno to Bakersfield Section of the HST System. Compensatory mitigation will preserve, create, and/or enhance aquatic resource conditions, functions, values, and services.

The compensatory mitigation should focus on improving conditions within watersheds where the linear project has the most significant detriment, where opportunities for improvement are present, and where the mitigation can provide the greatest benefit to the overall condition of the watershed. The latter can be implemented by focusing mitigation efforts on restoring historically predominant and valuable aquatic resources in the landscape that have been lost over time, namely Tulare Lake and its associated emergent wetlands. Though not impacted by this project, the historical loss of Tulare Lake to development and land conversion represents the greatest aquatic habitat loss in the Central Valley. Therefore, restoration of Tulare Lake through compensatory mitigation would greatly benefit watershed condition.

Because the watershed profile and impact evaluation identified significant vernal pools and swales in the Upper Deer–Upper White Watershed, compensatory mitigation should focus on maintaining or improving these features and the overall conditions in this watershed. Other watersheds that have significant areas of vernal pools and swales in good condition—and therefore present an opportunity for improvement that should be considered for vernal pool compensatory mitigation—include the Upper Dry, Tulare–Buena Vista Lakes, Upper Kaweah, and Upper Tule watersheds. Compensatory mitigation for impacts to seasonal riverine features could occur in any of the identified watersheds because these features are present in all watersheds. Out-of-kind mitigation should focus on creation or restoration of Tulare Lake and historical emergent wetlands. Selection of compensatory mitigation sites should focus on areas where there is connectivity to protected lands, up-stream stressors are absent or reduced, and opportunities for stream and riparian habitat enhancement or restoration are available.

To date, several permittee-responsible mitigation options have been identified that may be suitable to partially or fully mitigate potential impacts to aquatic resources. Five potential mitigation sites containing aquatic features have been identified. Other properties are currently being considered and will be evaluated when the potential for mitigation has been analyzed in more detail. Suitable opportunities exist to satisfy mitigation obligations in the potential permittee-responsible mitigation properties and in unidentified areas within the project watersheds.

ES6.0 Summary

From the detailed evaluation of the Level 1 Watershed Profile and the results of the Level 2 Impact Evaluation, several conclusions are apparent. The conclusions of the Level 1 Watershed Profile are affirmed by the Level 2 Impact Evaluation, both in terms of the conditions in the watersheds and the land uses identified in the watersheds. The themes identified in the Level 1 Watershed Profile are consistent with the conditions observed in the study area:

A. The vast majority of the aquatic resources in the Great Valley have been significantly degraded through extensive conversion to agricultural, urban, and transportation land uses. As a result, aquatic features are generally in poor condition, though some features, including seasonal riverine and vernal pools and swales, are generally in excellent or good condition. The condition of features in the study area is generally tied to the type of feature: man-made or manipulated features are typically in poor or fair condition and natural features are generally in good or excellent condition. These conditions were

anticipated by the Level 1 Watershed Profile and supported in the study area by the CRAM results. However, some vernal pools and swales near the Corcoran alternatives are in fair condition because they are near major stressors (State Route 43 and the existing BNSF Railway tracks).

B. The relative abundance and condition of aquatic resources in the study area reflect the relative condition of habitats within their watersheds. For example, aquatic resources within the study area identified through CRAM as being in relatively "poor" condition generally correspond to habitats in the greater watershed most impacted by altered hydrology and land conversion. Likewise, aquatic resources within the study area identified through CRAM as being in relatively "good" condition generally correspond to relatively natural habitats in the watershed.

C. As described in Section 6.1, Impacts on Aquatic Resources, and Section 6.2, Existing Conditions, most aquatic features in the study area are man-made or manipulated. Natural aquatic features are present in the study area, but their acreage and distribution are limited. The natural aquatic features present (vernal pools and swales and seasonal riverine features) are generally in better condition, but many of these features have been subject to disturbance associated with the conversation of adjacent areas and, in the case of seasonal riverine features, the reduction of the flood channel and riparian areas.

D. Similar aquatic features (canals/ditches, lacustrine, emergent wetlands, seasonal wetlands, seasonal riverine, riparian (not USACE jurisdictional), and vernal pools and swales) are present throughout the study area. Many of these aquatic resources have been manipulated or are man-made to support agricultural land use practices. However, as discussed in the Level 1 Watershed Profile, a relatively high density of vernal pool features is present in the Upper Deer–Upper White Watershed, which is associated with the Allensworth alternatives.

E. Due to the presence of extensive networks of canals and water diversions, clear watershed boundaries were not observed.

The above themes, which are discussed in detail in the Level 1 Watershed Profile and the Level 2 Impact Evaluation, reduce the potential for the project to result in a net negative impact on the project watersheds. The results of the watershed profile and project impact evaluation (both in terms of quantity and quality) indicate that compensatory mitigation will be conducted in select areas and will focus on select watersheds (consistent with project impacts to sensitive resources). Sufficient opportunities will be available to provide significant enhancements and benefits to one or more recipient watersheds that will, in both the short term and the long term, provide local and regional ecological benefit (or lift) to the watersheds and the condition of the associated aquatic features. At the conclusion of project implementation (i.e., after impacts and compensatory mitigation), the condition of the watersheds would be sustained or enhanced through the long-term preservation of aquatic resources and would experience no net loss of aquatic functions, values, or services (i.e., condition).

The project impacts to existing aquatic resources are organized by watershed and by project alternative so that the project proponents (i.e., Authority and FRA), along with USACE and EPA, can use this report to evaluate, identify, and compare the preferred project alternative and ultimately assist in the identification of the preliminary LEDPA.

Section 1.0
Introduction

1.0 Introduction

1.1 Purpose

A watershed-level analysis of aquatic resources for the Fresno to Bakersfield Section of the California High-Speed Train (HST) System has been developed in conformance with the U.S. Army Corps of Engineers (USACE) and U.S. Environmental Protection Agency (EPA) April 10, 2008 "Compensatory Mitigation for Losses of Aquatic Resources" (Final rule) (2008 Mitigation Rule) (33 Code of Federal Regulations [C.F.R.] Parts 325 and 332 and 40 C.F.R. Part 230) and California's Level 1-2-3 framework for wetland monitoring and assessment.

The Level 1-2-3 framework builds on information gathered at each of three levels (Level 1-2-3). Level 1 is the Watershed Profile, Level 2 is the Rapid Wetland Assessment/Impact Evaluation and Level 3 is the Intensive Site Assessment.

The Level 1 Watershed Profile is used to characterize land uses and the distribution and abundance of wetland types across an area. This level of assessment is used to determine the geographical priorities where more intensive wetland monitoring is to occur and to identify environmental indicators that can be monitored to approximate wetland conditions. The resulting data layers and landscape profiles provide valuable information to guide wetland protection and restoration decisions, including the location and design of compensatory mitigation projects.

The Level 2 Rapid Wetland Assessment/Impact Evaluation evaluates the general condition of individual wetlands using relatively simple indicators. These assessments are based on identifying stressors, such as road crossings, encroachments, and hydrologic alterations. Rapid wetland assessment methods are used to monitor and report on the condition of wetlands in a watershed and to identify sites where more intensive monitoring is needed. Results are also used in Clean Water Act (CWA) Section 401/404 permitting and other wetland decisions and can be used to evaluate the performance of compensatory wetland mitigation and other restoration projects.

The Level 3 Intensive Site Assessment is necessary to test the indicators used in rapid wetland assessments and to validate landscape level assessments. Intensive Site Assessment requires the identification of wetland reference conditions. This level of assessment is also used to determine the attainment of water quality standards at individual wetlands.

This Watershed Evaluation Report evaluates and provides the Level 1 and Level 2 evaluations and accomplishes the following tasks:

- Develops a data layer of land use types that represent disturbance categories.
- Inventories the aquatic resources within Hydrologic Unit Code 8 (HUC-8) watershed units (per land use type).
- Determines the type, amount, and relative condition of the aquatic resources in the watershed units and in the footprints of the HST alternatives in the Fresno to Bakersfield Section.
- Evaluates and assigns a relative existing condition to all aquatic resources in the Fresno to Bakersfield Section alternatives within the watersheds.
- Evaluates the relative post-project condition of the aquatic resources in the watersheds associated with the alternatives.
- Describes the approach to compensatory mitigation and provides a summary of potential compensatory mitigation properties.

- Considers the net change in the acreage and condition of the watersheds considering both post-project condition and compensatory mitigation.

The analysis methods, tools, and approach, such as the use of the California Rapid Assessment Method (CRAM), used to evaluate the functional condition of aquatic resources affected by the project and the post-project condition are provided in this Watershed Evaluation Report.

This Watershed Evaluation Report includes an overview of the process whereby the watershed-level analysis was conceived, planned, and implemented; this report also provides an analysis of currently available, watershed-level Geographic Information System (GIS) data to gather information about the types and relative conditions of the aquatic resources. The overall approach was discussed within an interagency group referred to as the Technical Working Group (TWG). The appendices to this report are as follows:

- Appendix A, Evaluation of Wetland Conditions Using the California Rapid Assessment Method (CRAM).
- Appendix B, Impact Evaluation Schematics.

1.2 Regulatory Context

This section discusses the regulatory context for the Watershed Evaluation Report within the existing Checkpoint C framework of the Environmental Impact Report / Environmental Impact Statement (EIR/EIS) process for the Fresno to Bakersfield Section of the HST System.

1.2.1 The MOU Process and Checkpoint C

The *NEPA/404/408 Memorandum of Understanding* (MOU) between the Federal Railroad Administration (FRA), California High-Speed Rail Authority (Authority), EPA, and USACE, dated November 2010 (FRA et al. 2010) and the Checkpoint C Preliminary LEDPA Determination require a "detailed (rapid assessment or better) assessment of the functions and services of special aquatic sites and other waters of the U.S." to assist in the analysis of impacts. The goal of the MOU is to facilitate compliance with the National Environmental Policy Act (42 United States Code [U.S.C.] Section 4321 *et seq.*), Section 404 of the Clean Water Act (33 U.S.C Section 1344), and Section 14 of the Rivers and Harbors Act (33 U.S.C. Section 408) process for the project-level (Tier 2) Environmental Impact Statement for the project. The integration process comprises three "checkpoints," which punctuate ongoing coordination efforts. These checkpoints are:

A. Definition of purpose and need for the Tier 2 HST project.

B. Identification of the Range of Alternatives to be studied in the project (Tier 2) EIR/EIS.

C. Preliminary Least Environmentally Damaging Practicable Alternative (LEDPA) Determination; USACE Section 408 Draft Response; and Draft Mitigation Plan consistent with 33 C.F.R. Part 332 and 40 C.F.R. Part 230 (73 Federal Register [F.R.] 19,593, dated April 10, 2008).

This document provides information in support of the Checkpoint C Preliminary LEDPA Determination as it relates to the Section 404 of the Clean Water Act.

The CRAM is a tool for performing wetland condition assessments and meets the standards for "detailed (rapid assessment or better) assessment of the functions and services of special aquatic sites and other waters of the U.S" required by the MOU. Using CRAM across all sections of the California HST System provides a uniform approach to assessing wetland health and watershed needs and is consistent with the 2008 Mitigation Rule. CRAM works by scoring metrics that are

part of four key attributes: landscape and buffer, hydrology, physical structure, and biotic structure (CWMW 2012).

The *Condition Assessment Technical Work Plan* (Authority and FRA 2011a) details the technical approach to conducting the condition assessment for the Fresno to Bakersfield Section of the HST System. This Watershed Evaluation Report summarizes the overall approach, presents the outcome of the analysis, and draws conclusions about the effects of the project on the watersheds.

1.2.2 Technical Working Group

Several TWG meetings occurred to coordinate and communicate technical issues and clarifications regarding the application of the watershed approach. These technical issues included Level 1-2-3, assignment of condition values to aquatic features; identification of direct impacts, indirect impacts, and post-project conditions, and their application in determining the least environmentally damaging practicable alternative (LEDPA). Members of the TWG included the USACE, EPA, the State Water Resources Control Board, FRA, the Authority, and the Authority's regional consultants (for the Fresno to Bakersfield Section, the URS/HMM/Arup Joint Venture). The details of TWG meeting and the key discussion topics are summarized below.

The TWG meetings focused on discussion of the application of the 2008 Mitigation Rule, the Level 1-2-3 Framework, including development of Level 1 Watershed Profile and the Level 2 CRAM field assessment, impact assessment methodology (direct and indirect; permanent and temporary), methods to extrapolate CRAM scores into relative conditions for all aquatic features, and potential relative sensitivity to indirect impacts. The discussions and information that came out of them assisted in the development of this Watershed Evaluation Report, the Evaluation of Wetland Conditions Using the California Rapid Assessment Method (CRAM) Report (Appendix A), mitigation planning and the development of the Compensatory Mitigation Plan, and the *Fresno to Bakersfield Section: Checkpoint C Summary Report* (Authority and FRA 2012e).

Two notable products were produced from the TWG meetings, one referring to the concept of developing watershed profiles for each particular watershed unit affected by the Fresno to Bakersfield Section and the other referring to the assessment framework for Checkpoint C and the Section 404(b)(1) determination process. These two products were integrated into the Checkpoint C Summary Report (Authority and FRA 2012e), this Watershed Evaluation Report, and the Evaluation of Wetland Conditions Using the California Rapid Assessment Method (CRAM) Report (Authority and FRA 2012c; see also Appendix A).

1.2.2.1 Watershed Approach (August 2011)

The watershed approach relies on the use of a "watershed profiles" and project "impact profiles" (Sumner 2011). A component of the Section 404(b)(1) analysis is comparing the aquatic resource in the watershed profiles with the impact profiles for each HST alternative alignment to help make decisions as they concern compensatory mitigation and the net post-project condition of the watershed.

A watershed profile is a coarse estimation of the abundance and condition of types of aquatic resources in a project watershed area. A watershed profile is constructed by tabulating the relative abundance, diversity (of types), and condition of aquatic resources in project watershed areas. Project watershed areas are geographically bounded areas of watersheds that encompass the HST alternative alignments. California water planning watershed maps, U.S. Geological Survey (USGS) HUC-8 maps, and Level 4 Ecoregion maps can be used to demarcate project watershed area boundaries.

The abundance and type of aquatic resources within a project watershed area are gleaned from existing databases, such as the National Wetland Inventory, the National Hydrography Dataset (NHD), and the Holland Central Valley Vernal Pool Complexes dataset. The conditions of aquatic resources are suggested in a broad sense by overlaying the mapped occurrences of aquatic resources onto generally classified land use maps. This broad-scale analysis indicates general distribution of aquatic resources, the degree of interrelation among aquatic resources in the landscape, and the existence of landscape stressors and landscape buffers for aquatic areas.

An impact profile identifies both the amount (quantity) of aquatic resources affected (acreage and/or linear feet) and the condition of the aquatic resources (excellent, good, fair, or poor) extrapolated from the CRAM results. Each impact profile is then summarized by aquatic resource type and the type of impact (direct or indirect and permanent or temporary). The impact profile also includes an analysis of the post-project condition of the aquatic resources. Where applicable, this Watershed Evaluation Report summarizes these impacts and discusses them for each of the seven watersheds evaluated.

The precision (quality) of the estimates used in the impact profiles is sufficiently robust to make a relative comparison between the alternative alignments (e.g., an order of magnitude comparison; see Sumner 2011). Based on guidance received from the TWG meetings, the assessment approach used in this Watershed Evaluation Report, including CRAM sampling and extrapolation of survey results, meets this quality standard.

Combining the watershed profiles with the impact profiles helps determine the extent, if any, of substantial net impacts attributed to each of the alternative alignments. The criterion for making that determination is whether there is a risk that an alternative's impact profile will substantially degrade current-day watershed profiles. Special consideration is given to aquatic resource types in the watershed profile that are relatively rare, highly valued, or difficult to mitigate (e.g., restore, re-establish).

1.2.2.2 Assessment Framework (September 2011)

An assessment framework was developed to summarize the types of analyses required by Checkpoint C. The components (or factors) of this framework include:

1. Aquatic resource acreage affected, classified by aquatic resource type and type of impact (direct and indirect), including non-wetland waters and wetlands.

2. Amount of impact on important/rare wetland acreage, which includes difficult-to-replace wetlands (e.g., vernal pools, seasonal riverine with riparian area).

3. Amount of impact on special-status habitats, including aquatic habitats, species listed under the federal Endangered Species Act (ESA), and ESA critical habitat.

4. Amount of impact on aquatic resources in good condition along the alignments, which is determined using both Level 1 and Level 2 (i.e., CRAM) data.

5. Relative risk of net project impact on the watershed.

In this context, net project impact means the extent to which impacts assessed at a smaller scale (an alignment) are likely to have a substantial effect on the functioning of the broader landscape. Each alternative is qualitatively evaluated relative to its risk of causing a net impact. The assessment of this factor is a qualitative comparison of the relative adverse effect of impacts along alternative alignments on the overall abundance, diversity, and condition of aquatic resources in the project watershed area(s). In other words, net impact is a comparison of the impact profile of each alignment (#1 through #4, above) with the broader "watershed profiles."

This watershed profile informs the impact review, and is useful in mitigation planning (i.e., using the "watershed approach" pursuant to the federal rule and the pending state rule). For example, if direct and net impacts cannot be adequately mitigated, then there is a risk of significant degradation.

In addition to the factors listed above, other assessment factors are also considered in making a LEDPA determination; these include nonaquatic habitat, cultural resources, community impacts, agriculture, etc.

Assessment factors required for making a permit determination based on the EPA Section 404(b)(1) Guidelines (alternative analysis and mitigation requirements) include:

1. Identification of the LEDPA.
2. Environmental restrictions (e.g., ensuring there are no violations of water quality standards, the ESA, and sanctuaries).
3. Significant degradation of waters of the U.S. (e.g., ensuring there is no significant degradation, which depends on the net impact, including mitigation).
4. Mitigation includes an examination of the relative amount of mitigation opportunity associated with each alternative and the potential for mitigation elements to enhance the overall area and/or quality of aquatic resources within each planning watershed and the project as a whole (as required by the 2008 Mitigation Rule). Addressing these requirements includes the completion of a mitigation plan for the selected LEDPA (taking into consideration watershed profiles and other site-specific information) and taking appropriate and practicable steps to minimize adverse impacts (i.e., applicants must take all appropriate and practicable steps to minimize adverse impacts on the aquatic environment).

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Section 2.0
Project Description

2.0 Project Description

The proposed action is to construct and operate an HST rail line from Fresno to Bakersfield (Figure 2-1). The Fresno to Bakersfield Section is one of nine sections that were identified in the Program EIR/EISs (Authority and FRA 2005, 2008, 2010). The nine HST sections constitute a system that would connect the major population centers of the San Francisco Bay Area with the Los Angeles metropolitan region. The California HST System is planned to be implemented in two phases. Phase 1 would connect San Francisco to Los Angeles and Anaheim via the Pacheco Pass and the Central Valley. Phase 2 would connect the Central Valley (Merced Station) to the state's capital, Sacramento, and another extension would connect Los Angeles to San Diego. The HST System is envisioned as a state-of-the-art, electrically powered, high-speed, steel-wheel-on-steel-rail technology system that would employ the latest technology, safety, signaling, and automated train control systems. The trains would be capable of operating at speeds of up to 220 miles per hour over fully grade separated, dedicated tracks.

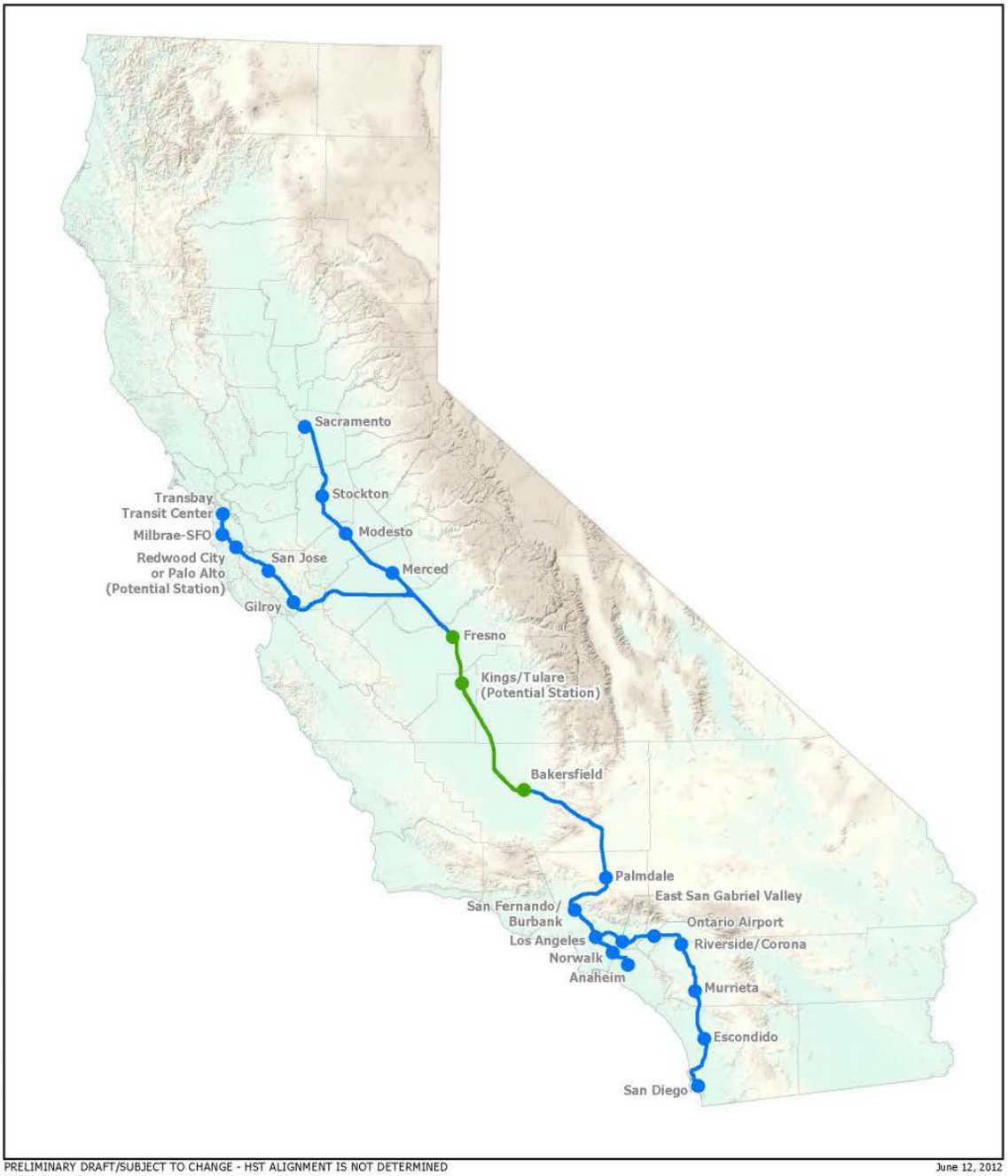
The Fresno to Bakersfield HST Section would be a critical link in the Phase 1 HST System connecting San Francisco and the Bay Area to Los Angeles and Anaheim. The Authority and the FRA's prior program EIR/EIS documents selected the BNSF Railway route as the preferred alternative for the Fresno to Bakersfield Section in the 2005 Statewide Program EIR/EIS decision document. Therefore, the project EIR/EIS for the Fresno to Bakersfield Section focuses on alternative alignments along the general BNSF Railway corridor.

The *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* (Authority and FRA 2012a) evaluates 10 alignment alternatives, including the No Project Alternative, the BNSF Alternative and the Hanford West Bypass 1, Hanford West Bypass 2, Corcoran Elevated, Corcoran Bypass, Allensworth Bypass, Wasco-Shafter Bypass, Bakersfield South, and Bakersfield Hybrid alternatives (Figure 2-2). Of the nine Fresno to Bakersfield Section alternatives, eight alternatives deviate from the BNSF Alternative for portions of the route to avoid environmental, land use, or community impacts.

The infrastructure and systems for the Fresno to Bakersfield Section alternatives are composed of trains (rolling stock), tracks, grade-separated right-of-way, stations, train control, power systems, and maintenance facilities. The design of each alternative includes a double-track right-of-way to accommodate planned project operational needs for uninterrupted rail movement. Also, the HST System safety criteria preclude any at-grade intersections, and therefore the system must be grade separated from any other transportation system. This requirement means that planning the HST System would also require grade-separated overcrossings for roadways or roadway closures and modifications to existing systems that do not span the planned right-of-way.

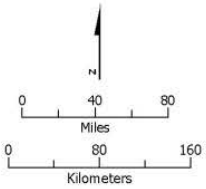
The Fresno to Bakersfield Section would consist of a fully dedicated rail line, constructed from continuous welded steel rail. In the Fresno to Bakersfield Section, the alternatives would use four different track profiles. These track types have varying profiles: low, near-the-ground tracks are at-grade; higher tracks are elevated or on retained fill; and below-grade tracks are in a retained cut. Types of bridges that might be built include full channel spans, large box culverts, or, for some wider river crossings, limited piers within the ordinary high-water channel. Besides the alternative alignments, two station alternatives in Fresno, two potential station locations in the Hanford area, three station alternatives in Bakersfield, and five potential heavy-maintenance facility alternatives are considered.

The Fresno to Bakersfield Section would connect to Merced in the north and to Palmdale in the south. A heavy maintenance facility would be sited in either the Merced to Fresno Section or the Fresno to Bakersfield Section. Additional details on project features and construction are presented in the *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* (Authority and FRA 2012a).



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Source: URS, 2012

June 12, 2012



Proposed station Statewide HST system
Proposed station Fresno to Bakersfield
Statewide HST system
Fresno to Bakersfield section

Figure 2-1
Fresno to Bakersfield Section of the California HST System

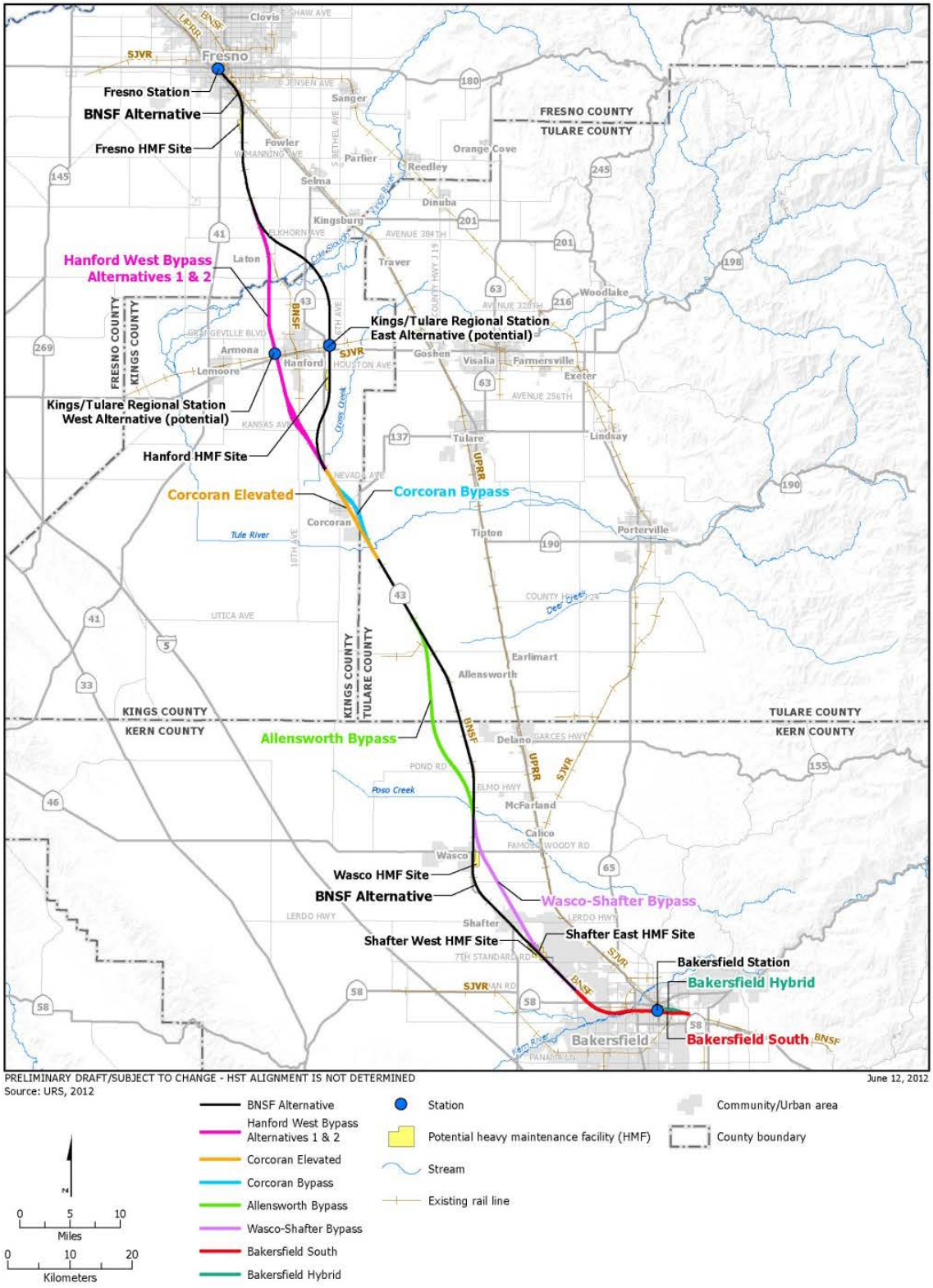


Figure 2-2
Fresno to Bakersfield Section alternatives

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Section 3.0
Methodology

3.0 Methodology

This section describes the methods used to develop the Level 1 and Level 2 analyses presented in this report. The analyses include developing a watershed profile, identifying the existing conditions of the aquatic resources, quantifying direct and indirect impacts on aquatic resources, and estimating the post-project condition of the aquatic resources. In some instances, the data used were developed in part at a national or statewide level by other sources (e.g., the U.S. Fish and Wildlife Service [USFWS], USGS). In other instances, the information used was collected and developed by the Authority's regional consultant, the URS/HMM/Arup Joint Venture. Information collected by the URS/HMM/Arup Joint Venture is described in more detail in the *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* (Authority and FRA 2012a), the *Fresno to Bakersfield Section: Biological Resources and Wetlands Technical Report* (Authority and FRA 2012b), the *Fresno to Bakersfield Section: Preliminary Jurisdictional Waters and Wetland Delineation* (Authority and FRA 2011b), the *Fresno to Bakersfield Section: Supplemental Preliminary Jurisdictional Waters and Wetlands Delineation Report* (Authority and FRA 2012g), and the *Fresno to Bakersfield Section: Evaluation of Wetland Conditions Using the California Rapid Assessment Method* (CRAM) *Report* (Authority and FRA 2012c).

The Level 1 Watershed Profile uses a number of national and statewide or regional databases to estimate the types, distribution, extent (quantity), and condition of the aquatic resources in each watershed. This information helps identify the regional setting of the aquatic resource impacts expected to occur as part the implementation of the project. Direct and indirect impacts are conservatively estimated by overlaying the construction and project footprints on the results of the wetland delineation as presented in the *Fresno to Bakersfield Section: Supplemental Preliminary Jurisdictional Waters and Wetlands Delineation Report* (Authority and FRA 2012g).

The construction and project footprints were used to identify direct impacts. A 250-foot buffer around the footprints (i.e., the study area) was used to calculate indirect impacts to adjacent aquatic resources. The existing conditions of the aquatic resources were determined by a two-step process: (1) conducting a site-specific assessment using CRAM on a sample of aquatic features representative of the type of features found in the study area; and (2) extrapolating the CRAM results and assigning a relative condition (i.e., poor, fair, good, or excellent) to the aquatic features. The Level 2 Impact Evaluation consists of quantifying the impacts, assessing the condition of the aquatic resources, and extrapolating the conditions of the aquatic features.

The model for estimating the post-project conditions of the aquatic resources directly affected by implementation of the project was developed based on a set of projections that extrapolated post-project condition based on the type of aquatic resource affected, the location within the construction or project footprints, the type of impact (direct or indirect), and the existing relative condition. A similar set of projections was generated to assess the risk (low, moderate, or high) of loss or change to aquatic resources as a result of indirect impacts.

The methods, as employed and described herein, were largely developed in close coordination with the USACE and EPA as part of the TWG meetings.

3.1 Methodology: Watershed Evaluation

A Level 1 Watershed Profile was developed to provide an analysis and description of the seven HUC-8 watersheds that intersect the Fresno to Bakersfield Section alternative alignments. For each watershed, the profile includes a description of the major aquatic features and associated land uses. In the analysis, land use is a proxy to distinguish higher-quality aquatic features from features that are likely degraded. Aquatic features in high-intensity land use types were considered to be degraded based simply on surrounding land uses. Conversely, aquatic features in low-intensity and natural land use types are considered less disturbed. The land uses for each

watershed were identified using a number of existing datasets that have been developed by State of California regulatory agencies, including:

- California Essential Habitat Connectivity Project Natural Landscape Blocks (Spencer et al. 2010) map and classify areas of natural land. The California Department of Fish and Game and the California Department of Transportation commissioned the California Essential Habitat Connectivity Project to assist in land use planning, transportation planning, land management, and conservation planning. This dataset provides an assessment of natural lands and assists users in avoiding, minimizing, and mitigating impacts to habitat connectivity during the transportation-planning process. The Essential Habitat Connectivity Project identifies natural landscape blocks through a number of approaches, including the use of the Ecological Condition Index developed for the California Legacy Project (Davis et al. 2003, 2006); the Essential Habitat Connectivity Project also considers conservation protection status and areas known to have high biological value.

- California GAP Analysis Land-Cover for California (UCSB 2002) maps land cover and natural communities. The California GAP Analysis Land-Cover for California is a product of a number of vegetation mapping systems that are best described provisionally as the National Vegetation Classification Standards (more recently known as the "UNESCO/TNC system"). This dataset also incorporates aspects of the California Natural Diversity Database vegetation descriptions for natural land use types and USGS methods for identifying non-vegetation and human-induced land use categories (e.g., urban, barren, agricultural land uses) (Anderson et al. 1976).

The various land uses were categorized by land use intensity into the following categories: relatively undisturbed (natural), low-intensity agriculture, and high-intensity agriculture/developed land.

Aquatic features within each watershed were mapped using a number of available databases that are widely accepted and used for understanding the locations and types of aquatic resources within a given region. These databases were produced or funded by the following natural resource regulatory agencies:

- The National Wetlands Inventory (USFWS 2011b), which identifies the approximate locations and types of wetlands in each watershed. This dataset was used to calculate acreage and map locations of the following wetland types within each watershed:

  - Emergent wetland: herbaceous marsh, fen, swale, or wet meadow.
  - Forested/shrub wetland: forested swamp or wetland shrub bog or wetland.
  - Freshwater pond: pond.
  - Lake: lake or reservoir basin.
  - Other wetland: farmed wetland, saline seep, or other miscellaneous wetland.
  - Riverine: river or stream channel.

- The National Hydrography Dataset (USGS and EPA 1999), which identifies the approximate locations and types of rivers, streams, canals, and ditches in each watershed. In maps and tables, this dataset is divided into natural features (streams/rivers) and man-made or altered features (canals/ditches). Results from this dataset were used to calculate linear feet of these feature types.

- The Holland Central Valley Vernal Pool Complexes data layer (Holland 2009b), which identifies vernal pool landscapes (not vernal pool areas). These data are presented as acres of vernal pool communities, which include both upland and aquatic habitats. The acreage associated with the data is often significantly greater than the actual area of aquatic features present within a given area.

A combination of the land use and the aquatic feature databases was used to provide a profile for each of the watersheds that intersect the Fresno to Bakersfield alternative alignments. The Level 1 Watershed Profile lists (1) the types of aquatic features; (2) the extent or amount of each aquatic feature within a watershed; and (3) the relative condition of the aquatic features within each of the watersheds. Because of the significant variation in topography, soil, vegetation, and land uses in the watersheds crossed by the alternative alignments, the types, extent, and conditions vary greatly. To provide a meaningful analysis of the watershed profile as it relates to the context of the alternative alignments, the watershed profile was divided into ecological sections based on the USDA's ecological subregions (USDA 2007).

Both the types and the extent of the aquatic features present in each watershed were generated directly from the aquatic feature databases. The extents of some aquatic features are represented as polygons, which translate into areas (acreages), and other features, typically those that are linear, are represented as line features, which translate into linear feet. In a few instances, aquatic features from one database overlap with features from another database. In these cases, feature types were selectively removed from all but one of the databases based on a detailed review. This process made possible the development of a more robust dataset.

The assessment of the condition of an aquatic feature in a watershed is based on the location of the aquatic feature within a given land use type. The ecological condition of the aquatic feature is categorized as either poor, fair, or good based on the land use type and land use intensity in the area surrounding the aquatic feature. A water feature in relatively undisturbed (natural) land is given a condition of *good*. A feature in a low-intensity agriculture area is considered fair, and a feature in a high-intensity agriculture/developed land area is considered to have a condition of *poor*. The land use types are as follows:

- Aquatic features in high-intensity land use cover types (e.g., orchard and vineyard, croplands, urban,) are subject to a number of significant man-induced alterations, inputs, and constraints and are typically in poor ecological condition. High-intensity land uses:
  - Provide limited or no buffers to aquatic resources.
  - Often control or significantly alter the natural hydrology.
  - Have limited wildlife and biological value.
  - Often remove the physical structure of aquatic features and often include man-made features.
- Aquatic features in low-intensity land use cover types (e.g., barren) are subject to few man-induced alterations, inputs, and constraints and are typically in fair ecological condition. Low-intensity land uses:
  - Provide some buffers to aquatic resources.
  - May mildly to significantly alter the natural hydrology.
  - Have some wildlife and biological value.
  - Often retain the natural physical structure of aquatic features, though some characteristics may be removed or altered.
- Aquatic features in natural land use cover types (e.g., annual grassland, alkali desert scrub, blue oak woodland) are generally subject to minor man-induced alterations, inputs, and constraints and are typically in good ecological condition. Natural land uses:
  - Provide important buffers to aquatic resources.
  - Typically have natural or near-natural hydrology, though upstream or downstream land uses may affect aquatic features.

- Have considerable wildlife and biological value.
- Retain natural physical structure, though historical land use practices have reduced or altered some of the natural characteristics.

In general, these databases may over- or underestimate the extent of natural aquatic features in urban or agricultural regions; these regions are subject to constant manipulation, and even though the data presented are relatively current, the data may not reflect present-day conditions. Maps showing the aquatic features and land use types were generated for each watershed from the information in these databases. Charts were also created; the charts describe the quality and distribution of the aquatic features in each watershed by ecological section. Each chart uses linear feet to show the distribution of the rivers, streams, canals, and ditches and acres to show lakes, ponds, and wetlands. In addition, for each watershed, a table presents the breakdown of each type of aquatic feature, its presumed quality, and its size by ecological section.

3.2 Methodology: Existing Conditions

This section describes the methods used to identify the existing conditions of the aquatic resources in the study area. The condition of aquatic resources is one of the components analyzed as part of the Section 404(b)(1) alternatives analysis and is required as set forth in the MOU (the requirement to conduct a "detailed (rapid assessment or better) assessment of the functions and services of special aquatic sites and other waters of the U.S.") (EPA et al. 2010). The existing conditions can be used to establish the baseline from which project impacts are analyzed and assist in the identification of compensatory mitigation requirements.

The condition of the aquatic resources in the study area was established using a two-step process: (1) the CRAM assessment and (2) extrapolation of the CRAM assessment results to provide relative condition values. In the first step, the conditions of a representative sample of aquatic features were assessed using CRAM. CRAM works by scoring metrics that are part of four key attributes: landscape and buffer, hydrology, physical structure, and biotic structure. To the extent possible, CRAM methodology, as described in the CRAM User's Manual, Version 5.0.2 (CWMW 2008), Version 6.0 (CWMW 2012), and corresponding module field books, was followed. A complete description of the field methodology is provided in the CRAM report (Appendix A). In the CRAM approach, aquatic resources are scored from 25 (poor) to 100 (ideal).

In areas where permission to enter had been granted, CRAM was conducted on the various types of aquatic resources present in the study area. In areas where permission to enter had not been granted, it was not possible to obtain field-assessed CRAM condition scores for all aquatic features present in the study area. Rather, the CRAM assessment attempted to assess a representative sample of aquatic feature types within the confines of areas where permission to enter had been granted. Where permission to enter was allowed, the CRAM assessment made use at least five sample assessment areas for each type of aquatic resource (canal, ditch, vernal pool, and seasonal riverine).

A CRAM-certified trainer, Chad Roberts, Ph.D. (CRAM coordinator), of Roberts Environmental and Conservation Planning, provided oversight and guidance, and both the CRAM coordinator and URS/HMM/Arup Joint Venture staff conducted the CRAM field work. Field staff used best professional judgment, as informed by direction from the CRAM coordinator and consultation with the USACE and EPA, in using CRAM.

In the second step, the results from the CRAM assessment were extrapolated to provide relative condition values for all aquatic resources in the study area. The extrapolation process started by converting the CRAM scores to the qualitative condition values of poor, fair, good, or excellent (Table 3-1). The range of CRAM scores identified in the field for each sampled aquatic resource

type was calculated and converted to a relative condition indication (poor, fair, good, or excellent) for those resource types.

Table 3-1
CRAM Scores as They Relate to Relative Condition

CRAM Score Range	Relative Condition	Types of Aquatic Features
81–100	Excellent	—[1]
62–80	Good	Seasonal riverine, vernal pool
44–61	Fair	Ditch, seasonal wetland
25–43	Poor	Canal, retention/detention basin

[1] Individual vernal pool and vernal pool system CRAM scores fell into the excellent relative condition category. However, the average vernal pool score corresponded to a good relative condition.

CRAM = California Rapid Assessment Method

The relative condition for all aquatic features of a particular type was combined with other existing information (e.g., land use and wildlife habitat mapping) and used to inform and extrapolate conditions for all aquatic features. The extrapolation of conditions is important to qualify the conditions for aquatic resources where permission to enter was not granted. For example, the range of CRAM scores of retention/detention basins was between 31.6 and 51.5 (poor to fair) and similar features (other retention/detention basins) found in a similar landscape context (agriculture) were assigned the same relative condition (poor or fair). The range of the CRAM scores for the feature type, along with aerial photographic interpretation and other factors, including feature type, watershed, and proximity to stressors, were also considered in extrapolating condition scores. Although such extrapolations are inherently limited, they provide meaningful information and assistance in understanding the abundance and relative condition of aquatic resources that may be affected by the project.

3.3 Methodology: Impact Calculations

This section describes the methods used to evaluate impacts on aquatic features, special aquatic features, and terrestrial habitats. Four types of impacts are analyzed: direct-permanent, direct-temporary, indirect-bisected, and indirect. Direct impacts were calculated for all aquatic features present in both the construction and the project footprints. Indirect impacts were calculated for all aquatic features present within the 250-feet study area surrounding the construction and project footprints.

The extents (quantity: area) of the aquatic features affected by the project were calculated using a GIS model in which the mapped aquatic features as presented in the *Fresno to Bakersfield Section: Supplemental Preliminary Jurisdictional Waters and Wetlands Delineation Report* (Authority and FRA 2012g) were overlaid on the construction and project footprints. The footprints include all the infrastructure and construction areas that would be needed to build and operate the Fresno and Bakersfield Section of the HST System. In general, temporary impacts are those associated with construction activities (laydown and storage areas) and utility relocations in the construction footprint; permanent impacts are associated with permanent infrastructure, including the right-of-way for the HST tracks, the stations, the road overcrossings, the electrical facilities, and the heavy maintenance facility site alternatives.

The output of the GIS model included calculations of the acres of aquatic features directly and indirectly affected by the project. Schematic drawings that represent the types of footprint

features and the four types of impacts (direct-permanent, direct-temporary, indirect-bisected, and indirect) are provided in Appendix B. These types of impacts are described in more detail below.

3.3.1.1 Direct Impacts

Direct impacts are impacts to all aquatic features or portions of aquatic features within the construction and project footprints. Direct impacts result from filling existing aquatic features or excavating soils of aquatic features, thereby removing all or a portion of those features. For aquatic features that are partially present in the construction or project footprint, only the portion within the footprint is considered directly affected. Direct impacts are classified into either permanent or temporary impacts.

Permanent and temporary impacts are largely distinguished by the purpose of the disturbance and whether the impact occurs solely for the construction phase or would result in a permanent or long-term disturbance of the resource. For example, temporary impacts are associated with construction staging areas and underground utility relocation efforts, whereas permanent impacts result from the construction of the HST tracks, stations, and associated infrastructure (e.g., road overcrossings, electrical facilities). For vernal pool and swale features that straddle the footprint, the portion of the feature within the footprint would be considered to be directly affected. The portion of the feature outside the construction footprint would be said to undergo an “indirect-bisected” impact.

Direct-Permanent Impacts

Direct-permanent impacts occur to all aquatic features present within the project footprint of permanent construction elements. Permanent project footprint elements include:

- BNSF yard relocation.
- Canal relocation.
- Drainage basins.
- Freight rail relocation.
- Heavy maintenance facility sites.
- Train track (at-grade, elevated, and below-grade).
- Pedestrian bridges.
- Road closures.
- Roadways (including underpasses).
- Train stations.
- Traction power sub-stations.

Most of these construction elements would result in the permanent filling of aquatic features in the project footprint associated each element. However, elevated train track, which includes bridges, would be an exception because these structures would only require fill within a limited portion of the footprint, where supports and pilings are located. Outside of the limited area of fill, aquatic features spanned by elevated track or bridges would potentially be degraded but would not be permanently filled. However, to provide a conservative estimate of aquatic resource impacts, the portion of the footprint beneath the viaduct or elevated track structure is considered to be permanently impacted.

Direct-Temporary Impacts

Direct-temporary impacts can occur to aquatic features present within the footprint of temporary construction elements. Temporary construction footprint elements include:

- Construction staging areas.
- Natural gas line relocation.
- Petroleum line relocation.
- Removal of base and surfacing.
- Removal of bridge.
- Temporary construction easement.
- Transmission line relocation.
- Utility easement.

The duration of the direct-temporary construction elements varies from months to years. The disturbances associated with utility relocations are anticipated to be relatively short in duration, but the disturbances associated with construction staging areas may be longer in duration (e.g., 5 years). Aquatic resources subjected to direct-temporary impacts will be restored to their pre-project condition after the completion of construction.

3.3.1.2 Indirect Impacts

Indirect impacts to aquatic features would occur within 250 feet of the construction and project footprints. Indirect impacts would not overlap with direct impacts. Indirect impacts would occur due to the alterations in hydrology and soil that result from adjacent direct impacts associated with construction and project activities. Adjacent direct impacts may indirectly result in changes in the hydrology of an aquatic feature by reducing, increasing, or diverting the flow of its water source. Indirect impacts are not subject to dredging or discharge of fill material and are not subject to construction or project encroachment. For calculating the acres of indirect impacts to aquatic features, two possible impact levels were applied to the GIS model: indirect-bisected and indirect.

Indirect-Bisected Impacts

This impact type only occurs to vernal pools and vernal swales and reflects their sensitivity to disturbance. These vernal features are particularly sensitive to soil disturbance. In instances where a vernal feature straddles the construction or project footprints, direct impacts to the feature may result in significant disturbance to the feature. The indirect-bisected category was developed to track these potentially significant indirect impacts. Other aquatic resources present in the 250-foot area beyond the construction footprint (man-made features and seasonal riverine features) are not as sensitive to indirect impacts and therefore are not calculated in this manner.

Therefore, for vernal features that cross into the construction or project footprint, only the portion of the vernal pool outside the footprint is considered to be subject to indirect-bisected impacts. Any portion of the vernal feature that occurs inside the footprint is defined as a direct impact. Impacts to vernal features located entirely within the study area but outside the footprint are identified and quantified as an indirect impact.

Indirect Impacts

Indirect impacts to aquatic features are quantified based on the extent and type of aquatic feature present within 250 feet of the construction and project footprints. For features that extend into the construction and project footprints, only the portion of the feature outside of the footprint is categorized as being subject to an indirect impact. The portion of the aquatic feature inside the construction and project footprints is categorized as a direct impact (either direct-

permanent or direct-temporary). However, for vernal pools, vernal swales, and vernal pool and swale complexes, if the vernal feature extends into the construction and project footprints, the indirect impact is categorized as an indirect-bisected impact (see above). Indirect impacts to vernal pools are quantified as—and only include—those vernal features that are entirely outside of the construction and project footprints.

3.4 Methodology: Post-Project Conditions

The post-project conditions of aquatic resources in and adjacent to the construction and project footprints were estimated using a set of projections generated for the project. These projections considered the type of aquatic feature (man-made or natural), the type of impact (direct or indirect), and the relative condition (poor, fair, good, or excellent). The post-project condition assessment is important to identify the net aquatic functions and services lost within each watershed or by each project alternative, so that decisions can be made in terms of understanding the mitigation obligation to achieve “no net loss” of aquatic functions and services (or conditions).

The results of the relative condition assessment (described above) indicate that a set of projections was generated for direct impacts and for indirect impacts. After the application of the projections, wetland scientists reviewed the results and used best professional judgment to make minor modifications on a feature-by-feature basis. Modifications to impacts and post-project condition were made to features separated from the construction and project footprints by the existing BNSF railroad tracks. The BNSF railroad provides a buffer to those aquatic features to the east from the effects of the HST project because the footprint of the HST project is west of the existing BNSF railroad tracks. Therefore, the indirect impacts were modified to “low” for such features as seasonal wetlands and vernal pools and swales, that otherwise would have been considered moderately affected by the project.

3.4.1.1 Direct Impacts

For post-project conditions resulting from direct impacts, the projections were largely based on the construction or project element. The post-project condition assessment includes the implementation of the proposed mitigation measures identified in the *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* that would restore direct-temporary impacts and some direct-permanent impacts. Under direct impacts, three post-project condition outcomes where identified: (1) the feature is no longer present; (2) the feature has a reduced condition from its existing condition; or (3) the feature does not change from its existing pre-construction condition. A summary of the projections used to generate the post-project conditions associated with direct impacts on aquatic resources is provided in Table 3-2.

Table 3-2
Summary of Post-Project Condition of Aquatic Resources: Direct Impacts

Construction Element	Type of Direct Impact	Man-Made Aquatic Resources [a]	Natural Aquatic Resources [b]
BNSF yard relocation	Permanent	Does not exist	Does not exist
Canal relocation	Permanent	Does not exist	Does not exist
Construction area	Temporary	No change	Reduced condition
Drainage basin	Permanent	Does not exist	Does not exist
Freight rail relocation	Permanent	Does not exist	Does not exist

Table 3-2
Summary of Post-Project Condition of Aquatic Resources: Direct Impacts

Construction Element	Type of Direct Impact	Man-Made Aquatic Resources [a]	Natural Aquatic Resources [b]
Heavy maintenance facility	Permanent	Does not exist	Does not exist
HST track			
At-grade	Permanent	Does not exist	Does not exist
Elevated	Permanent	No change	Reduced condition
Below-grade	Permanent	Does not exist	Does not exist
Pedestrian bridge	Permanent	Does not exist	Does not exist
Roadway work (closures, overpasses, and underpasses)	Permanent	Does not exist	Does not exist
Stations	Permanent	Does not exist	Does not exist
Traction power sub-station	Permanent	Does not exist	Does not exist
Utility line relocation (natural gas, petroleum, and transmission line relocation)	Temporary	No change	Reduced Condition

[a] Man-made aquatic resources include canals, ditches, emergent wetlands, reservoirs, and retention/detention basins.
[b] Natural aquatic resources include seasonal riverine features, seasonal wetlands, vernal pools, and vernal swales.

Direct-Permanent Impacts

For most direct-permanent impacts, the post-project condition of aquatic resources is that the feature is no longer present. Aquatic features will not long be present when HST tracks are constructed at-grade and where impacts are associated with other HST facilities and infrastructure. However, aquatic features in areas where the HST track would be constructed on an elevated structure may retain some of their existing functions and services (or conditions). For example, seasonal riverine, canals, or ditches below an elevated structure would likely retain some of their existing functions and services (conditions). However, for sensitive features such as vernal pools, the post-project condition would be that the feature is completely lost (no longer present).

Direct-Temporary Impacts

For all direct-temporary impacts, the post-project condition results in either no net change in feature condition or reduced relative condition, depending on the type of aquatic feature. Man-made features (canals, ditches, retention/detention basins, emergent wetland, and reservoirs) that are already highly manipulated and generally have low existing condition values can and will be restored to their pre-project condition after the completion of temporary construction activities and the implementation of project restoration measures. Therefore, direct-temporary impacts will result in no change in these features. Seasonal riverine, riparian areas, and seasonal wetland features are more sensitive to disturbance and are difficult to replace due to alterations in hydrology, soil, and/or vegetation that would occur as a result of the project. Such alterations are expected to reduce the condition of these features from their existing condition. Because it is difficult to restore vernal pools to pre-project conditions after they are temporarily affected, all impacts on vernal pools are considered permanent and would therefore cause those vernal pools to no longer exist.

3.4.1.2 Indirect Impacts

Although no direct impacts would occur in—or fill material would be placed in—aquatic resources that occur outside of construction and project footprints (area of direct impacts), aquatic features in the 250-foot buffer could be indirectly affected due to the proximity of these resources to the direct impacts and the effects that direct impacts would have on the surrounding landscape, hydrology, and physical and biological conditions. For calculating the post-project conditions of aquatic features that are indirectly affected, three possible indirect impact levels (risk) were applied to the GIS model: high, moderate, and low. Post-project conditions were calculated based on the risk of indirect impacts and type of aquatic resource. A summary of the projections used to identify the risk of adverse indirect impacts on aquatic resources is provided in Table 3-3.

Table 3-3
Summary of Risk Assessment for Aquatic Resources: Indirect Impacts

Type of Aquatic Resource	Man-Made or Natural	Type of Indirect Impact	Risk of Indirect Impacts	Post-Project Condition	Notes
Canals/ditches	Man-made	Indirect	Low	Same as existing condition	Highly manipulated
Emergent wetland	Man-made	Indirect	Low	Same as existing condition	Most features highly manipulated.
Lacustrine	Man-made	Indirect	Low	Same as existing condition	Highly manipulated
Riparian (not USACE jurisdictional)	Natural	Indirect	Moderate	Same as existing condition / reduced by one condition class	Features tied directly to seasonal riverine impacts. Post-project condition is the same as existing condition for features that have a poor existing condition.
Seasonal riverine	Natural	Indirect	Moderate	Same as existing condition / reduced by one condition class	Post-project condition is the same as existing condition for features that have a poor existing condition.
Seasonal wetland	Natural	Indirect	Low/moderate	Same as existing condition / reduced by one condition class	Some features Low risk. Post-project condition is the same as existing condition for features that have a poor existing condition.
Vernal pools and vernal swales	Natural	Indirect	Low	Reduced by one condition class	Applies to vernal pools east of BNSF
	Natural	Indirect	Moderate	Same as existing condition / reduced by one condition class	Post-project condition is the same as existing condition for features that have a poor existing condition.
	Natural	Indirect-bisected	High	Reduced to poor condition	Abutting direct impact

Because the functions and services (conditions) of man-made aquatic features are already low due to a number of existing stressors, additional HST-induced impacts are not expected to result in any significant overall change in the quality of these features. Therefore, canals/ditches, emergent wetland, and lacustrine features are subject to low indirect impacts. These resources have a low risk of being converted to another wetland type or being reduced in functions and services (or conditions). Their post-project condition is expected to remain the same as their existing condition. Because the majority of man-made aquatic features have a poor existing condition, their post-project condition resulting from low risk indirect impacts will also be poor. For man-made or manipulated features with fair or good existing conditions (as applies to emergent wetland), their post-project condition will remain fair or good because the risk to change is low.

Because seasonal riverine, riparian, and seasonal wetlands are more sensitive to indirect alterations to hydrology and landscape, indirect impacts to these aquatic feature types are generally projected to be moderate. The resulting post-project condition for these features is expected to be reduced by one condition class, unless the existing condition is poor, in which case, the condition does not change. For example, most seasonal riverine features have an existing condition of good, so moderate indirect impacts to these features would result in a post-project condition of fair. For seasonal wetlands east of the existing BNSF railroad tracks, the risk of indirect impacts is expected to be low, due to the buffer the tracks provide from construction and project impacts. The post-project condition of these features would remain the same as their existing condition, which is generally fair.

Because of the ecological sensitivity of organisms and processes in vernal pools and vernal swales, the risks associated with adverse indirect impacts are projected to be high or moderate. The difference between moderate and high risk indirect impacts is based on the proximity and location of the impact in relation to direct impacts. For vernal features that are bisected by the project footprint (with indirect-bisected impacts) and abut direct impacts, the risk of being converted to another aquatic resource type (seasonal wetland or not present) is high. The resulting post-project condition of these features, regardless of existing condition, is assumed to be poor. Vernal pool features that are entirely outside of the construction and project footprints on an at-grade profile are at moderate risk. The post-project condition of these vernal pool features would be reduced by one condition class. For vernal pools with an existing condition of good, the moderate risk associated with indirect impacts would result in a post-project condition of fair. For vernal pool features on the east side of the existing BNSF railroad tracks and outside the construction and project footprints, the risk of indirect impacts is low. Therefore, the post-project condition of these vernal pool features would remain the same as their existing condition, which is either good or fair.

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Section 4.0
Environmental Setting

4.0 Environmental Setting

This section discusses the physical and biological conditions identified during pre-field investigations, reconnaissance-level surveys, and field surveys in the study area.

The Fresno to Bakersfield Section of the HST System is in in the San Joaquin Valley of California. In general, it parallels the existing BNSF Railway tracks and State Route (SR) 43. The study area is west of SR 99 and east of Interstate 5. The alignment trends in an overall northwest to southeast direction for approximately 118 miles with a minimum study area width of 250 feet. The study area crosses a number of major rivers, canals, agricultural ditches, smaller creeks, and ephemeral drainages and is primarily composed of agricultural lands, urban and rural communities, and scattered fragments of undeveloped natural habitat. The following sections provide a general overview of the physical conditions (e.g., geological setting, climate, watershed, hydrology, soils) and biological conditions (e.g., terrestrial habitats and land uses, aquatic resources and special areas, conservation areas).

4.1 Physical Conditions

The existing physical conditions pertinent to the Watershed Evaluation Report include physiography and regional geologic setting, climate, watershed, hydrology, and soils. Five ecological sections are represented in the Tulare Lake Basin, as shown on Figure 4-1. They are the Sierra Nevada Ecological Section, the Sierra Nevada Foothills Ecological Section, the Great Valley Ecological Section, the Central California Coast Ranges Ecological Section, and the Southern California Mountain and Valley Ecological Section. The Fresno to Bakersfield Section alternative alignments lay entirely within the Great Valley Ecological Section; the alternatives are bordered by the Sierra Nevada and Sierra Nevada Foothills ecological sections to the east, the Central California Coastal Ranges (Coast Ranges) Ecological Section to the west, and the Southern California Mountain and Valley (Mountain and Valley) Ecological Section to the south.

4.1.1 Physiography and Regional Geologic Setting

The project is in the Central Valley of California, which is in the Great Valley Geomorphic and Physiographic Province (CGS 2002). The Central Valley is a large, nearly flat valley bound by the Klamath and Trinity mountains to the north, the southern Cascade Range and the Sierra Nevada to the east, the San Emigdio and Tehachapi mountains to the south, and the Coast Ranges and San Francisco Bay to the west. The Central Valley consists of the Sacramento Valley in the north and the San Joaquin Valley in the south.

The Central Valley occupies a structural trough created about 65 million years ago by the collision of the Pacific and North American tectonic plates. Sediment from ocean water, river deposition, and glacial deposition filled the trough with an approximately 6-mile-thick layer of continental and marine sediments above rock (Authority and FRA 2004).

The study area is in the central part of the San Joaquin Valley. The topography in this part of the Central Valley is flat-lying, with elevations across the project alternatives and the HMF site alternatives ranging from +395 feet (North American Vertical Datum of 1988) to +205 feet (North American Vertical Datum of 1988). A general downward gradient occurs in the study area to the west-southwest, determined principally by the gentle slope of the vast alluvial fans extending from the Sierra Nevada in the east to the center of the San Joaquin Valley.

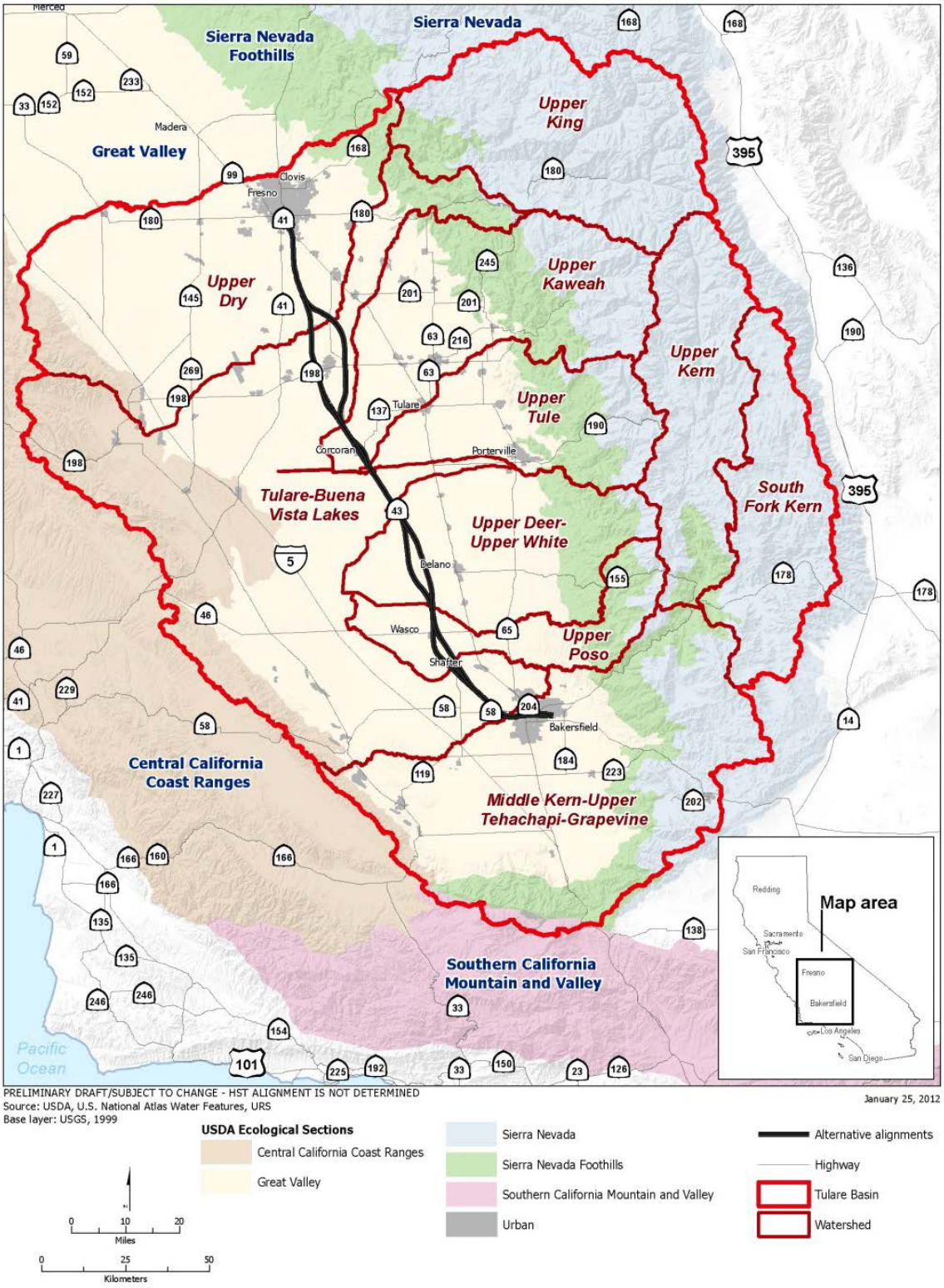


Figure 4-1
Tulare Lake Basin ecological sections and watersheds

4.1.2 Climate

The climate within the study region is semi-arid, with long, hot, dry summers and relatively mild winters. Heavy rainfall and snow in the western Sierra Nevada are the major sources of water in the Tulare Lake Basin (Gronberg et al. 1998). As determined from the long-term records of precipitation, the average annual precipitation in the study region ranges from approximately 6.23 to 10.94 inches. More than 80% of the precipitation in the study area occurs from November through April. In the Sierra Nevada, the majority of the mean annual precipitation falls as snow and ranges from 20 inches in the foothills to over 80 inches at higher elevations. The annual precipitation in the Coast Ranges, west of the valley floor, ranges from 10 to more than 20 inches (Gronberg et al. 1998).

4.1.3 Watershed

The Fresno to Bakersfield Section of the HST system lies in the southern portion of California's San Joaquin Valley, within the Tulare Lake Basin (Figure 4-1). The Tulare Lake Basin is approximately 16,400 square miles and mostly spans Fresno, Kings, Tulare, and Kern counties (CVRWQCB 2004). The Tulare Lake Basin is drained by the Kings, Kaweah, Tule, and Kern rivers, which flow to the dry beds of Tulare, Buena Vista, and Kern lakes. The Fresno to Bakersfield Section occurs within seven HUC-8 watersheds in the Tulare Lake Basin (Figure 4-2):

- Upper Dry Watershed (18030009)
- Tulare–Buena Vista Lakes Watershed (18030012)
- Upper Kaweah Watershed (18030007)
- Upper Tule Watershed (18030006)
- Upper Deer–Upper White Watershed (18030005)
- Upper Poso Watershed (1803004)
- Middle Kern–Upper Tehachapi–Grapevine Watershed (1803003)

Before agricultural development, the Tulare Lake Basin was dominated by four large, shallow, and mainly temporary inland lakes (Gronberg et al. 1998). The Tulare Lake bed, which was the most northerly lake of the four, has been turned into a system of approximately 103 miles of levees and irrigation canals to direct flooding away from farmed tracts of land (USACE 1996). The Kern River once flowed south and west across the southern portion of the valley through a complex system of sloughs, creeks, ponds, and permanent wetlands and fed Buena Vista and Kern lakes.

To convey water for agricultural purposes, many watercourses are highly altered from their natural state. Farmers and other agricultural producers pump groundwater and surface water to and from the numerous canals and drains that deliver irrigation water to and from agricultural fields. Composed of packed earth or concrete lining, the canals generally lack the meanders, vegetation, biota, and other features of natural streams.

The California Aqueduct and Friant-Kern Canal are major water conveyance systems that cross the study region. The California Aqueduct, which is approximately 30 miles west of the alternative alignments, was constructed in the 1970s and supplies agricultural and municipal areas in Southern California. The California Aqueduct generally runs north to south.

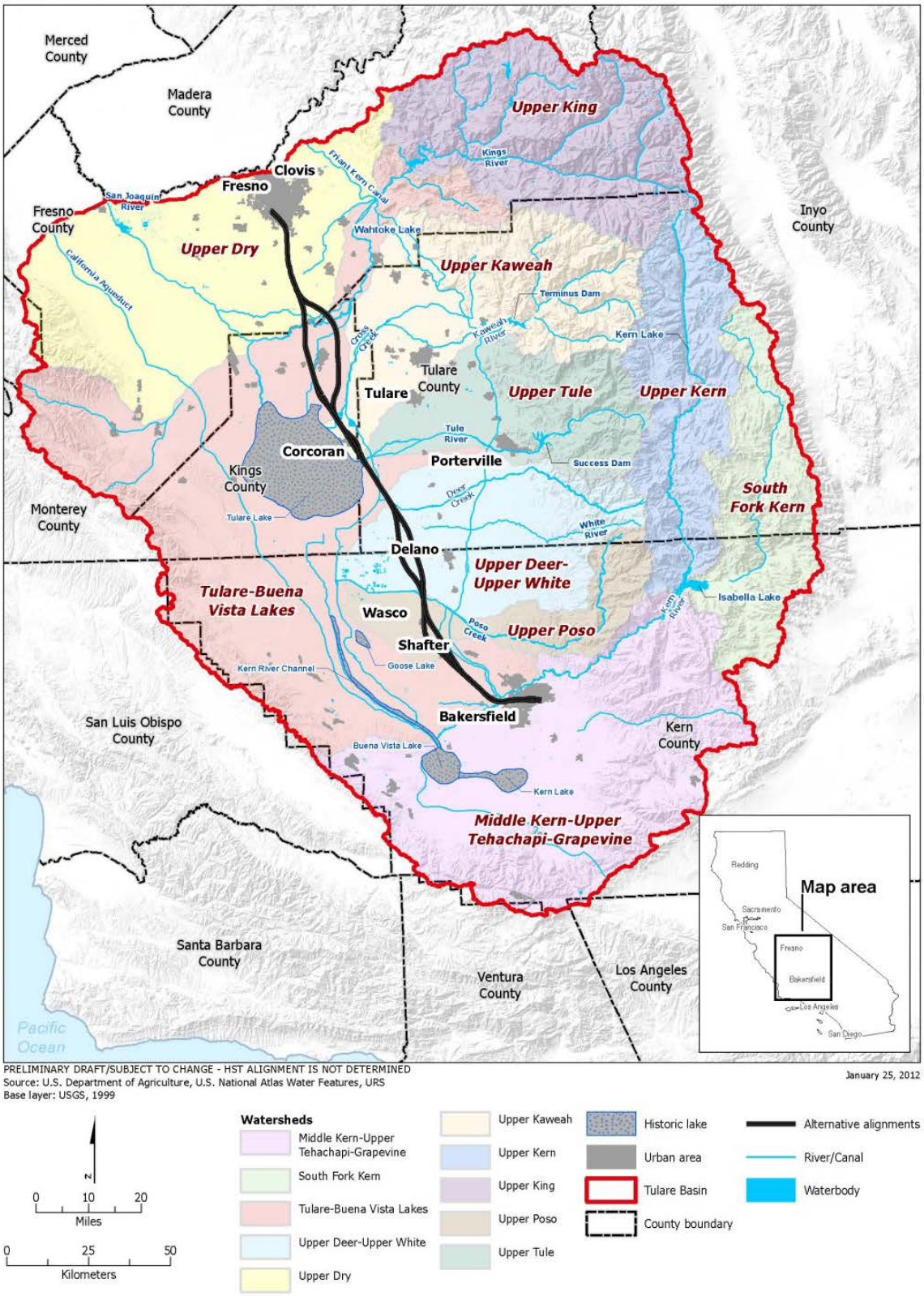


Figure 4-2
Tulare Lake Basin watersheds

The Friant-Kern Canal transports water south from Millerton Lake, a reservoir north of Fresno created by Friant Dam, and joins the Kern River approximately 4 miles west of Bakersfield. The 152-mile-long Friant-Kern Canal is east of the alternative alignments. The canal capacity near Millerton Lake is 5,000 cubic feet per second (cfs) but decreases to 2,000 cfs in the southern portion of the valley as water is diverted for municipal, industrial, and agricultural use (ICF Jones & Stokes 2008). With the consent of the U.S. Bureau of Reclamation, Kaweah River water is occasionally pumped to the canal to relieve downstream flooding in the Tulare Lake bed. When the canal is full or downstream demand is low, the Friant-Kern Canal may not be used for flood control purposes (USACE 1996).

4.1.4 Hydrology

Of all the precipitation that falls within the Tulare Lake Basin, most of the runoff (over 98%) is collected in the Sierra Nevada and ends up within the Kings, Kaweah, Tule, and Kern rivers (Figure 4-3). The remaining runoff contributes to stream flows, including Deer Creek, White River, and Poso Creek. Hydrologically, the Tulare Lake Basin is essentially closed, because water only drains north to the San Joaquin River during periods of extremely high rainfall. The contributing rivers are normally dewatered (for agricultural uses) before reaching the Great Valley floor (USDA 1982).

4.1.4.1 Historical Hydrology

Historically, the Tulare Lake Basin was dominated by four large, shallow, mainly seasonal, terminal lakes: Tulare, Buena Vista, Goose, and Kern lakes (Figure 4-3). Historical Tulare Lake was originally one of the largest lakes in California, occupying much of southern Kings and Tulare counties and northern Kern County and encompassing up to 790 square miles during the wettest years (USDA 1986; EPA 2007). Tulare Lake was historically fed by the Kings River, Kaweah River (the source of Poso Creek), Tule River, and the Kern River from the Sierra Nevada. It was a terminal lake, having no natural outlet in dry years and overflowing to reach the San Joaquin River periodically during wet years (USDA 1982).

Buena Vista and Kern lakes were fed by the Kern River, which once flowed south and west across the southern Central Valley through a complex system of sloughs, creeks, ponds, and permanent wetlands. Goose Lake was fed by the overflow of a Kern River distributary and the overflow of Buena Vista Lake. In particularly wet years, Buena Vista Lake would overflow into the Buena Vista Slough, ultimately feeding into Tulare Lake (EPA 2007). Evaporation of these historic lakes through water diversions and climate change has resulted in a wide area of saline-sodic soils on the southern Central Valley floor. These soils support plants and plant communities tolerant of the saline and alkaline conditions.

Large portions of the southern Central Valley floor were historically subject to frequent flood events, from either intense fall/winter rainfall or from late-spring/early-summer snowmelt originating in the Sierra Nevada.

4.1.4.2 Present-Day Hydrology

The Tulare Lake Basin has changed dramatically in the past 150 years. Although many of the headwaters and mountains of the southern Sierra Nevada and the Coast Ranges have been protected, the effects of urbanization and human use increase toward the valley floor. All four of the major rivers have been dammed and much of the water flowing into the basin is diverted by numerous irrigation canals for agricultural use. The level of conversion has been so significant that Tulare Lake no longer exists; its bottom was reclaimed for farming and its water diverted.

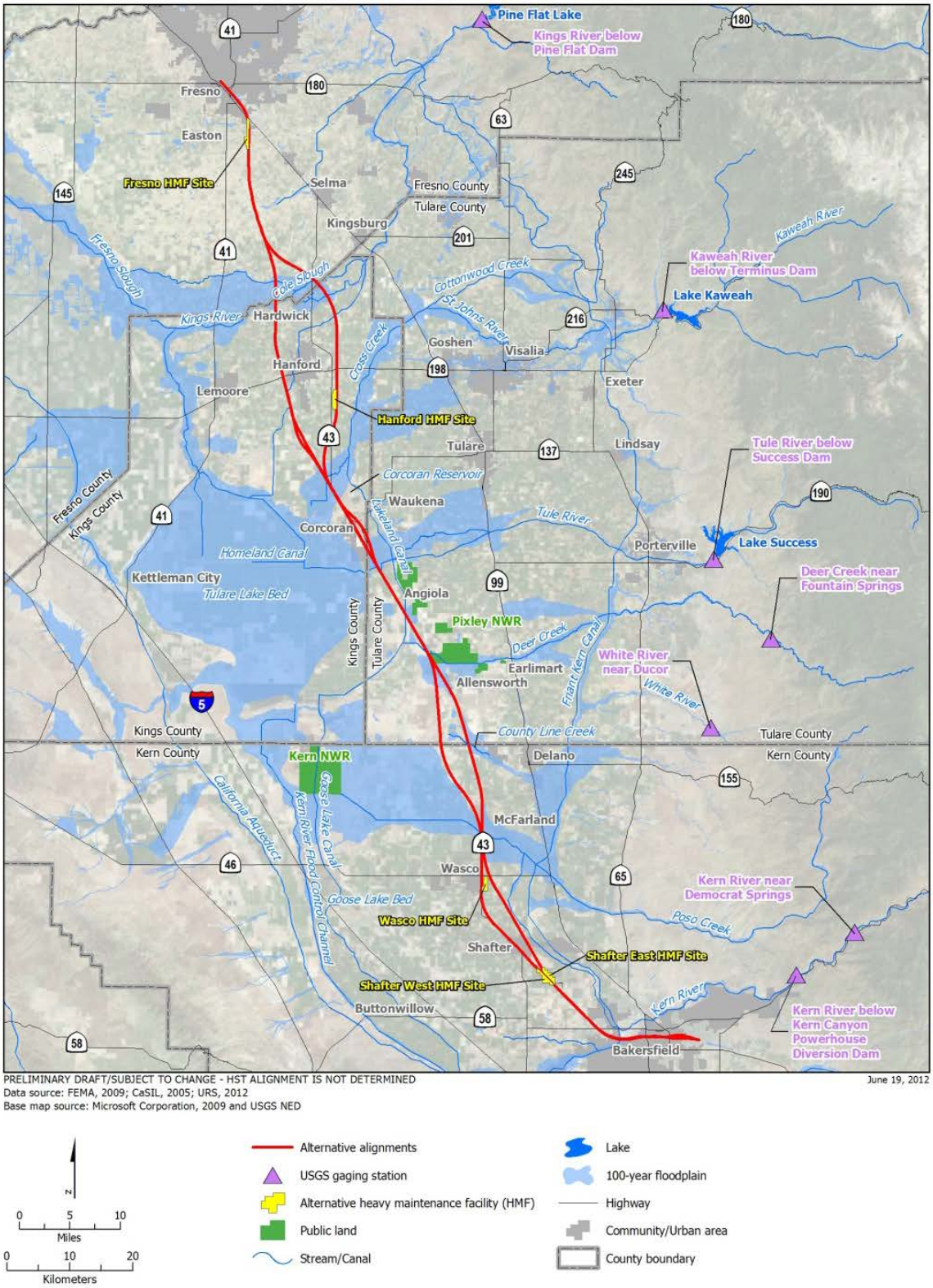


Figure 4-3
Floodplains and hydrology

The southern Central Valley once sustained rich riparian wetland habitats and shallow groundwater in the deltas of the major rivers (USDA 1982), but most of these habitats and the shallow groundwater are now greatly reduced or eliminated. More than 88% of wetlands and over 95% of the oak woodlands in the southern Central Valley have been converted to agriculture or urban use (Kelly et al. 2005). Much of the agriculture is supplied in the basin by the Friant-Kern Canal. This component of the federal Central Valley Project was built in the late 1940s (USDI Bureau of Reclamation 2011). This water conveyance system runs north-south through the eastern side of the basin, intersecting with all of the major rivers and creeks. The canal supplies water from the north to the drier southern areas. In high-water years, surplus flows are pumped into the Friant-Kern Canal to minimize flood risk (EPA 2007). The California Aqueduct runs through the western side of the Tulare Basin. This system delivers water from the state's California Water Project and the federal Central Valley Project (the water is diverted in the Sacramento–San Joaquin Delta directly to water consumers in the southern Central Valley and Southern California).

The water flowing into the valley floor provides critical beneficial uses, primarily irrigation for agriculture. California's Department of Water Resources estimates that about 84% of the water in the Tulare Lake region is used for agriculture, 5% is used for urban uses, and the remaining 11% is available for environmental uses, including wildlife and fish habitat (DWR 2005).

Regular flooding is now largely controlled by dams, diversions, levees, and dredging. The previous floodplain and riparian habitat have also largely been replaced by agriculture or urban development. Infrequent but catastrophic floods now occur in parts of the southern Central Valley; these floods are made more severe by the loss of the flood-attenuating functions of riparian and wetland habitats (USDA 1982; Vileisis 1997).

At the project level, all of the streams and rivers within the Fresno to Bakersfield alternative alignments have been dredged, culverted, diverted, dewatered, channelized, or have had their active floodplains severely reduced by levee construction. Therefore, most of the surface water in the project footprint is found in irrigation canals, ditches, or water retention/detention basins, and occasionally in river channels or in precipitation-fed wetlands and vernal pools. The remaining wetlands are largely unrelated to the historical floodplains or regional aquifers.

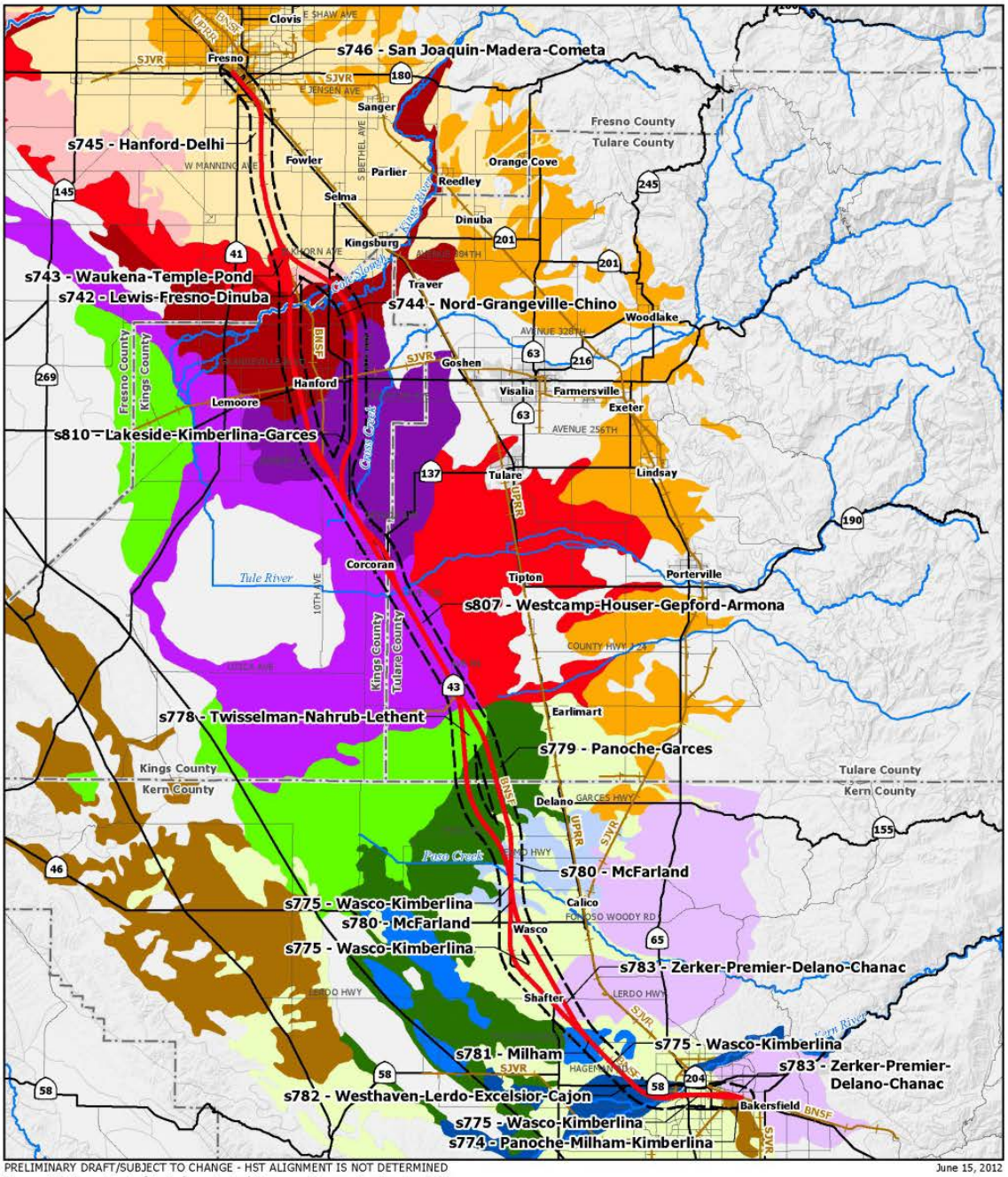
4.1.5 Soils

The soils underlying the project alternatives, the station alternatives, and the HMF alternatives are described in Natural Resources Conservation Service (NRCS) soil surveys; these soils consist primarily of alluvial deposits of clay, silt, sand, and gravel with varying grain sizes and content (USDA-NRCS 2006). The soil types and consistencies of these deposits vary by location and depend on how the soils were deposited. The surface soils in the project vicinity generally have high permeability and infiltrate runoff relatively quickly. This soils information is based on conditions within the upper 4 to 5 feet of the ground surface. Table 4-1 provides a summary of the physiographic features, soil associations, and counties of occurrence. Figure 4-4 shows the soil associations in the study area.

Table 4-1
Summary of Soil Associations

Soil Association	Counties of Occurrence	Landform Groups	Potential Soil Hazard Characterization
San Joaquin-Madera-Cometa	Fresno	Low alluvial terraces	No to moderate erosion potential; low to high shrink-swell potential; high corrosivity potential
Hanford-Delhi (also identified as Q_{sd} (sand dunes) on Figure 3.9-1 in the Revised Draft EIR / Supplemental Draft EIS)	Fresno	Young alluvial fans and alluvial benches,	No to slight water erosion potential; slight to moderate wind erosion potential; low shrink-swell potential; low corrosivity potential
Waukena-Temple-Pond	Fresno	Basin floodplain	No to slight water erosion potential; slight wind erosion potential; low to moderate shrink-swell potential; low to high corrosivity potential
Lewis-Fresno-Dinuba	Fresno	Alluvial fans/valley plains	No to slight erosion potential; low to moderate shrink-swell potential; high corrosivity potential
Nord-Grangeville-Chino	Fresno/Kings	Lower parts of recent alluvial fans and floodplains	No to slight erosion potential; low to moderate shrink-swell potential; low to high corrosivity potential
Lakeside-Kimberlina-Garces	Kings/Tulare	Alluvial fans	Slight water erosion potential; low to high shrink-swell potential; slight to moderate wind erosion potential
Westcamp-Houser-Gepford-Armona	Kings/Tulare	Low alluvial fans, basins, and floodplains	Slight wind erosion potential, moderate to high water erosion potential; low to high shrink-swell potential; high corrosivity potential
Twisselman-Nahrub-Lethent	Tulare	Basin rims and fan remnants	Moderate to high water erosion potential; moderate wind erosion potential; low to moderate shrink-swell potential; high corrosivity potential
Panoche-Garces	Tulare/Kern	Alluvial fans and floodplains	Slight water erosion potential; slight to moderate wind erosion potential; low to moderate shrink-swell potential
McFarland	Kern	Alluvial fans and floodplains	Slight water erosion potential; low to moderate shrink-swell potential; high corrosion potential to uncoated steel
Wasco-Kimberlina	Kern	Alluvial fans, fan skirts, and plains	Slight water erosion potential; low to moderate shrink-swell potential; low to high corrosivity potential
Zerker-Premier-Delano-Chanac	Kern	Alluvial plains and terraces	Low shrink-swell potential; low wind erosion potential
Milham	Kern	Alluvial fans	Low to moderate erosion potential; low to moderate shrink-swell potential
Westhaven-Lerdo-Excelsior-Cajon	Kern	Alluvial fans and fan skirts	Moderate to high erosion potential; slight wind erosion potential; low shrink-swell potential
Panoche-Milham-Kimberlina	Kern	Alluvial fans, plains, and low terraces	Local moderate water erosion potential; high corrosivity potential to uncoated steel

Source: USDA-NRCS 2006.
[a] As mapped by USDA-NRCS 2006. Refer to Figure 3.9-2 in the Revised Draft EIR / Supplemental Draft EIS for the locations of soil associations (Authority and FRA 2012a).



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Source: U.S. Department of Agriculture, Natural Resources Conservation Service, 2006
Note: Only soil within 1-mile buffer of alignments displayed in legend.

June 15, 2012

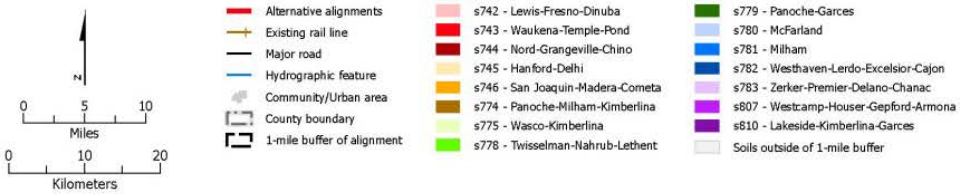


Figure 4-4
Soil associations

The soils within the study area generally occur in one of the physiographic locations (Figure 4-5). The characteristics of the physiographic locations and the associated soils are summarized below:

- Alluvial fans and floodplains. These soils are found in Fresno, Kings, Tulare, and Kern counties. Alluvial fans are fan-shaped deposits of water-transported material (alluvium). They typically form at the base of topographic features where there is a marked break in slope. Consequently, alluvial fans tend to be coarse-grained, especially at their mouths where the energy of the stream or river is still high. At their edges, however, where energy levels can be low to quiescent, they can be relatively fine-grained. These soils are developed in nearly level and gently sloped ground conditions, along drainage ways, on alluvial fans, and on floodplains. Characteristics often vary greatly within short distances because the soils developed in compositionally variable stream deposits. Some areas may have compacted silt or sand or an iron-silica hardpan. Typically, these soils have little clay content, exhibit low to moderate shrink-swell potential, are moderately to highly corrosive to uncoated steel, and are slightly corrosive to concrete. These soils also have slight potential for water and wind erosion. Sand dunes have been identified in the area south of Fresno (see Figure 4-5).

- Low alluvial terraces. These soils are found in Fresno and Kern counties. They are often found in rolling topography and can include a strongly cemented or indurated hardpan in the subsoil. The hardpan can be composed of cemented silica or clay. These soils contain expansive clays, resulting in moderate to high shrink-swell potential. These soils are highly corrosive to uncoated steel and moderately corrosive to concrete. They can have a moderate potential for water erosion and a high potential for wind erosion.

- Basin areas (including saline-alkali basins). These soils are found primarily in Kings, Tulare, and the northern portion of Kern counties. The topography of these areas is nearly level or gently undulating. They have more clay content than fans and terraces, and nearly all have accumulations of salt and alkali due to poor drainage. Most of these soils have cemented lime-silica hardpans in the subsoil. These soils exhibit low to high shrink-swell potential, are highly corrosive to uncoated steel, and are moderately corrosive to concrete. They are also moderately to highly susceptible to water and wind erosion.

4.2 Biological Conditions

Historically, the Central Valley was characterized by California prairie, marshlands, valley oak savanna, and extensive riparian woodlands (Hickman 1993). Today, more than 80% of the Central Valley is covered by farms and ranches (USDA-NRCS 2006). Overall, the study area is highly disturbed and fragmented because of urban, agricultural, railroad, highway, and local road land cover types. In a few areas, native vegetation remains relatively undisturbed, though invasive and non-native plant species may occur in these areas. If these areas have not been recently plowed or disked or if they show no sign of having been disturbed in recent decades, they are referred to as “natural areas” in this document.

This section describes the terrestrial habitat, land uses, and aquatic resources, including man-made and manipulated aquatic resources, sensitive aquatic resources, and special areas and conservation lands in the study area or in close proximity to the study area. The terrestrial habitats and land uses are based on the California Wildlife Habitat Relationships System (CDFG 2008; Mayer and Laudenslayer 1988) and conditions observed in the field assessments. Aquatic resources are as described in the *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* (FRA and Authority 2012a).

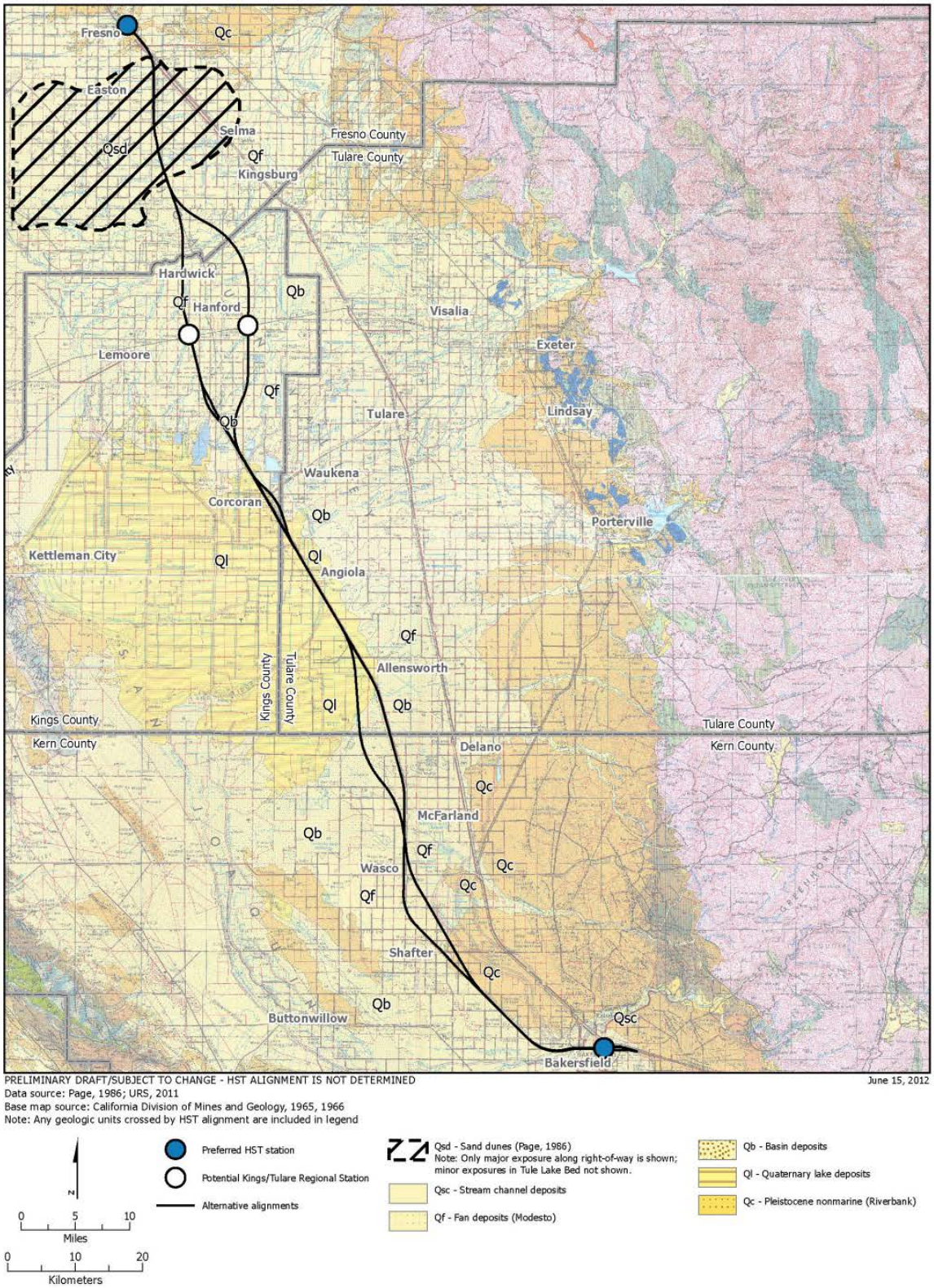


Figure 4-5
Physiographic characteristics

4.2.1 Terrestrial Habitats and Land Uses

The categories of terrestrial plant communities and land cover types that occur in the study area are summarized below. The plant communities and land cover types identified in the study area include agricultural lands, developed areas, semi-natural areas, and natural areas (Figure 4-6). Habitat conditions in the study area are discussed in detail in *Fresno to Bakersfield Section: Biological Resources and Wetlands Technical Report* (Authority and FRA 2012b).

The following descriptions of plant communities and land cover types are based on *A Guide to the Wildlife Habitats of California* (Mayer and Laudenslayer 1988) and the California Wildlife Habitat Relationships System (CDFG 2008).

4.2.1.1 Agricultural Lands

Eight types of agricultural land are found in the study area: cropland, dryland grain crops, irrigated grain crops, irrigated hayfield, irrigated row and field crops, deciduous orchard, evergreen orchard, and vineyard. These land uses, along with urban land uses, characterize the overwhelming majority of land in the study area. Agricultural lands may provide marginal habitat for seasonal forage and refugia for a limited number of common species and special-status species. Ruderal plant species, which are defined as species that grow where the natural vegetation has been removed or significantly degraded by past or current human activity, are found in these agricultural land types, especially where these types are bordered by roads, canals, ditches, or other highly disturbed features. Vegetation in these areas is highly variable but often includes a mix of non-native annual grasses such as ripgut brome (*Bromus diandrus*), soft chess (*Bromus hordeaceus*), red brome (*Bromus madritensis* ssp. *rubens*), wild oats (*Avena* spp.), Italian ryegrass (*Lolium multiflorum*), and smooth barley (*Hordeum murinum*) and weedy forbs such as bur clover (*Medicago polymorpha*), redstem filaree (*Erodium cicutarium*), yellow star thistle (*Centaurea solstitialis*), Russian thistle (*Salsola tragus*), tumbleweed, (*Amaranthus albus*), Johnson grass (*Sorghum jalapense*), and silver-leaf horsenettle (*Solanum elaeagnifolium*).

Some agricultural species have become naturalized outside the areas where they are planted. These include black mustard (*Brassica nigra*), rape mustard (*Brassica rapa*), Johnson grass (*Sorghum jalapense*), cultivated timothy (*Phleum pretense*), common barley (*Hordeum vulgare*), common wheat (*Triticum aestivum*), and peach (*Prunus persica*). Native species that also occur in ruderal areas in agricultural lands often consist of saltgrass (*Distichlis spicata*), fiddleneck (*Amsinckia menziesii* var. *intermedia*), Canada horseweed (*Conyza canadensis*), annual sunflower (*Helianthus annuus*), alkali mallow (*Malva leprosa*), and tarplants (*Hemizonia* spp.). Field and row crops such as alfalfa provide foraging habitat for raptors, particularly Swainson's hawks (*Buteo swainsoni*). Fallow fields and inactive farmland may provide nesting habitat for several wildlife species, including northern harrier (*Circus cyaneus*) and western burrowing owl (*Athene cunicularia*). These and other agricultural lands may provide foraging or dispersal habitat for loggerhead shrike (*Lanius ludovicianus*), white-tailed kite (*Elanus leucurus*), and American badger (*Taxidea taxus*).

4.2.1.2 Developed Areas

Developed areas are characterized by various types of cover, including barren and urban (e.g., commercial/industrial, and transportation corridors. These areas generally include landscaped areas, yards, and various outbuildings and provide low-quality resources for wildlife. However, certain species, such as the American peregrine falcon (*Falco peregrinus anatum*) and western mastiff bat (*Eumops perotis californicus*) have adapted to developed areas and may use these areas for nesting or roosting habitat.

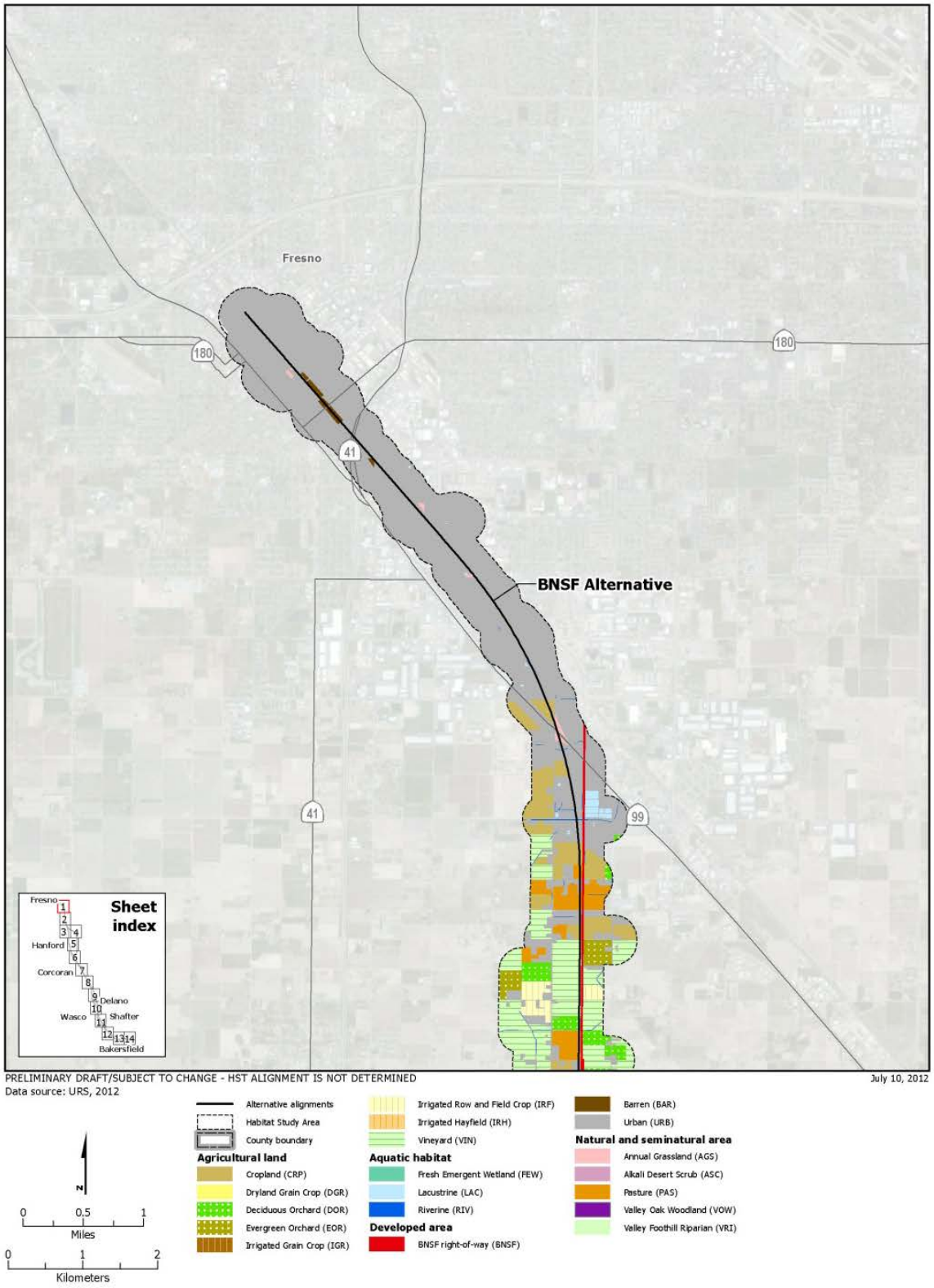


Figure 4-6
Wildlife habitat types (14 Sheets)

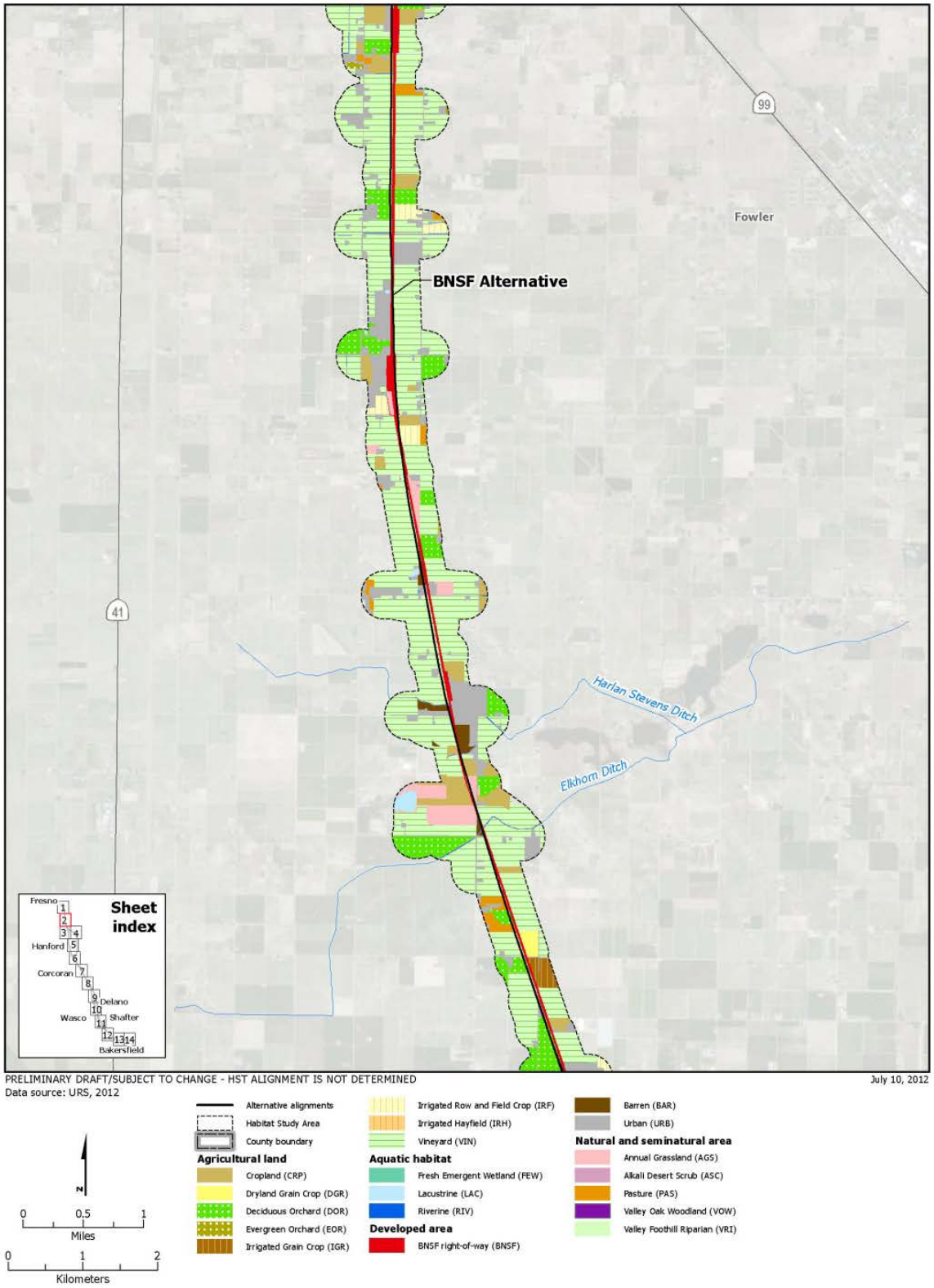
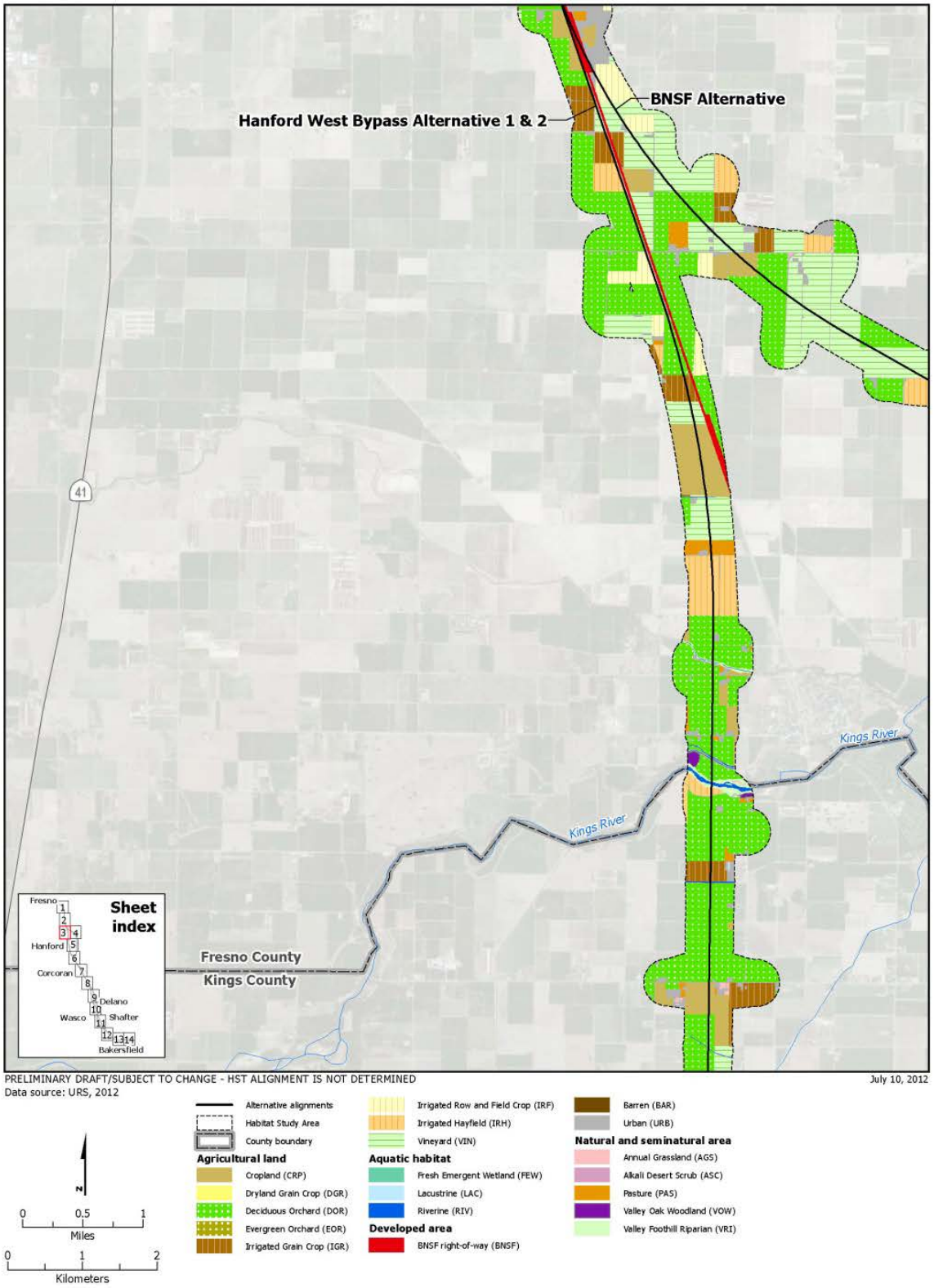


Figure 4-6
Wildlife habitat types (Sheet 2)



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Wildlife habitat types (Sheet 3)

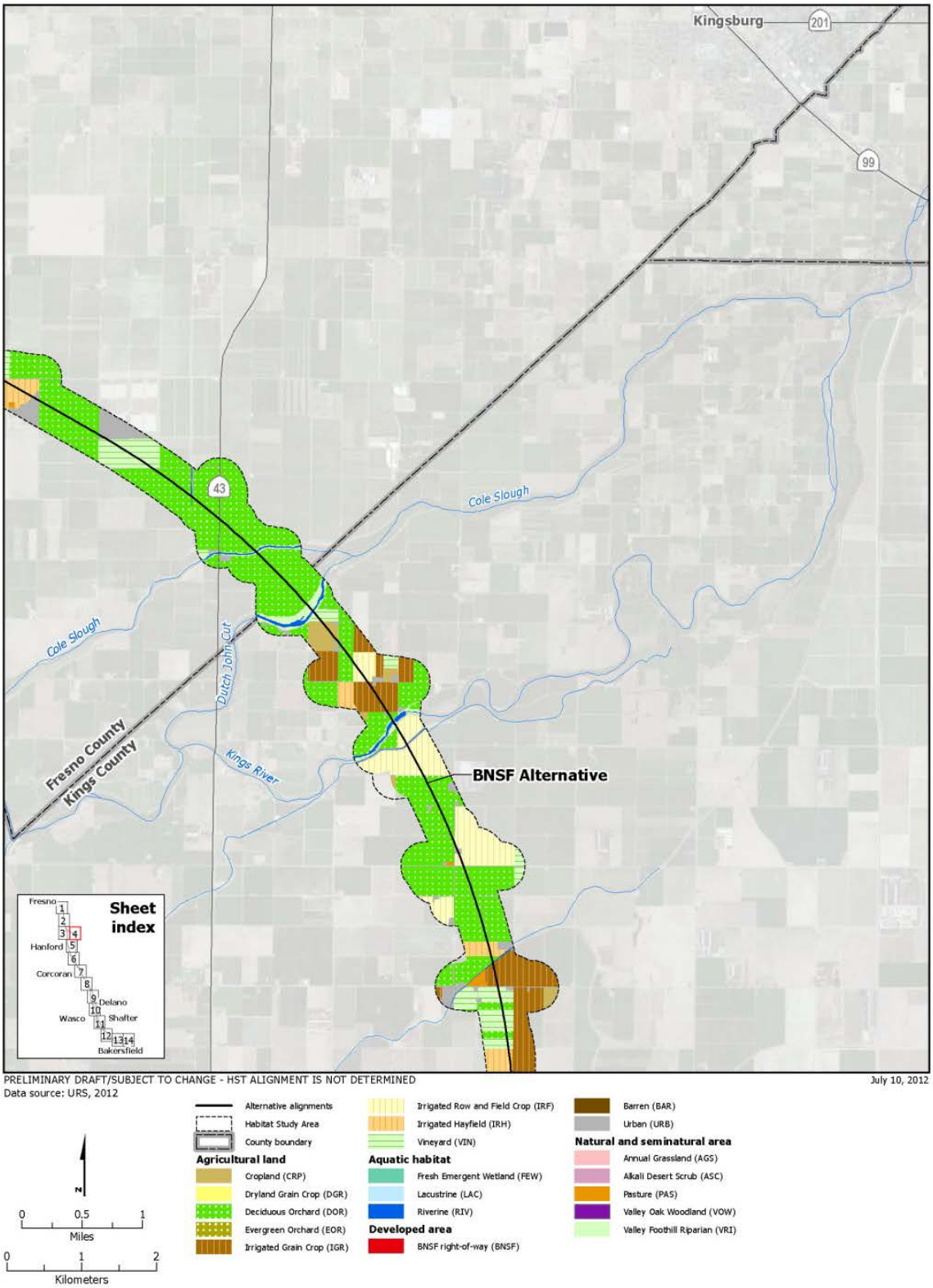
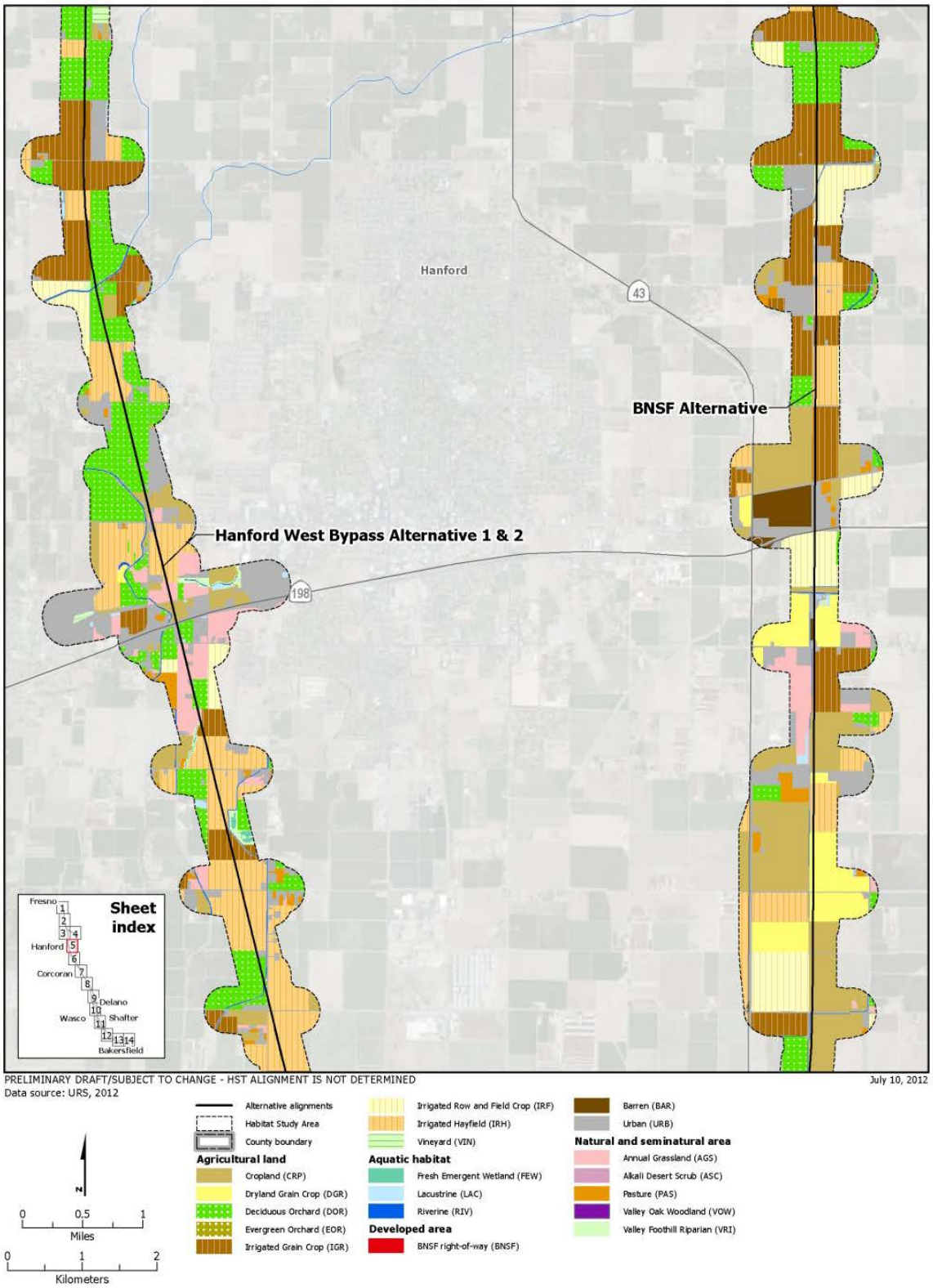


Figure 4-6
Wildlife habitat types (Sheet 4)



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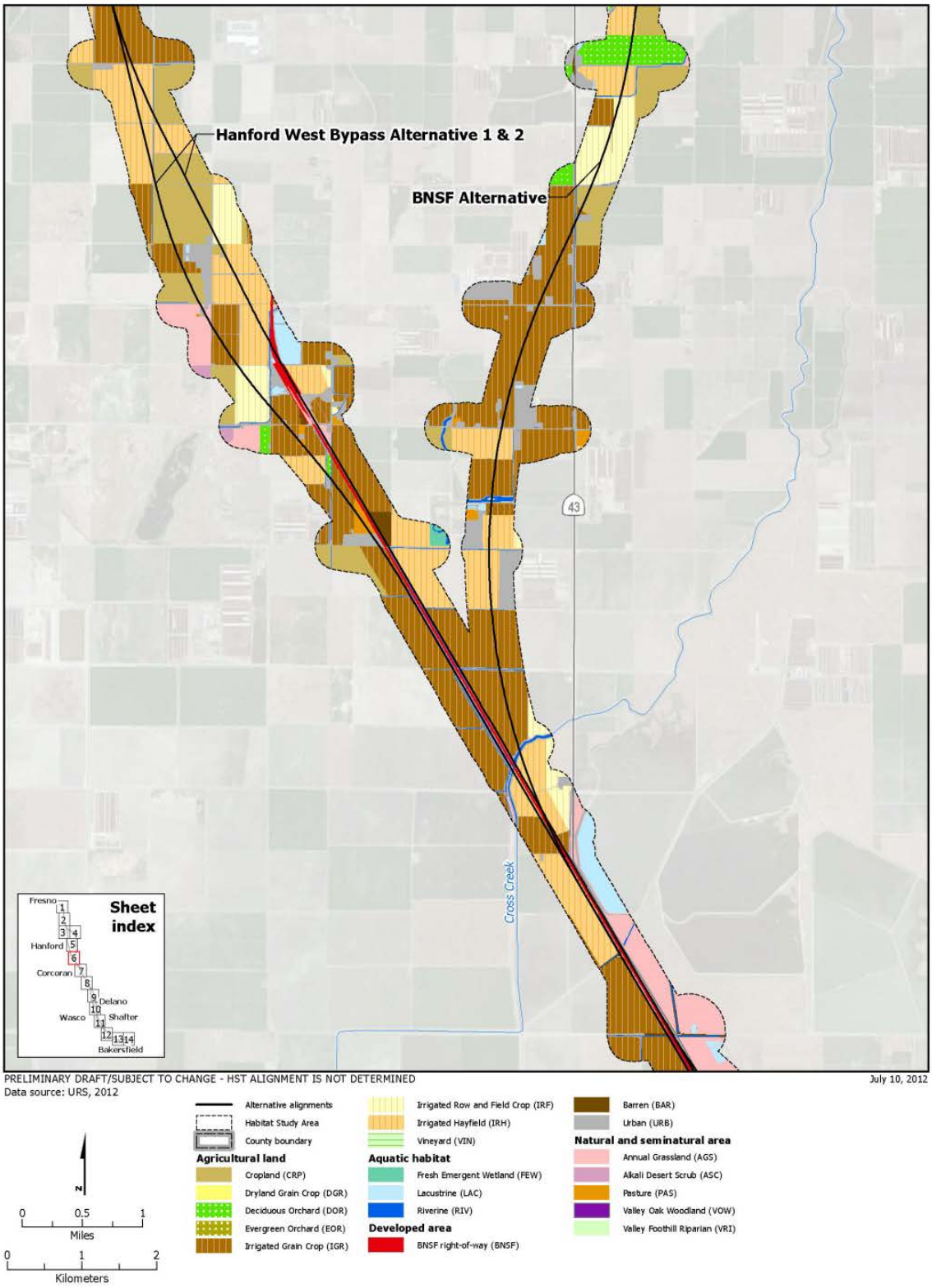
Wildlife habitat types (Sheet 5)



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Wildlife habitat types (Sheet 6)

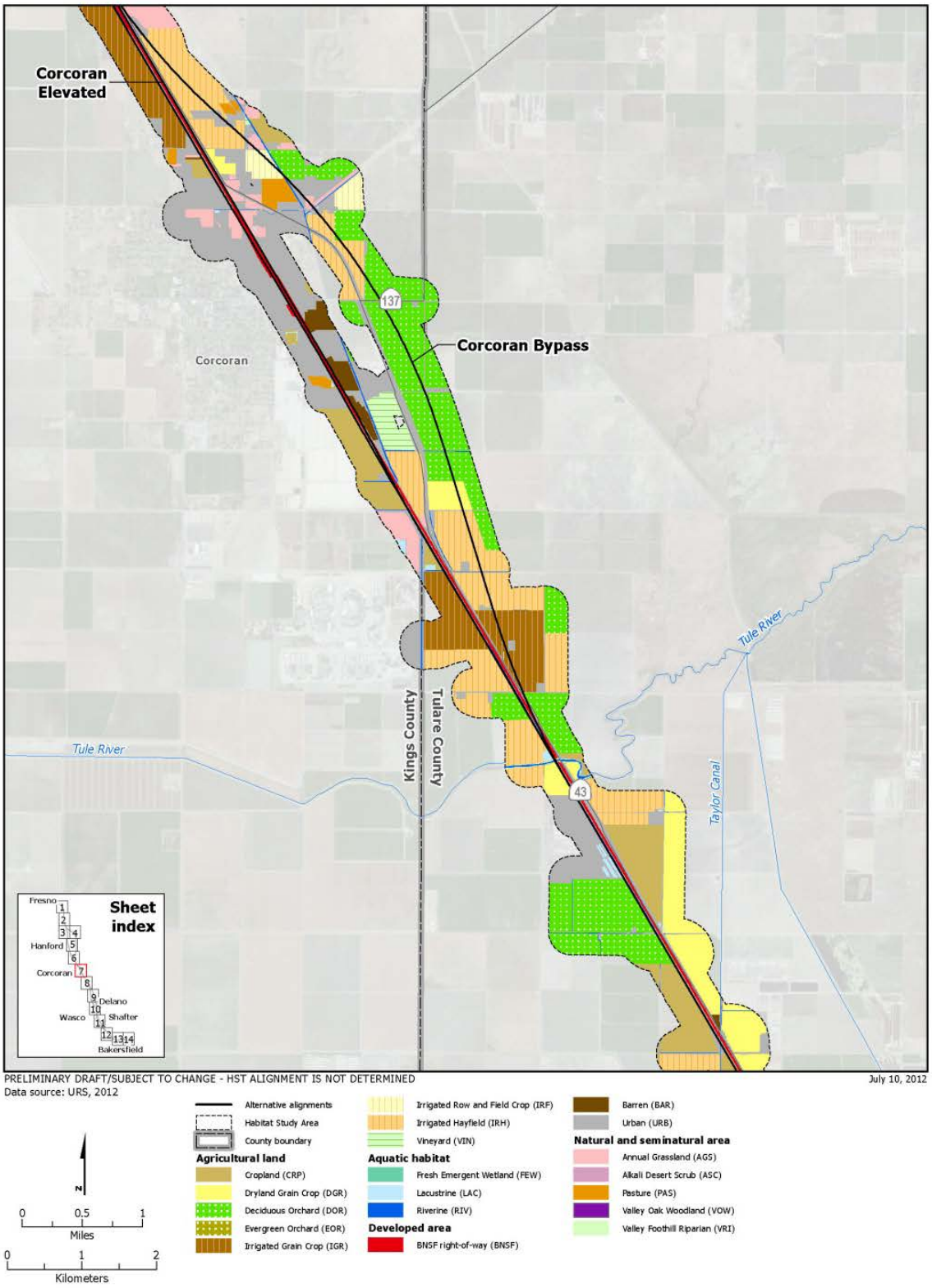


Figure 4-6
Wildlife habitat types (Sheet 7)

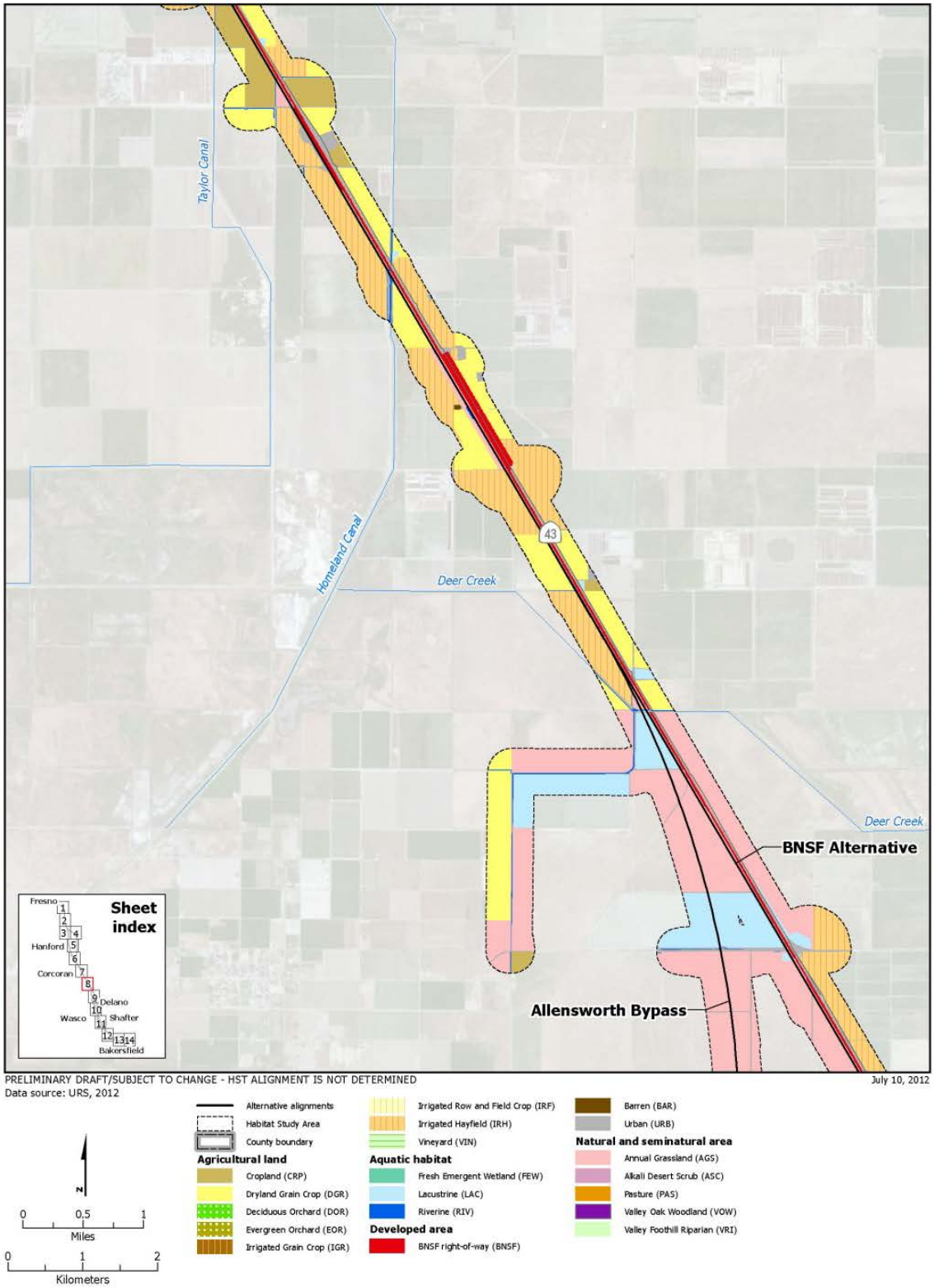


Figure 4-6
Wildlife habitat types (Sheet 8)

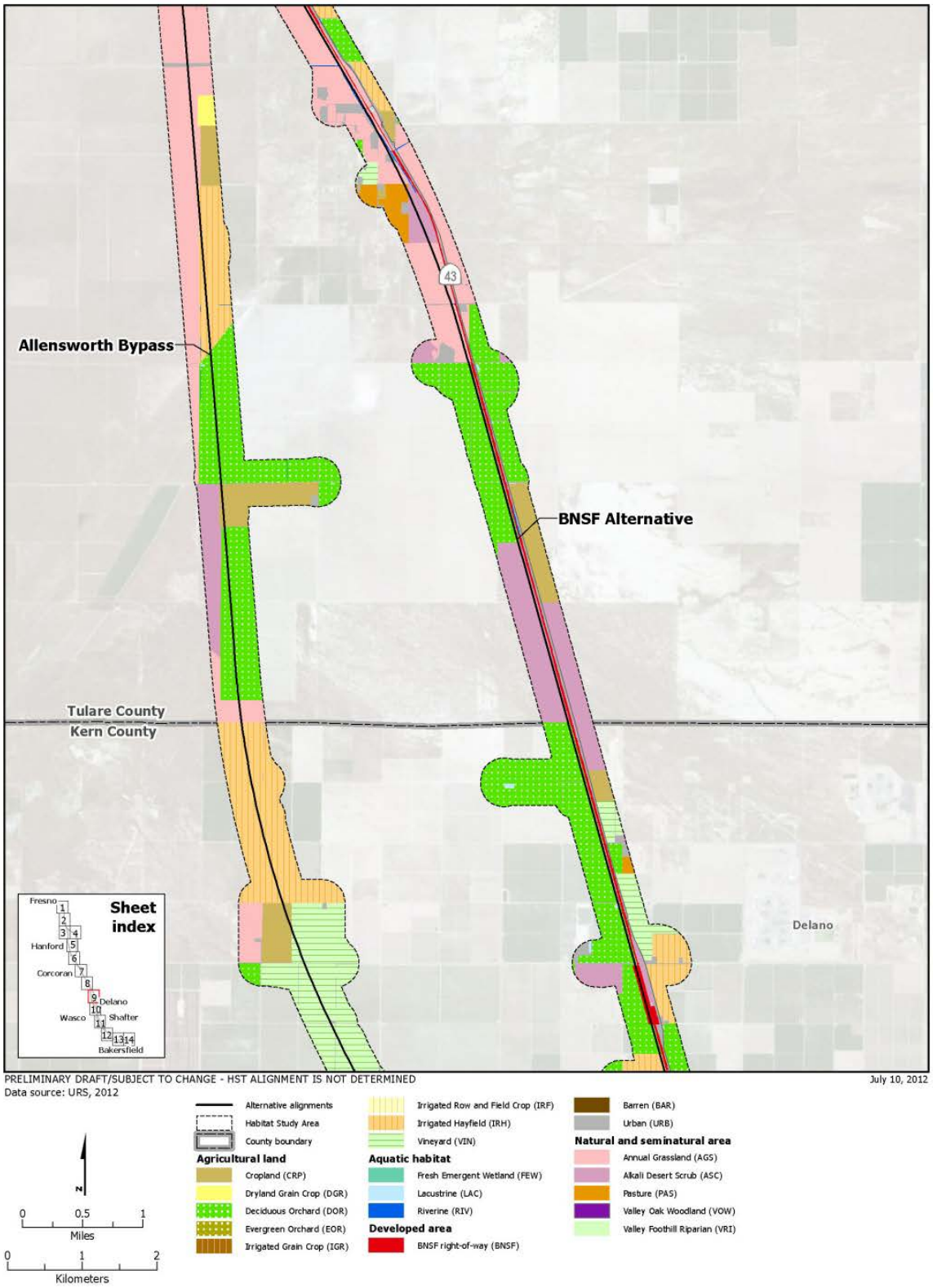


Figure 4-6
Wildlife habitat types (Sheet 9)

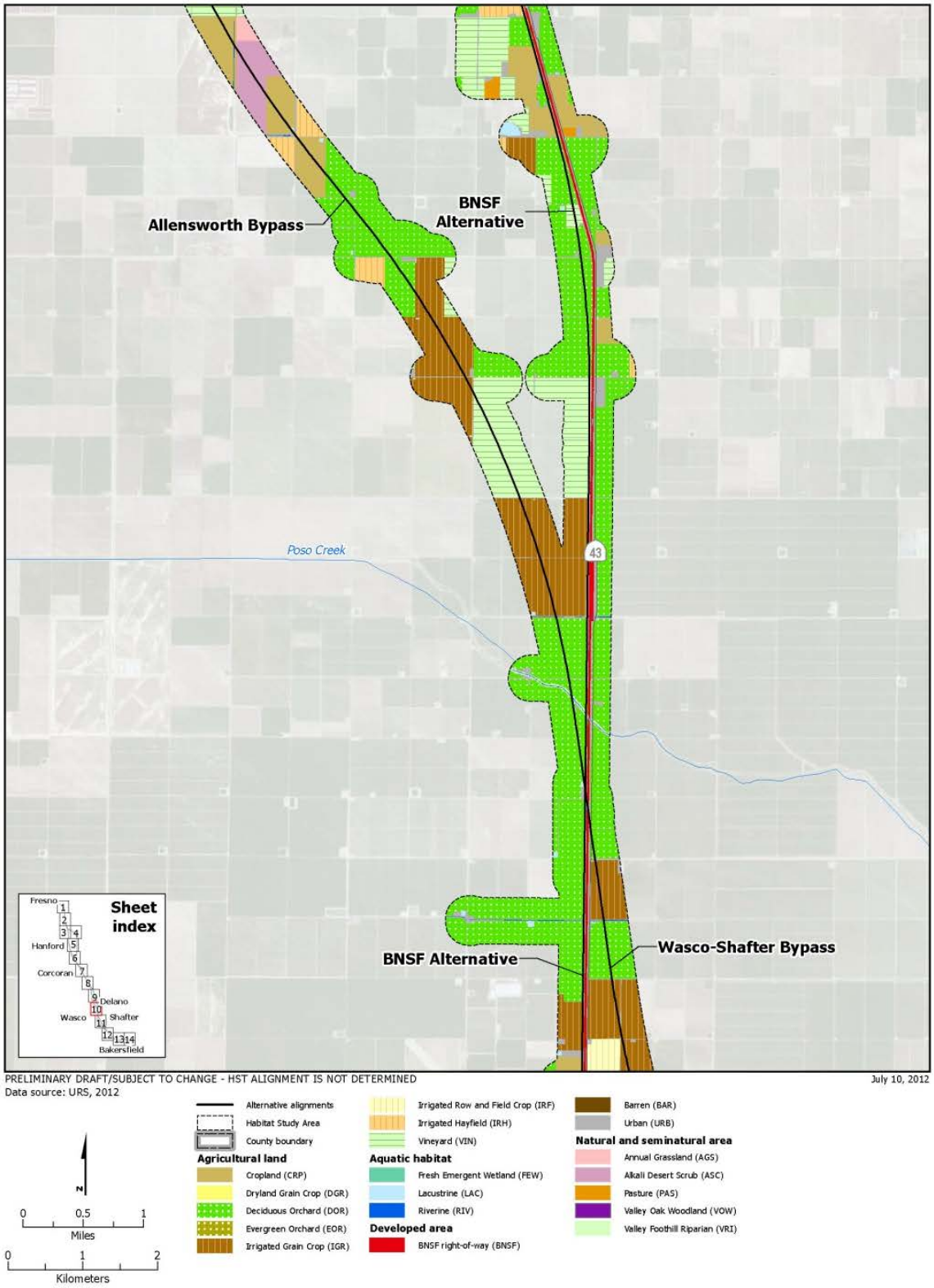


Figure 4-6
Wildlife habitat types (Sheet 10)

CALIFORNIA High-Speed Rail Authority
U.S. Department of Transportation Federal Railroad Administration

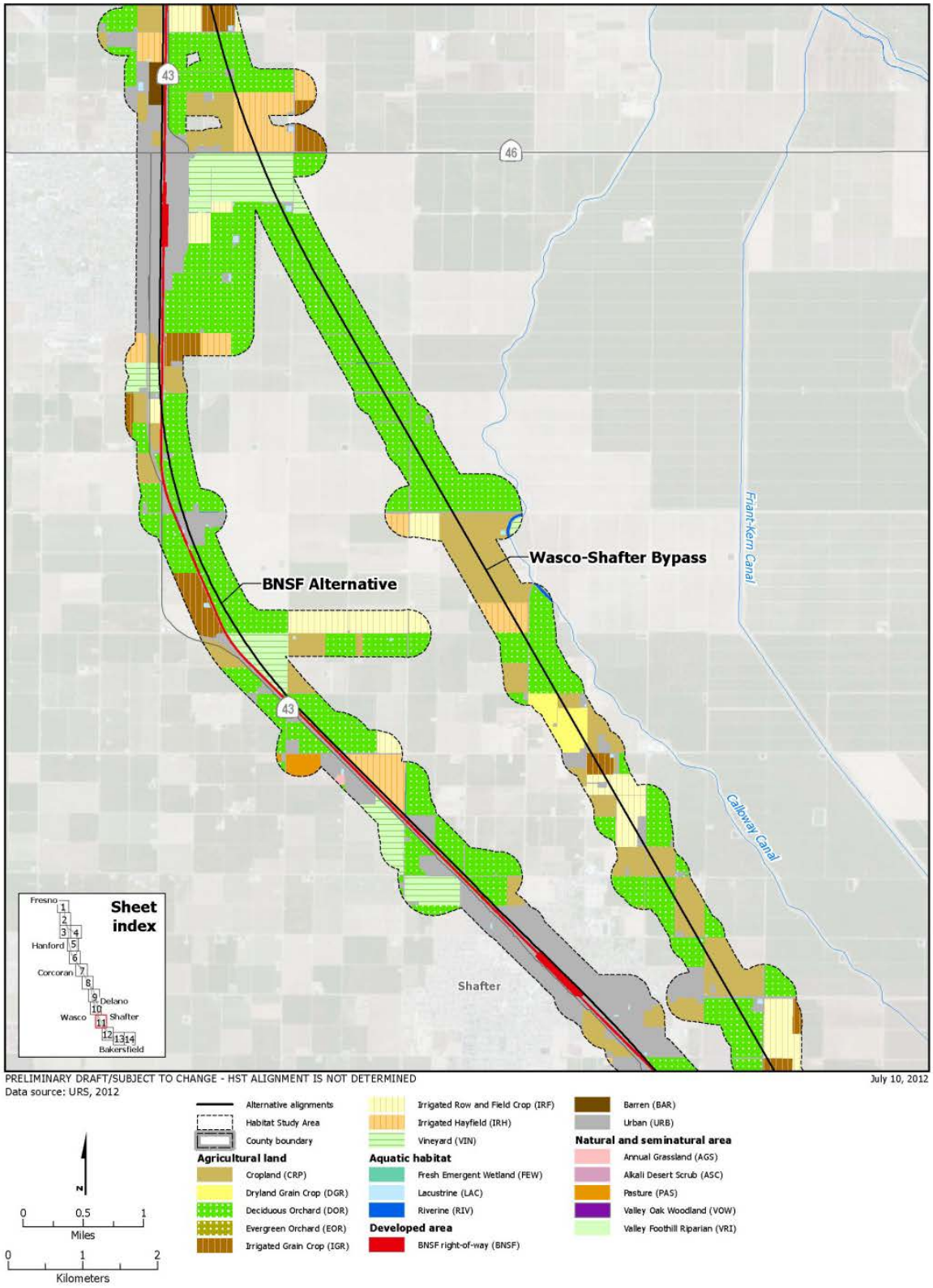
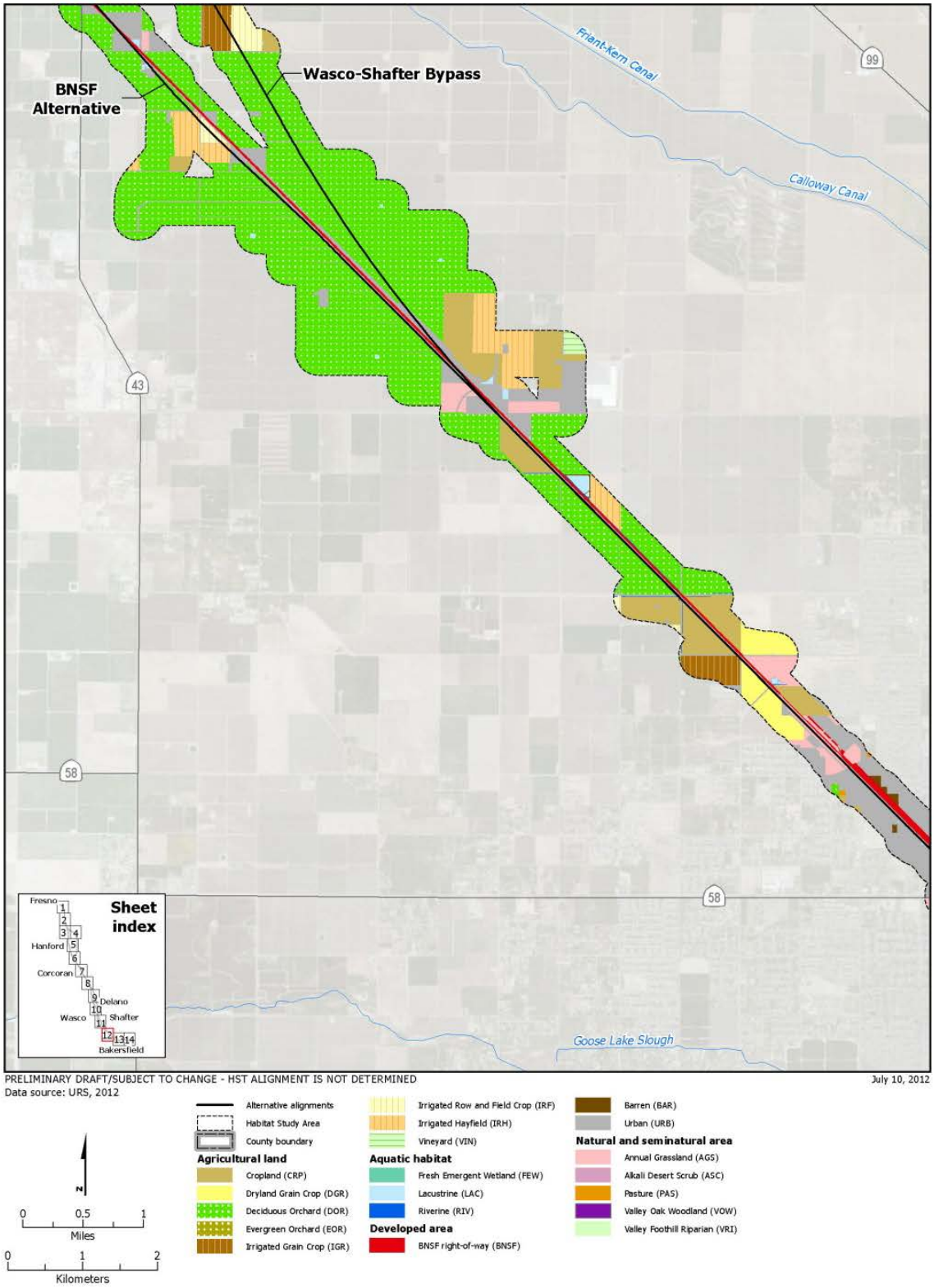


Figure 4-6
Wildlife habitat types (Sheet 11)



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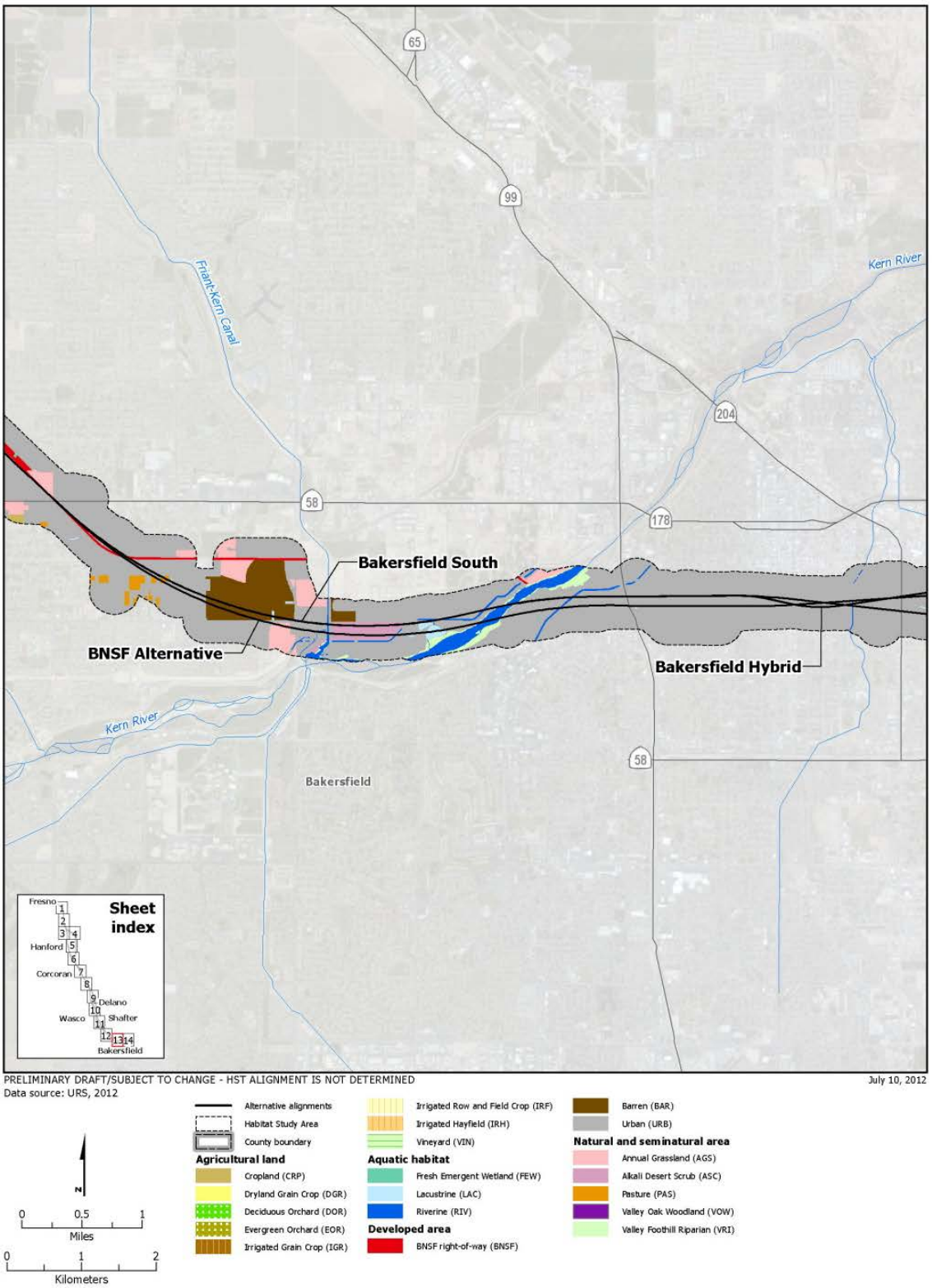
Wildlife habitat types (Sheet 12)



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Wildlife habitat types (Sheet 13)

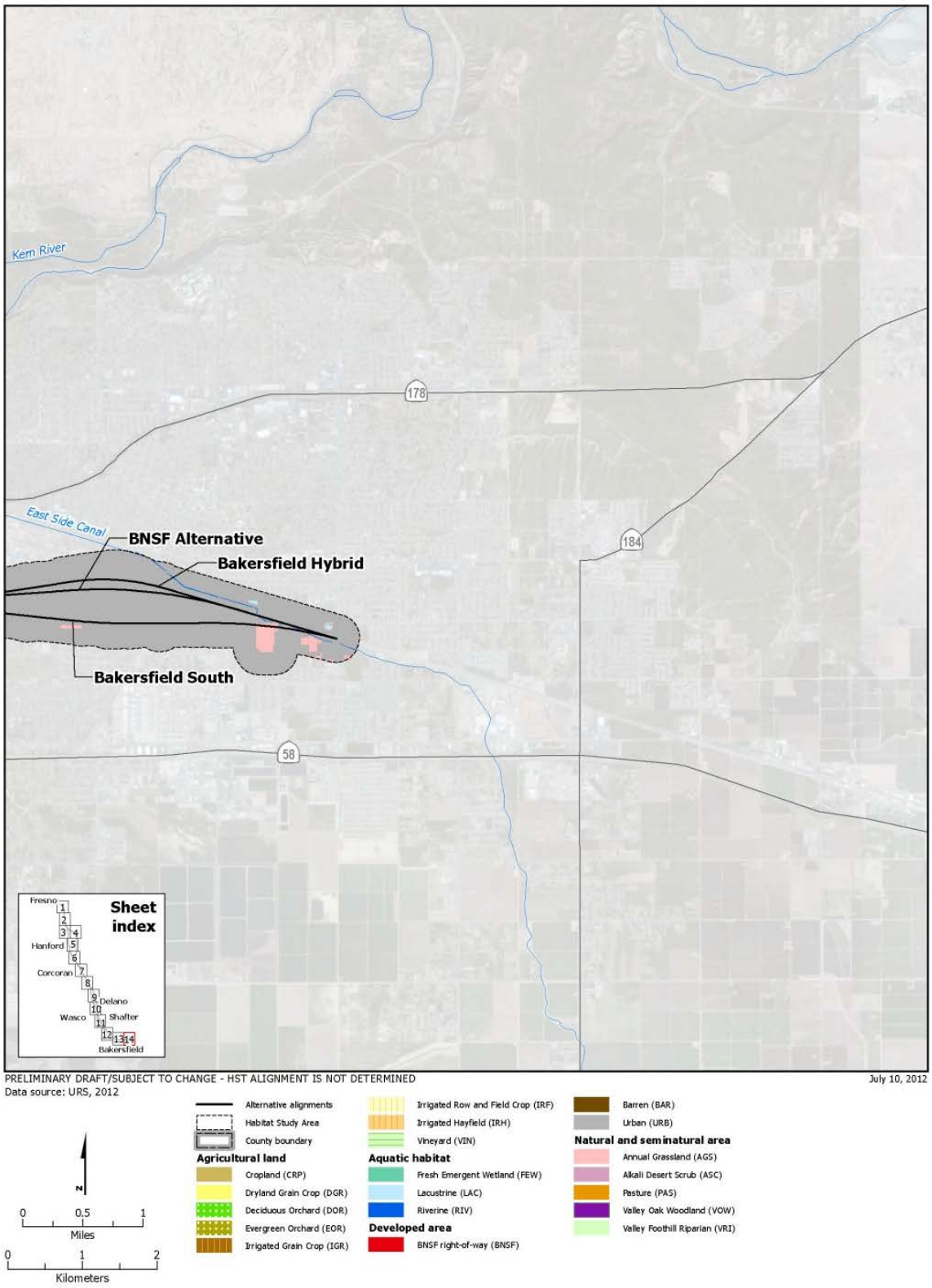


Figure 4-6
Wildlife habitat types (Sheet 14)

Ruderal and ornamental plant species, which are generally composed of non-native species, are dominant in all developed areas, particularly where land use was in transition and bare ground had recently been revealed, such as by roadsides, in median strips, and in vacant lots. Vegetation in these areas is highly variable, but generally includes non-native grass species, including ripgut bromes, wild oats, Italian ryegrass, and smooth barley, and weedy forbs, including bur clover, redstem filaree, yellow star thistle, Italian thistle (*Carduus pycnocephalus*), black mustard, rape mustard, white goosefoot (*Chenopodium album*), stinking goosefoot (*Chenopodium vulvaria*), and silver-leaf horsenettle. Escaped ornamentals in these areas often include oleander (*Nerium oleander*), elms (*Ulmus* spp.), bachelor's buttons (*Centaurea cyanea*), spotted knapweed (*Centaurea maculosa*), butterfly bush (*Buddleja davidii*), Athel tree (*Tamarix aphylla*), tree tobacco (*Nicotiana glauca*), and Himalayan blackberry (*Rubus armeniacus*).

Barren

Barren areas are defined by the permanent absence of vegetation. Areas mapped as barren during the field survey include areas of bare earth resulting from industrial activities such as gravel extraction. Barren habitats support few native wildlife or plant species, though rock dove (*Columba livia*), Brewer's blackbird (*Euphagus cyanocephalus*), killdeer (*Charadrius vociferus*), and western fence lizard (*Sceloporus occidentalis*) were observed in barren areas during the field surveys.

Urban

Urban areas include municipalities; industrial, residential, and agricultural structures (e.g., feedlots, poultry farms); and adjacent dedicated areas, such as yards, roads and road shoulders, highways, parking lots, and stockpiles. Both adaptive native species and non-native wildlife species occur in urban centers of the study area. Within urban areas, mapped wetland features such as ditches and seasonal wetlands are present. In Bakersfield, special-status species like the San Joaquin kit fox (*Vulpes macrotis mutica*) have also become acclimated to developed urban areas (CDFG 2012).

BNSF Urban

The BNSF Railway right-of-way travels the length of the Central Valley in a north-south direction, extending south from Fresno through Hanford and paralleling SR 43 from north of Corcoran to the town of Greenacres, just west of Bakersfield. In general, the BNSF Railway right-of-way is 50 feet wide and the rail tracks are set on an embankment that is a minimum of 5 feet above the surrounding grade. The embankment is constructed of compacted soil and imported gravel fills. Numerous culverts bisect the base of the berms for drainage purposes. Crossings of larger drainages exist as freestanding bridges. Most road crossings of the BNSF Railway right-of-way consist of at-grade crossings that allow vehicles to drive over the berms and tracks.

For the purposes of this analysis, all developed lands (e.g., crop, urban) in the BNSF Railway right-of-way were mapped under the BNSF urban classification. All areas of developed habitats (e.g., urban) in the right-of-way are controlled by the BNSF Railway, which retains the right to modify land use (e.g., remove orchard trees or structures). All riverine, canal, and natural upland habitats (i.e., annual grassland, alkali desert scrub, and valley foothill riparian) in the BNSF Railway right-of-way were mapped as such, not as BNSF Railway right-of-way.

At any given point along the BNSF Railway right-of-way, wildlife use is largely determined by adjacent habitats. However, in areas dominated by frequent soil disturbance, especially cropland habitats, the railroad berms may provide habitat for burrowing animals. The BNSF Railway right-of-way contains mapped wetland features such as seasonal wetlands and vernal pools.

4.2.1.3 Semi-Natural Areas

The term *semi-natural* is used to distinguish the land uses described in the previous sections from plant communities where current human influences only moderately influence the plant composition and structure. Although the semi-natural plant communities have been altered to some extent by past and present human activities, the composition and structure of these communities are generally not actively managed or controlled.

Pasture

Pastures are actively grazed fields associated with private property. Generally, these areas contain a mix of annual grasses, such as bromes, barley, oats, and annual fescues, with other herbaceous species. Typically, these areas are actively grazed by cattle or horses but not irrigated. These areas provide some potential to support special-status wildlife species and limited potential to support special-status plant species because of the high level of disturbance.

4.2.1.4 Natural Areas

The term *natural* is used to distinguish the land uses and semi-natural plant communities from plant communities where current human influences do not significantly influence the plant composition and structure. These natural areas could potentially support the life history requirements of special-status species that may be present in the study area. Natural areas are largely fragmented in the study area and may have experienced some alteration by past human activities; these characteristics reduce the potential of these areas to support special-status species. However, the composition and structure of these communities are generally not actively managed or controlled. This subsection provides descriptions for these special natural areas.

Alkali Desert Scrub

Alkali desert scrub vegetation in the study area is dominated by shrublands with understory cover of herbs and forbs and by vernally inundated or saturated areas lacking a shrub layer (vernal pools). These latter areas are characterized by herbs and forbs interspersed with barren, vernally inundated, or saturated alkali patches. Primary plant species observed during the various surveys included spinescale saltbush (*Atriplex spinifera*), cattle saltbush (*Atriplex polycarpa*), iodine bush (*Allenrolfea occidentalis*), goldenbush (*Isocoma acradenia*), and bush seepweed (*Suaeda moquinii*).

Alkali desert scrub supports a wide variety of wildlife species, including special-status species such as the blunt-nosed leopard lizard (*Gambelia sila*), the San Joaquin kit fox, the Tipton kangaroo rat (*Dipodomys nitratoides nitratoides*), and coast horned lizards *(Phrynosoma blainvillii*). Many wildlife species found in this habitat type are burrowers or burrow-dependent species, such as the western burrowing owl, western spadefoot toad (*Spea hammondii*), American badger, foxes (*Vulpes* sp.), coyote (*Canis latrans*), California ground squirrel (*Spermophilus beecheyi*), and a variety of kangaroo rats (*Dipodomys* spp.) species.

In the study area, this habitat is concentrated in the vicinity of Allensworth in relatively undisturbed areas. This community is fragmented throughout the region by agricultural land uses, linear infrastructure, and urban areas. Many natural areas have been converted to intensive agriculture land uses over the past 10 years.

Annual Grassland

Annual grasslands in the study area are typically characterized by non-native annual grass species. Dominant non-native grass species include several species of bromes, fescue (*Festuca* spp. and *Vulpia* spp.), oats (*Avena* spp.), and barley (*Hordeum* spp.). Native species, including

goldfields and owl's clover (*Castilleja* spp.), may be present in annual grasslands, but typically in lower densities. Annual grasslands in the study area have typically experienced some level of past disturbance associated with various agriculture practices, row cropping, or grazing. Although these areas typically have a history of disturbance, they continue to provide suitable habitat for a number of special-status plant and wildlife species.

Valley Oak Woodland

Valley oak woodland in the study area is along the floodplain of the Kings River and associated sloughs and side channels in the area of the Hanford West Bypass alternatives. This habitat is characterized by well-spaced stands of mature valley oak (*Quercus lobata*) with little or no sub-canopy and a well-developed herbaceous layer. Dominant herbaceous species include brome, annual fescues (*Vulpia* spp.), oats (*Avena* spp.), and barleys. Other herbaceous plants, including soap root (*Chlorogalum pomeridianum*), filaree, miner's lettuce, prickly ox-tongue (*Picris echioides*), and spiny sow thistle (*Sonchus asper*), may be present. In the study area, valley oak woodland abruptly transitions to developed areas such as cropland or orchard.

Valley oak woodland provides food, cover, nesting sites, and dispersal habitat for a wide variety of special-status wildlife species, including Swainson's hawk.

Valley Foothill Riparian

Valley foothill riparian biological communities in the study area are along the riparian corridors and associated floodplains or terraces of the Kings River, Cross Creek, Tule River, Deer Creek, Poso Creek, and Kern River and along their associated sloughs and side channels. These areas are characterized by tall trees, including Fremont cottonwood (*Populus fremontii*), western sycamore (*Platanus racemosa*), and valley oak. Subcanopy trees include white alder (*Alnus rhombifolia*) and ash (*Fraxinus* sp.). Understory shrubs and herbaceous species typically include California blackberry *(Rubus ursinus)*, elderberry (*Sambucus* sp.), poison oak (*Toxicodendron diversilobum*), buttonbush (*Cephalanthus occidentalis*), willows (*Salix* spp.), rushes (*Juncus* spp.), mugwort (*Artemisia douglasiana*), poison hemlock (*Conium maculatum*), and stinging nettle (*Urtica dioica* ssp. *holosericea*). In the study area, an abrupt transition from valley foothill riparian vegetation to cropland or orchard results in narrow bands of riparian vegetation.

Valley foothill riparian habitat provides food, water, migration and dispersal corridors, and escape, nesting, and thermal cover for an abundance of wildlife. Riparian vegetation also supports physical and biological processes, including temperature regulation and valuable aquatic food web services (inputs for nutrient cycling and food availability). Protected insects like the valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) are native to these habitats (Mayer and Laudenslayer 1988). Several sensitive natural communities overlap with this habitat type, including valley oak woodland, Fremont cottonwood forest, Goodding's willow thickets, and red willow thickets.

4.2.2 Aquatic and Riparian Resources

A number of jurisdictional waters were identified in the study area, including wetlands, other waters of the U.S., and riparian areas (Figure 4-7). Identified wetland features include seasonal wetlands, emergent wetlands, and vernal pools and swales. Other waters of the U.S. identified in the study area include canals/ditches, lacustrine, and seasonal riverine. Additionally, riparian areas, that are generally found in association with seasonal riverine features, were identified and are discussed with aquatic resources because of the important functions they provide that affect water quality, including groundwater recharge, surface water supply, nutrient cycling, water filtration, temperature control, maintenance of plant and animal communities, sediment transport and storage, stream channel dynamic equilibrium, and streambank stabilization.

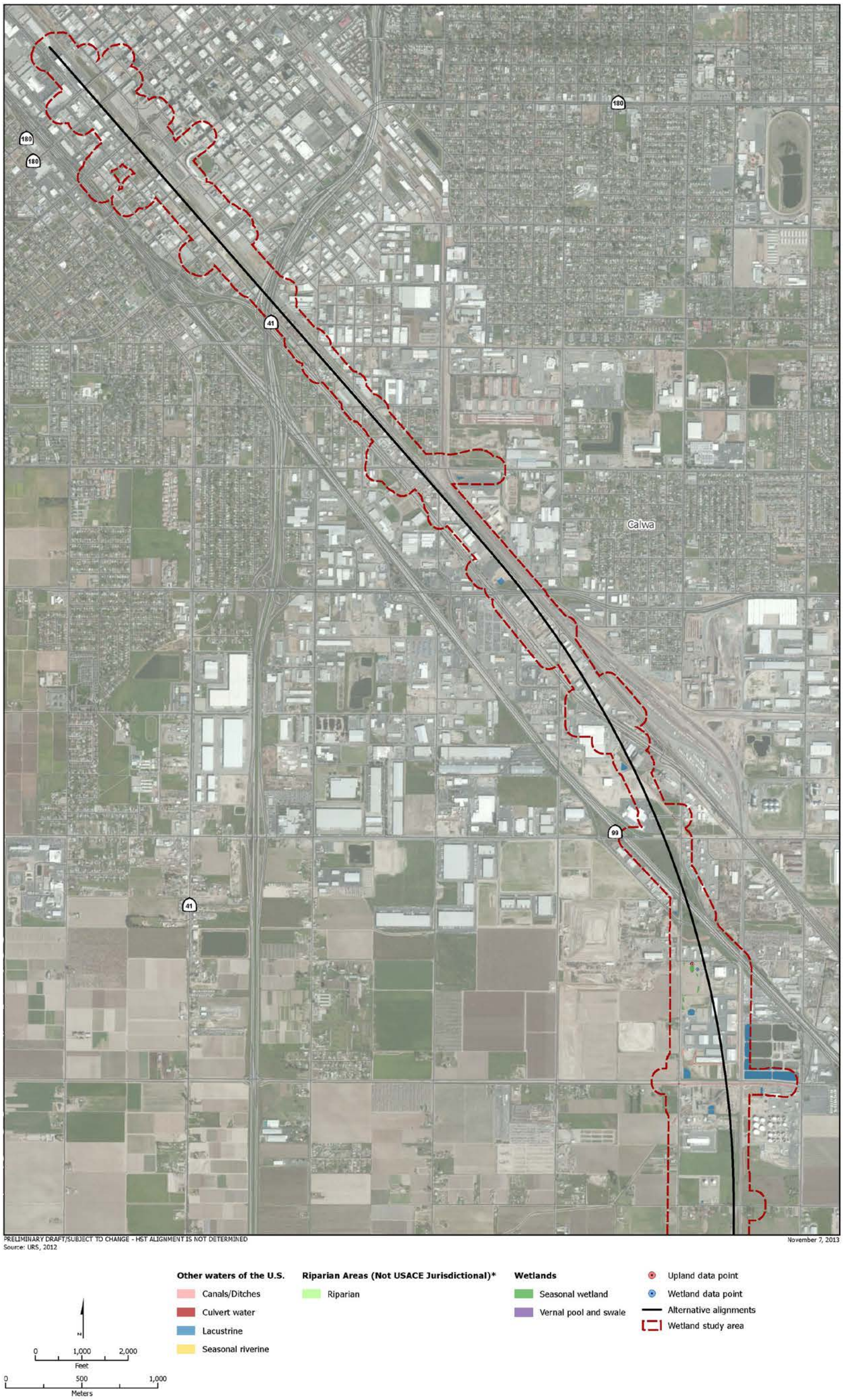


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 1 of 33)

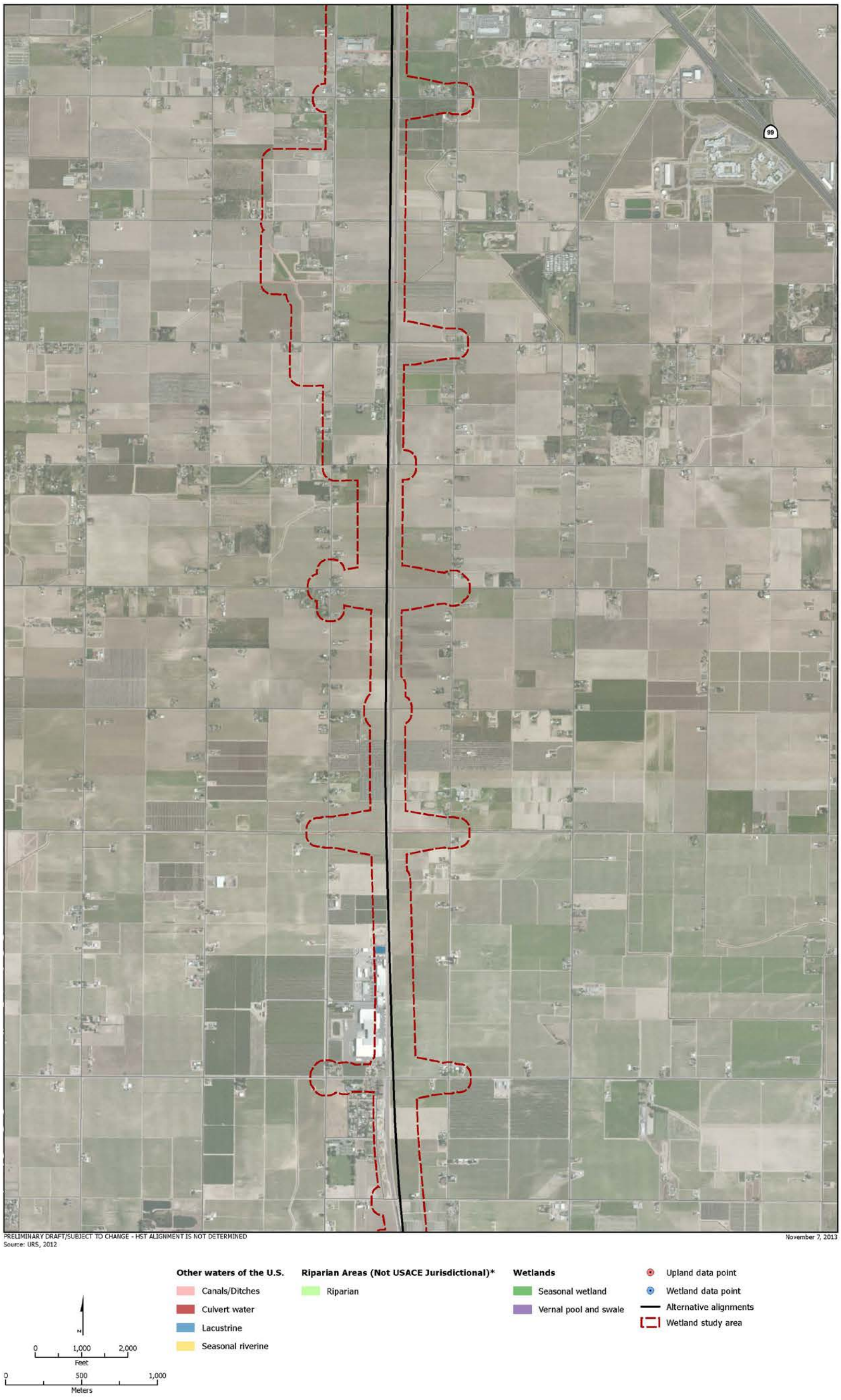


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 2)

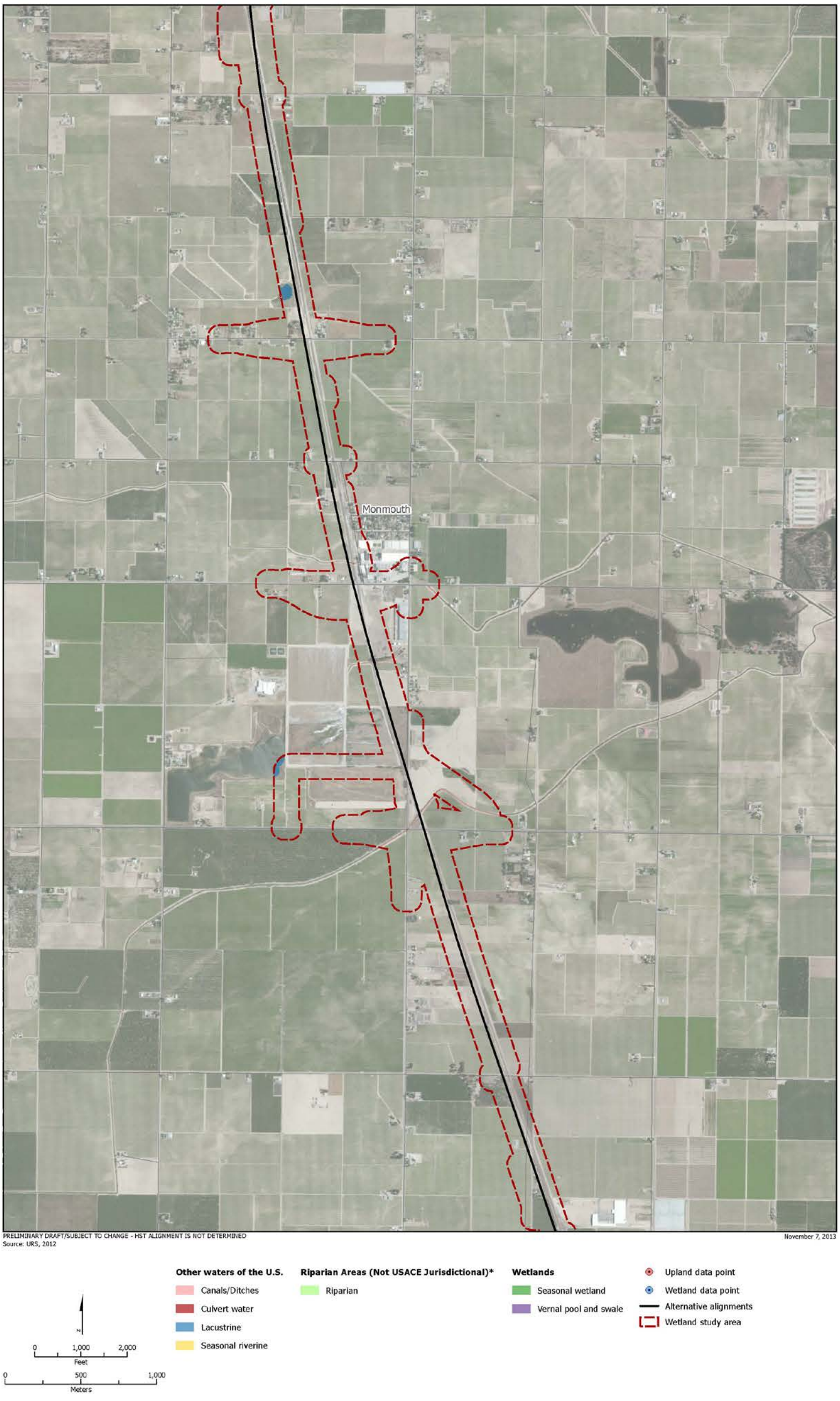


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 3)

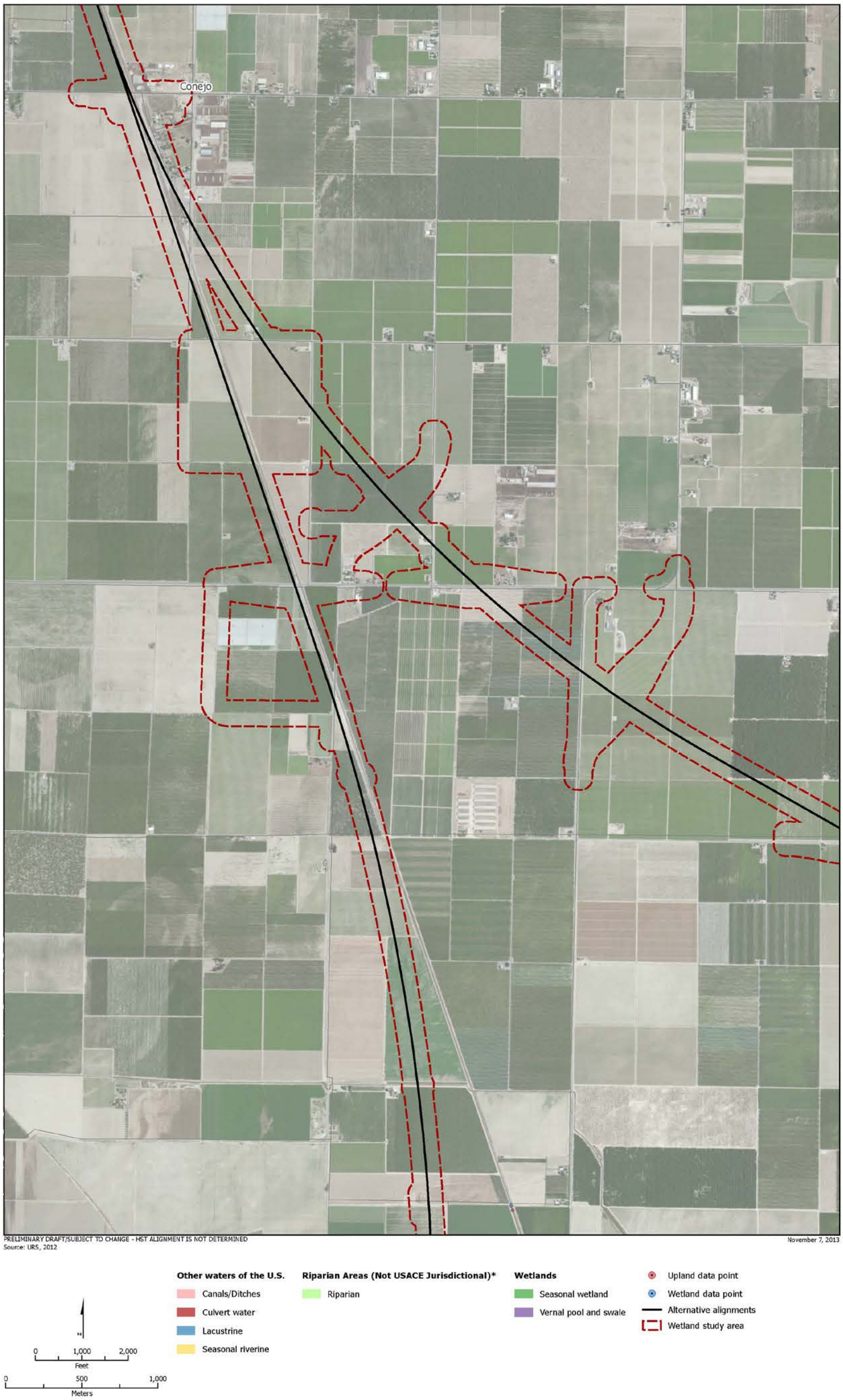


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 4)

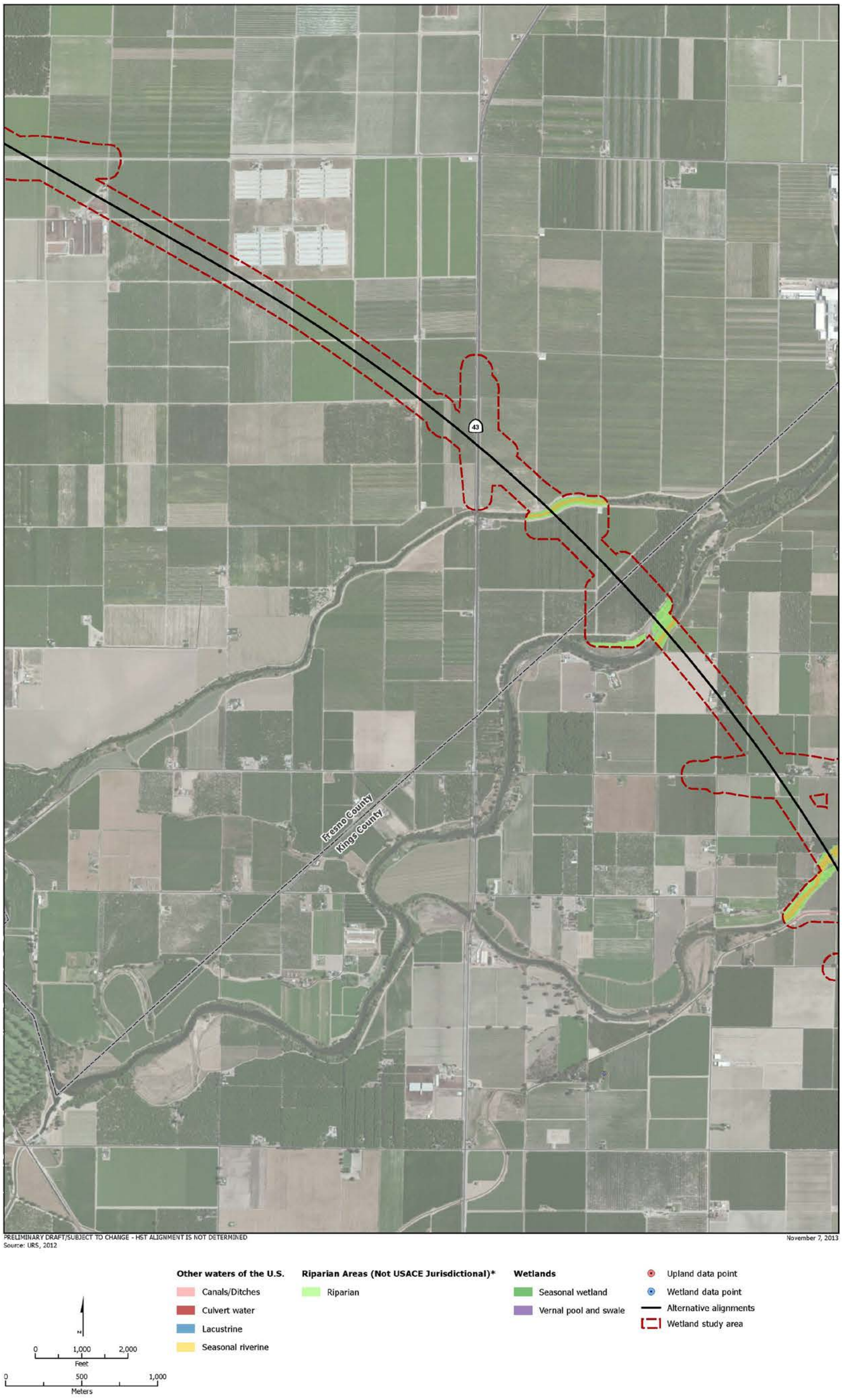


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 5)

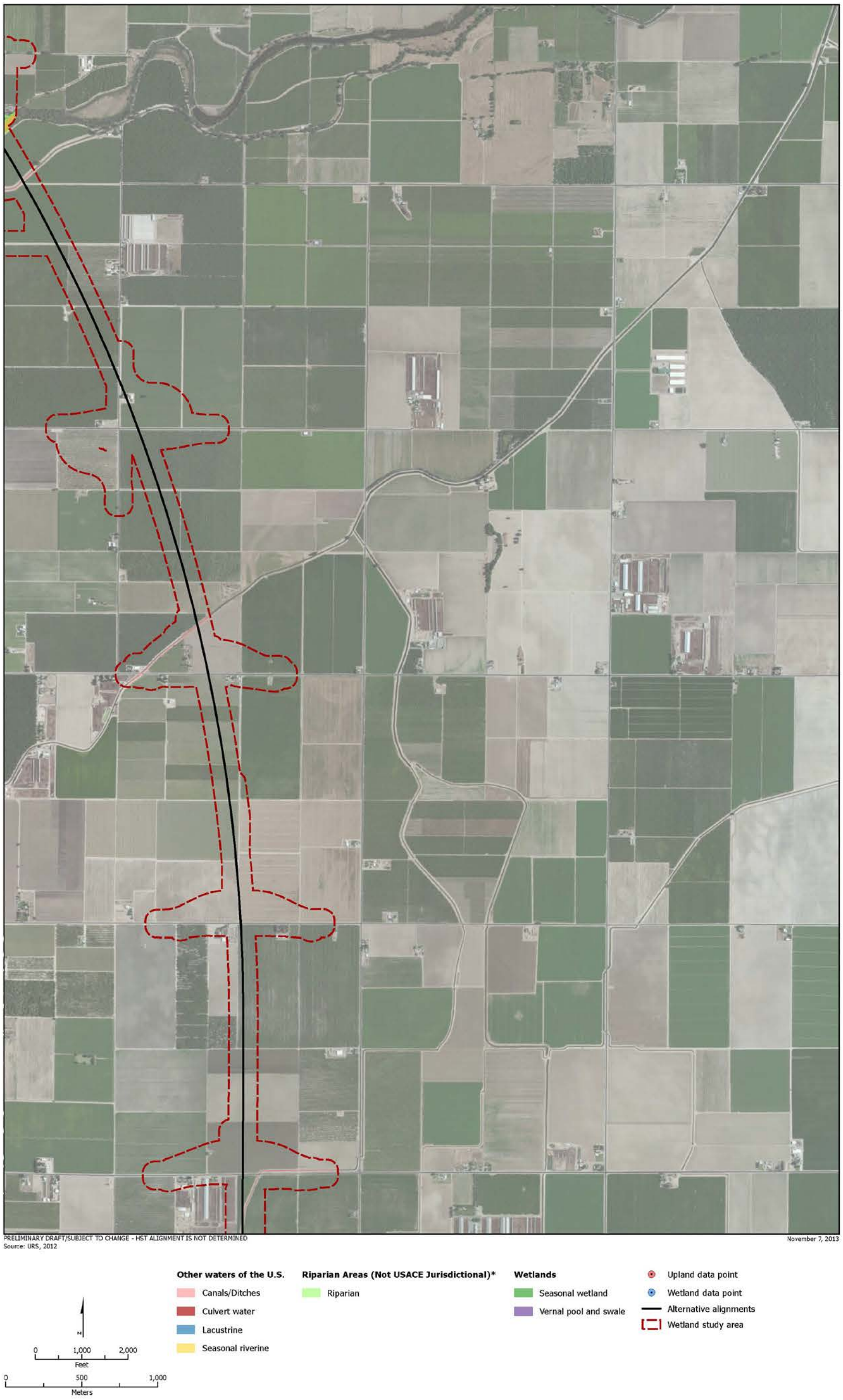


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 6)

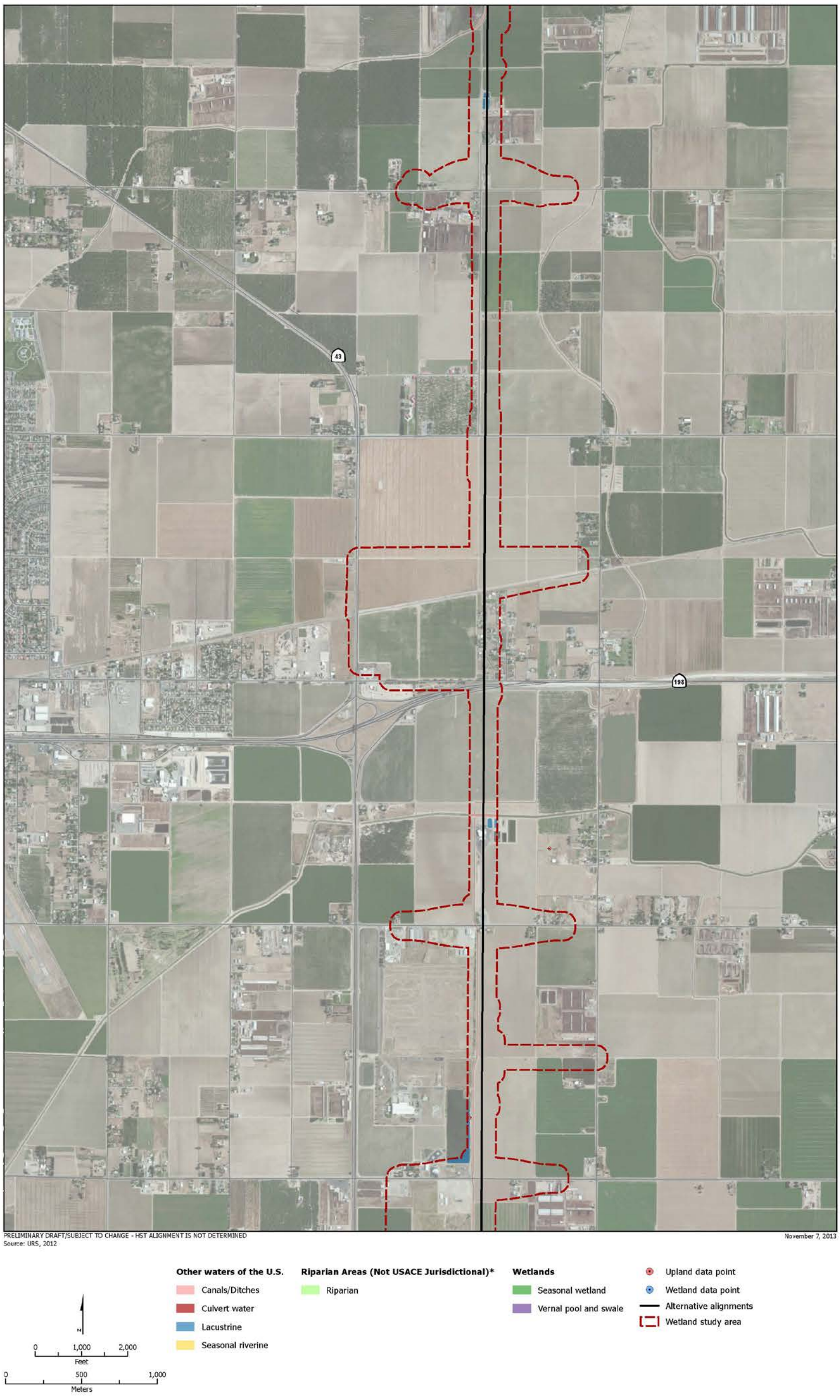


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 7)

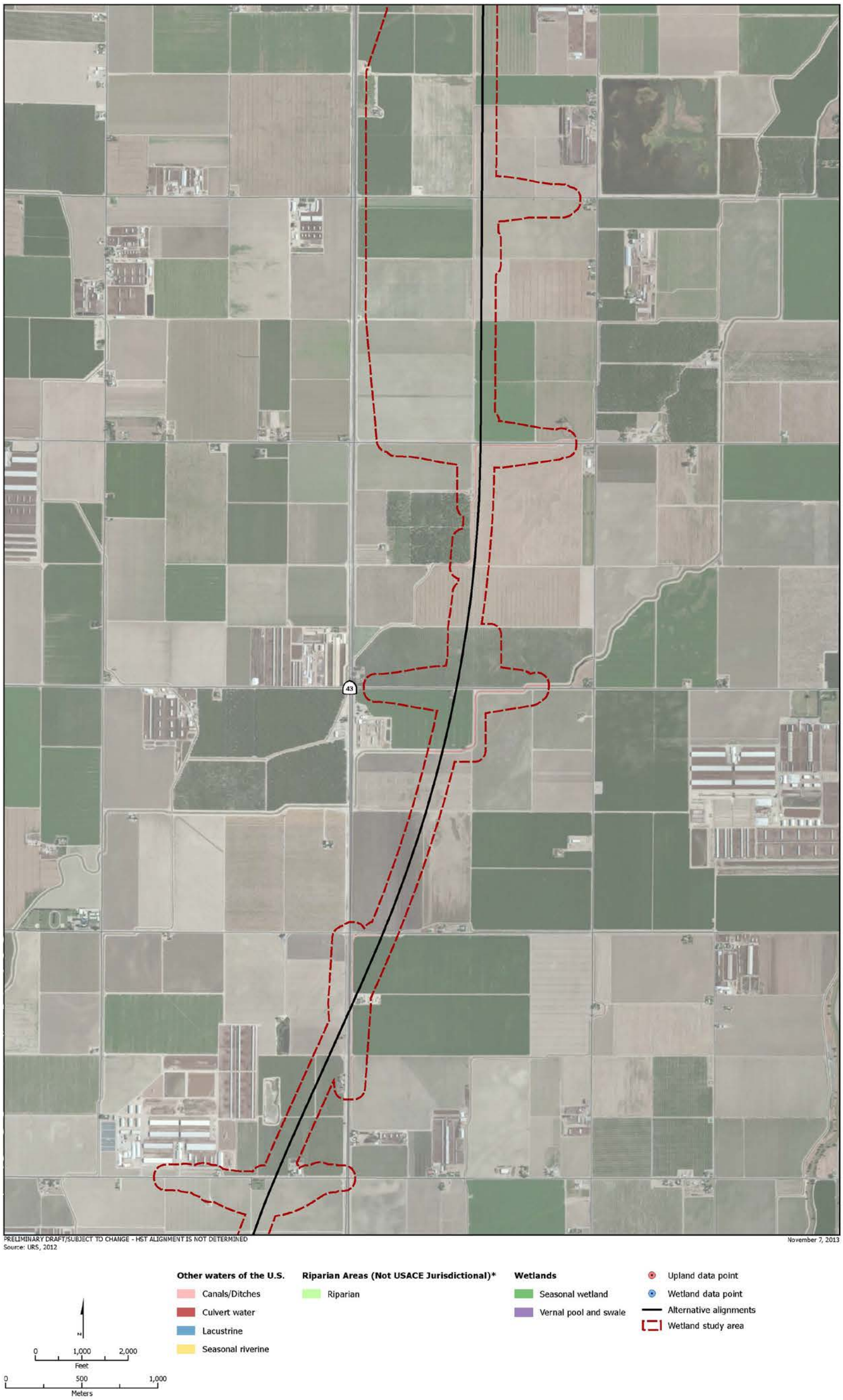
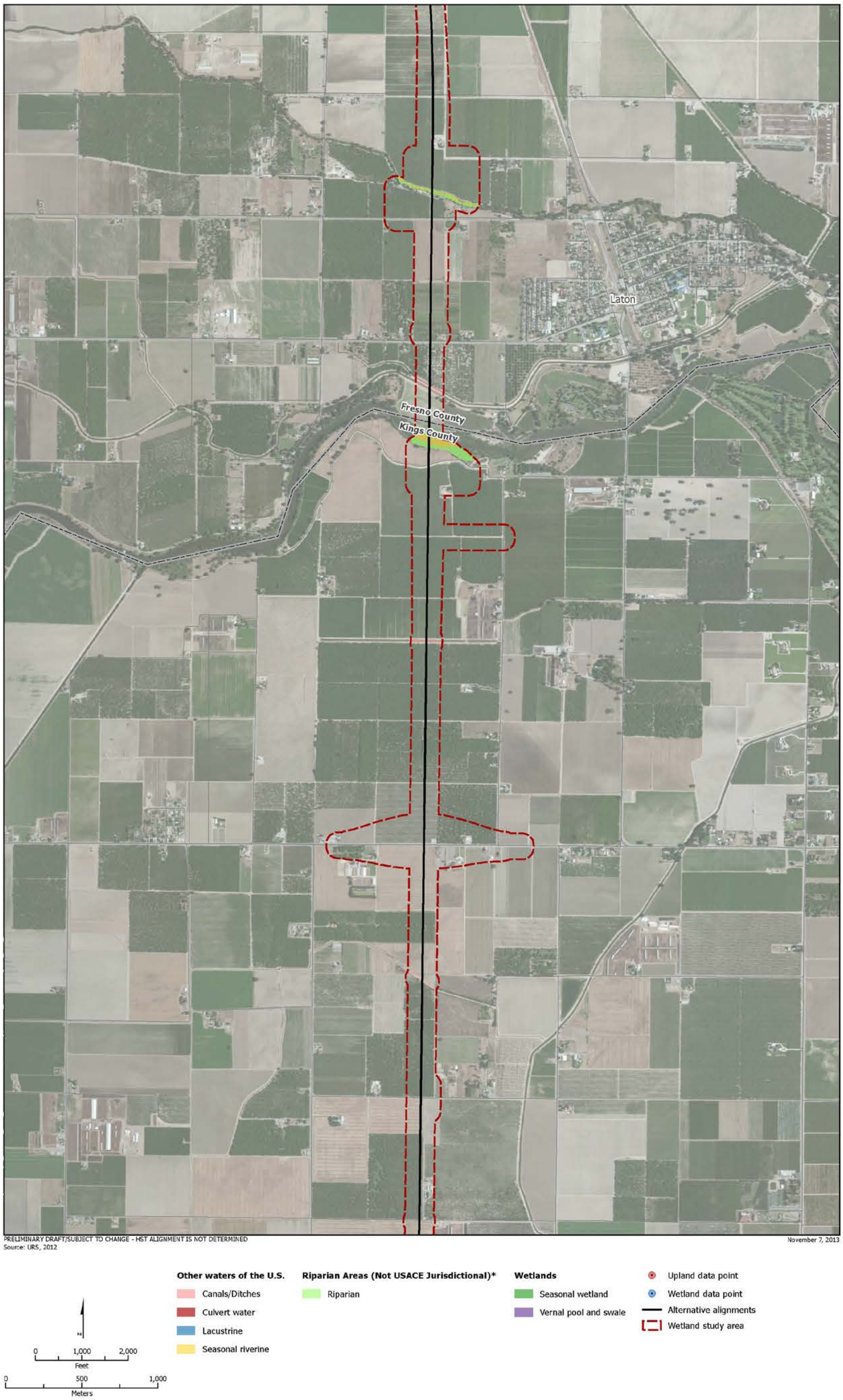


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 8)



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Jurisdictional waters delineation and riparian areas (Sheet 9)

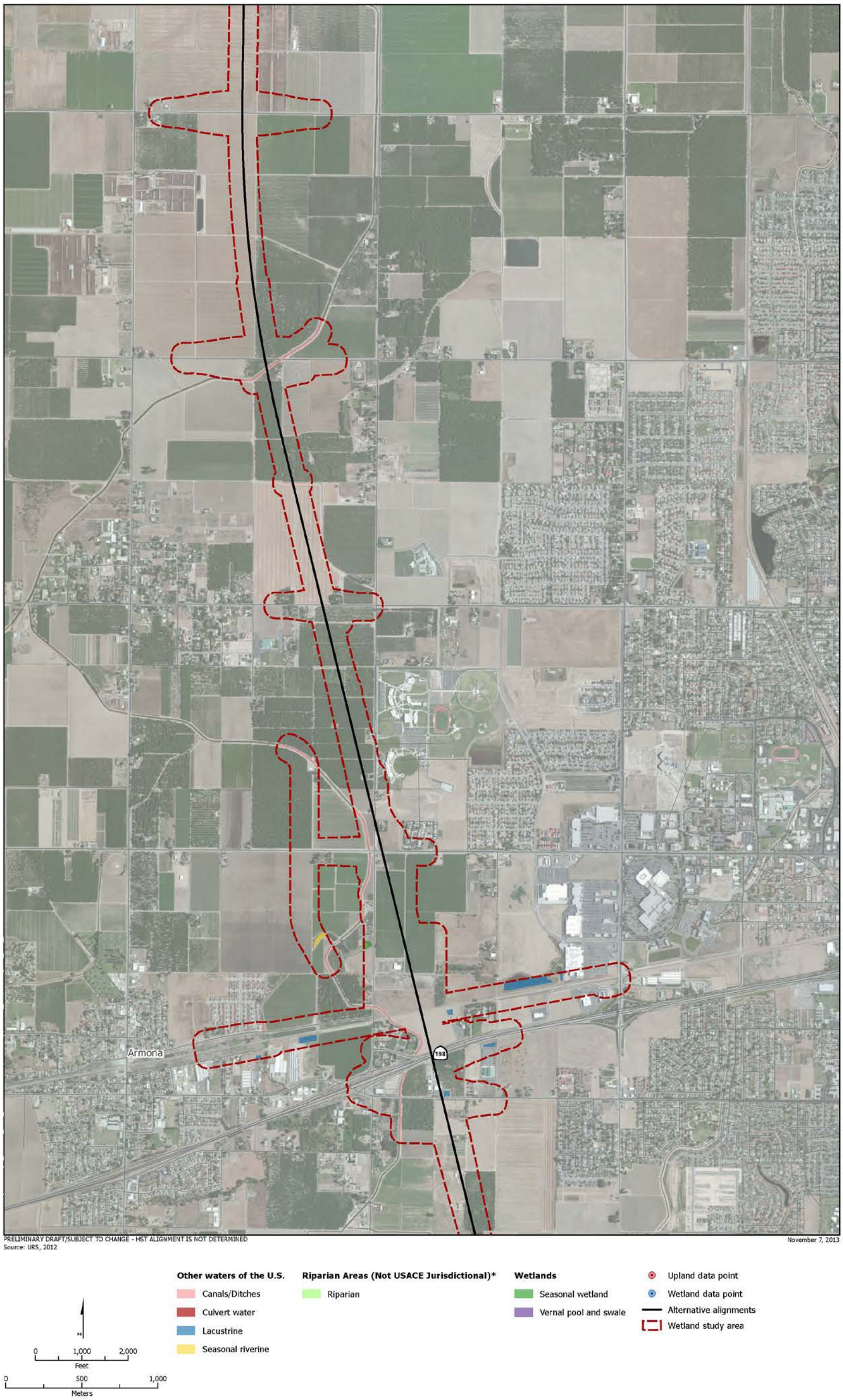


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 10)

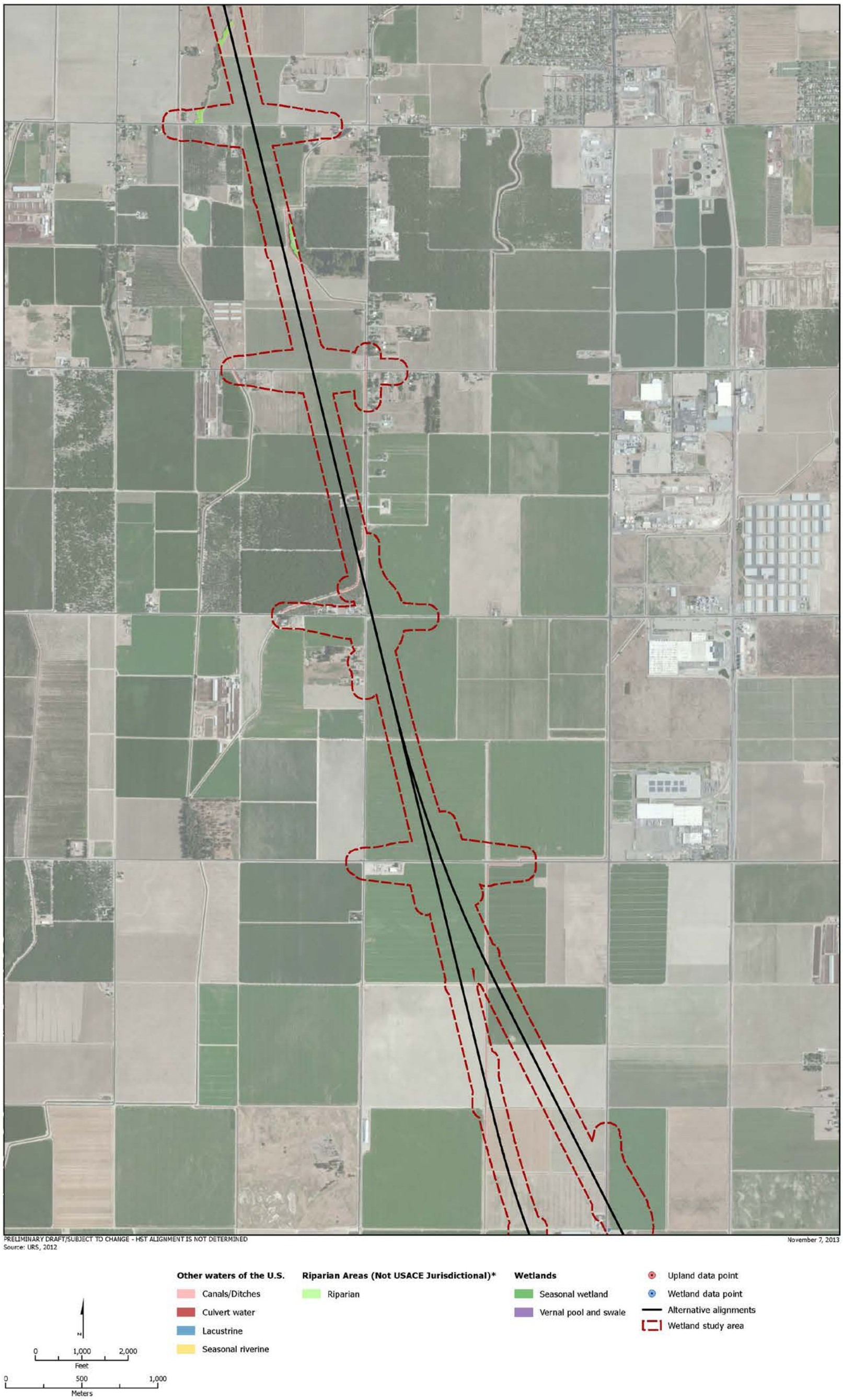


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 11)

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 12)

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 13)

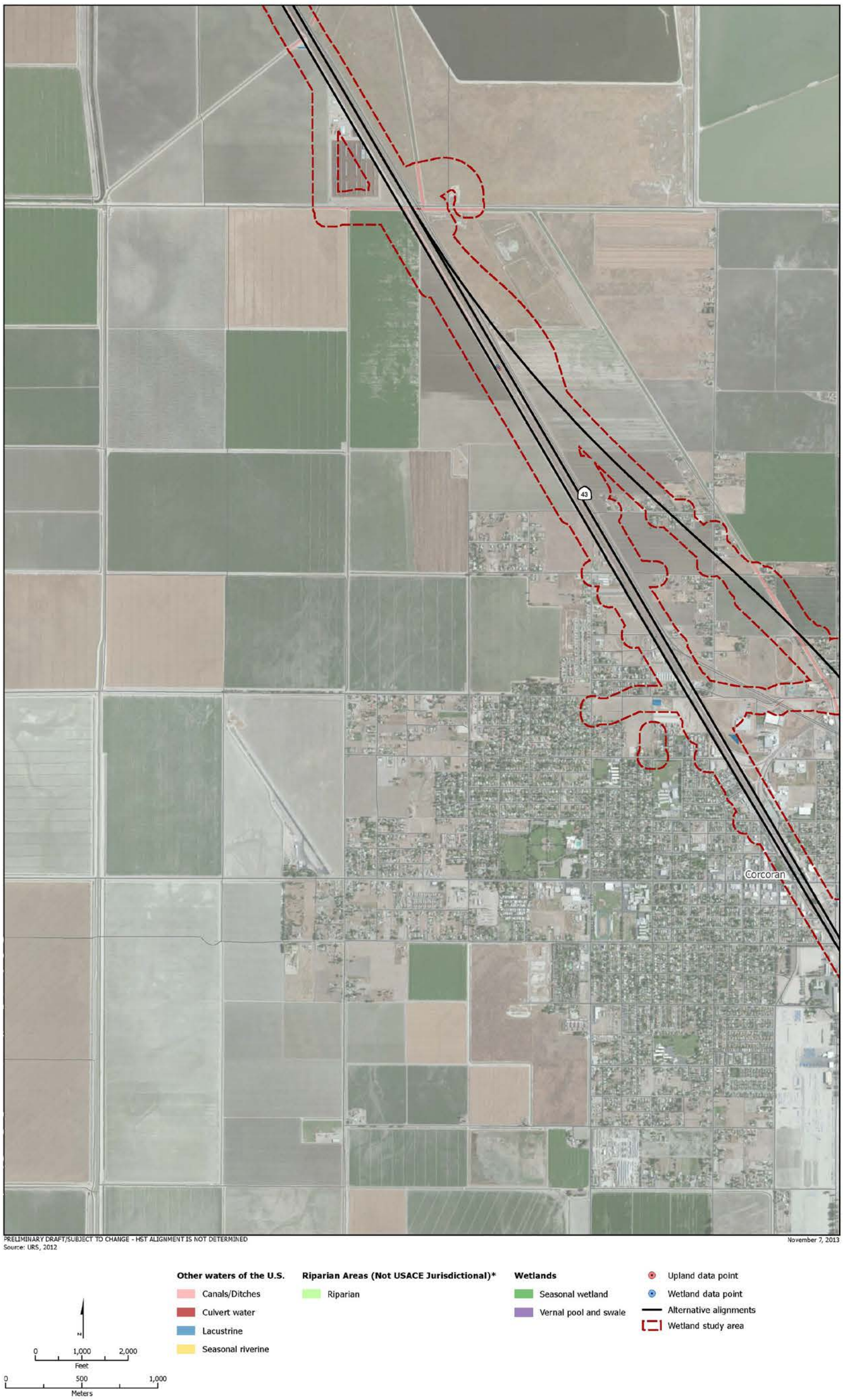


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 14)

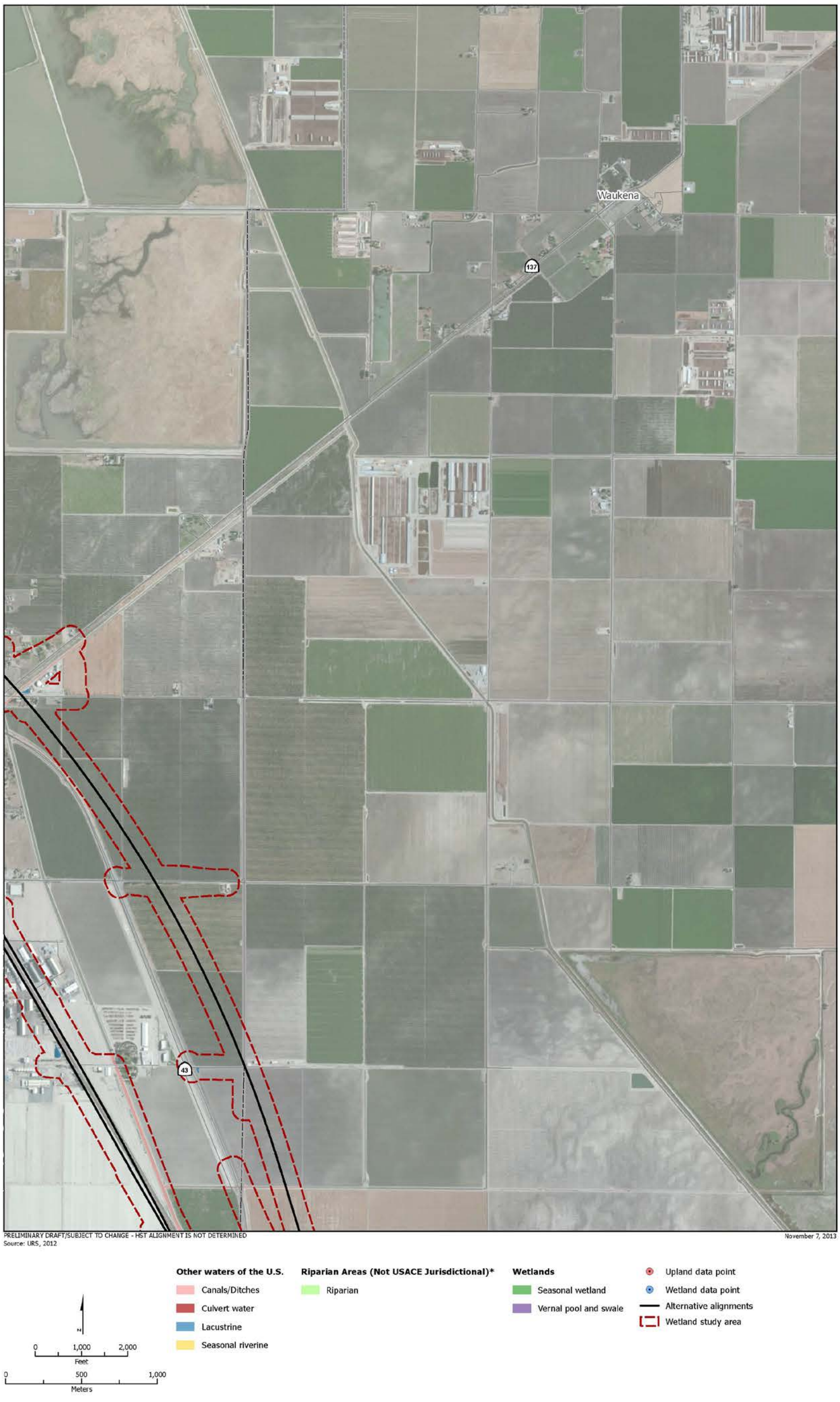


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 15)

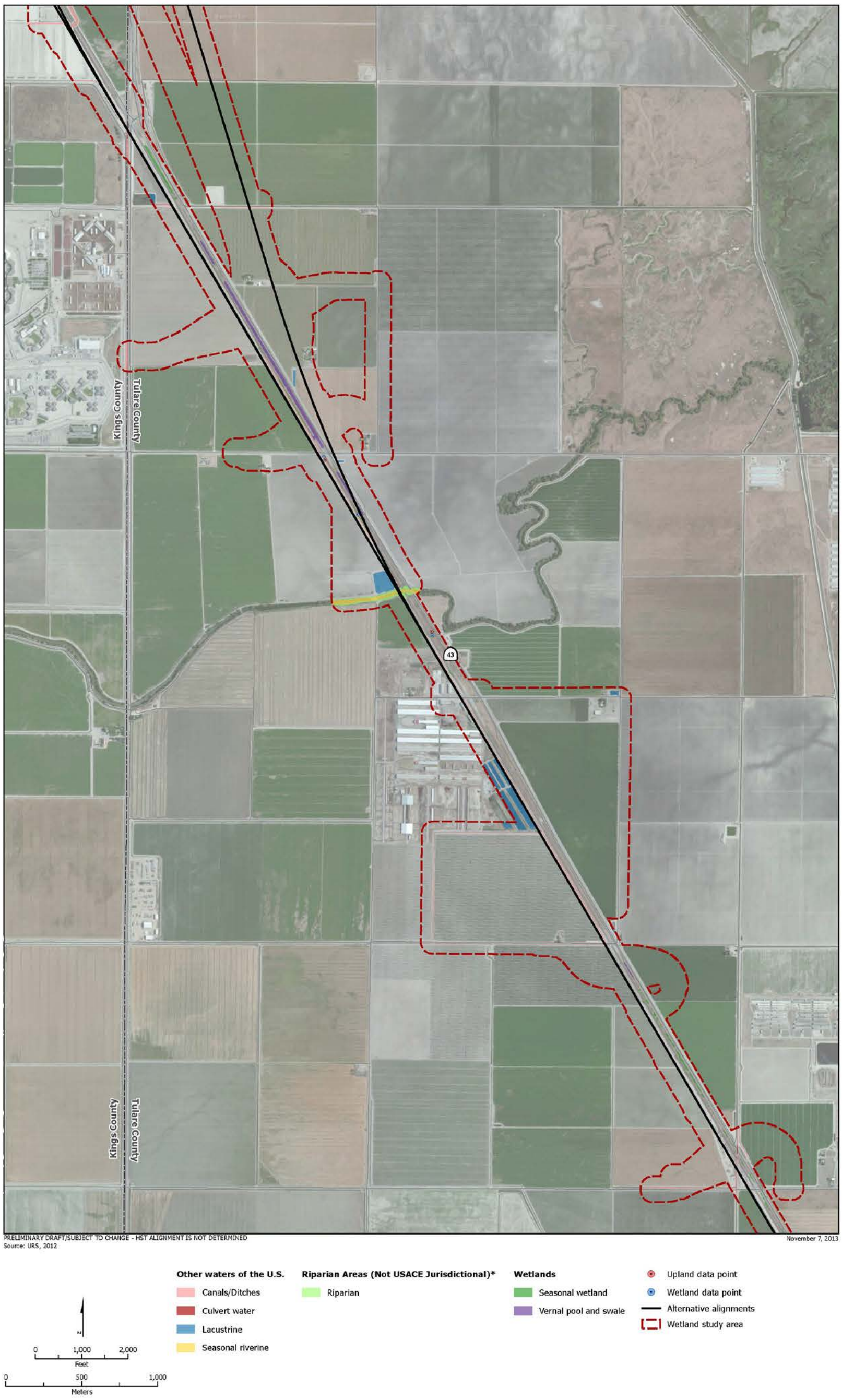
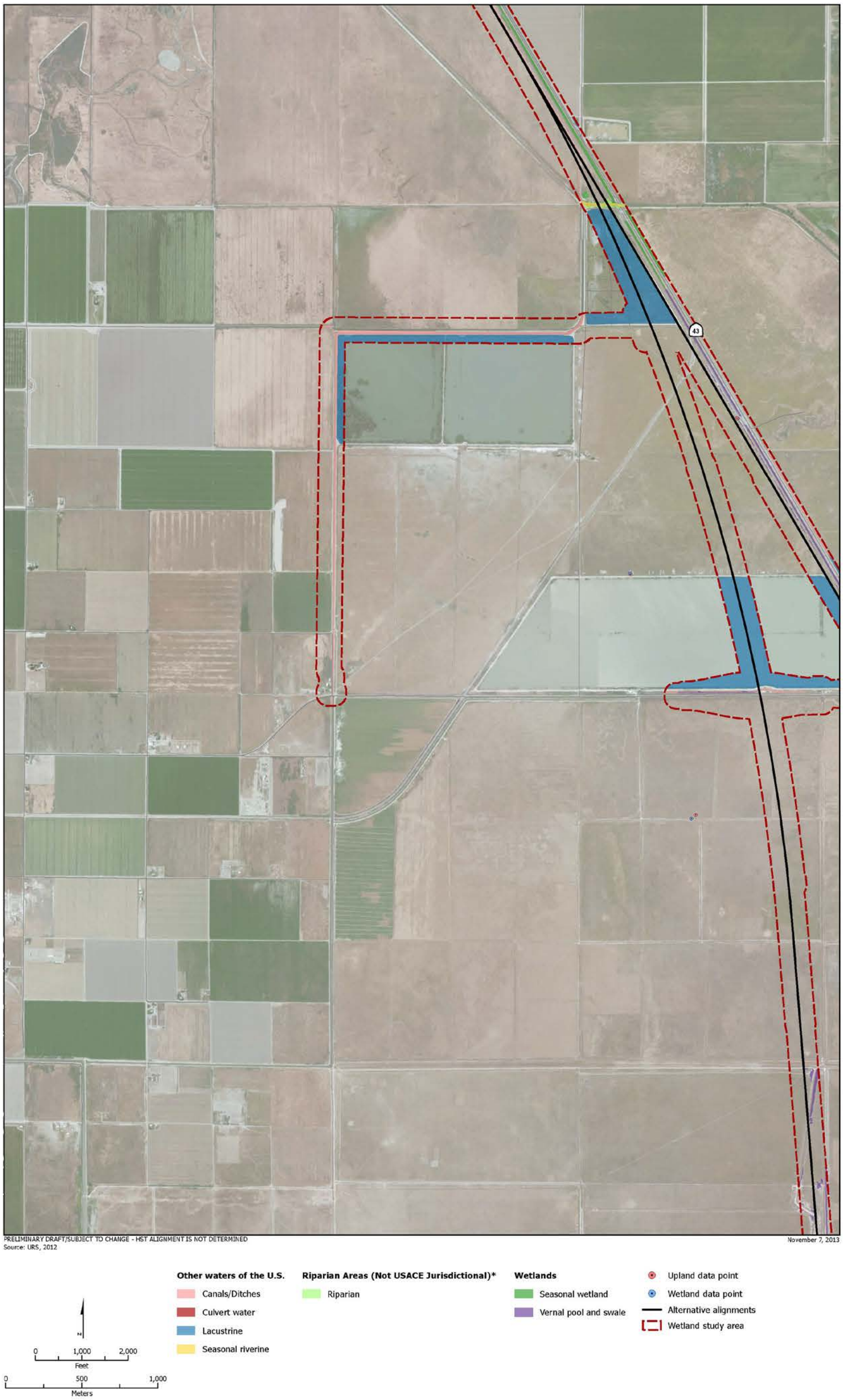


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 16)

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 17)



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Jurisdictional waters delineation and riparian areas (Sheet 18)

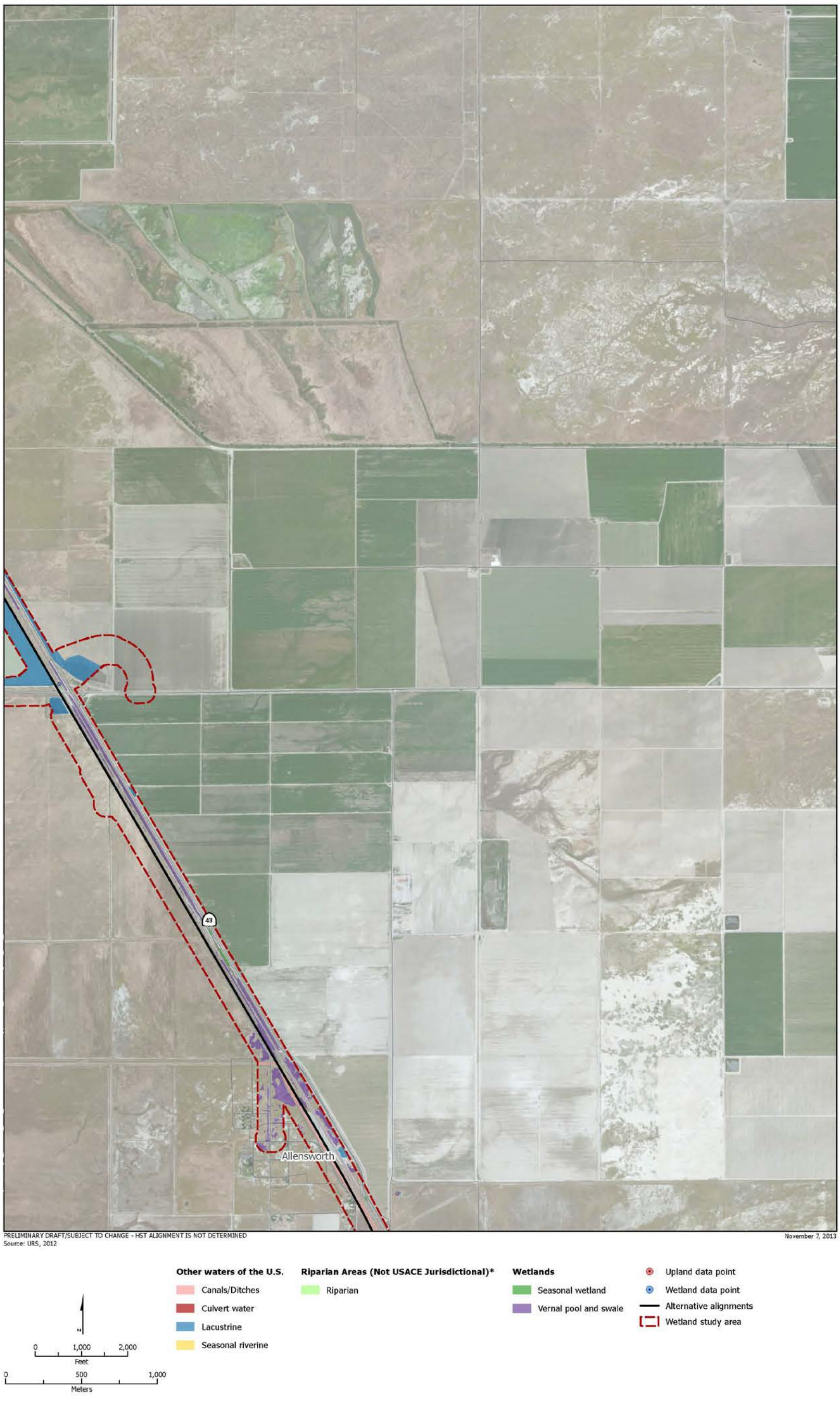


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 19)

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 20)

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 21)

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 22)

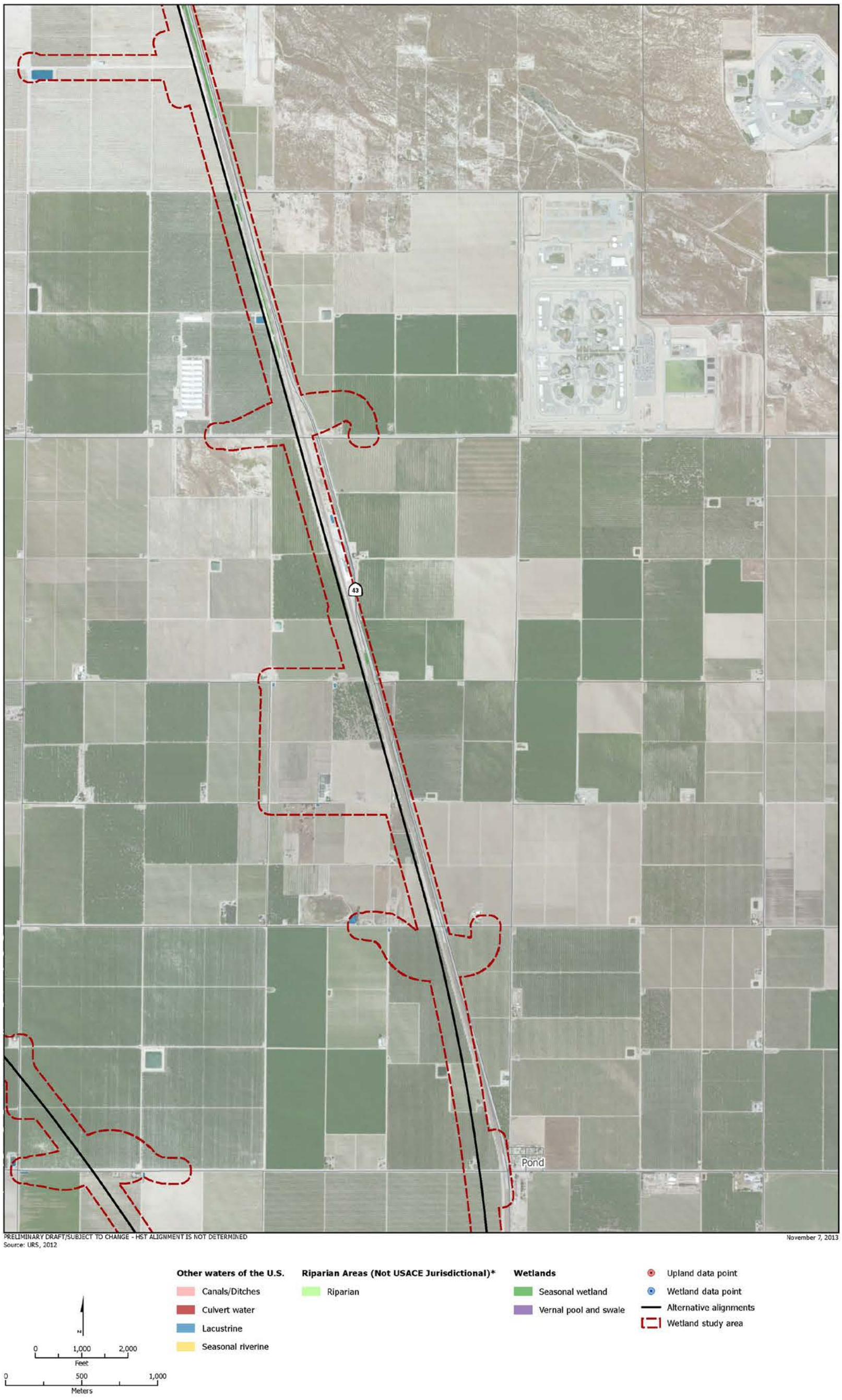


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 23)

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 24)

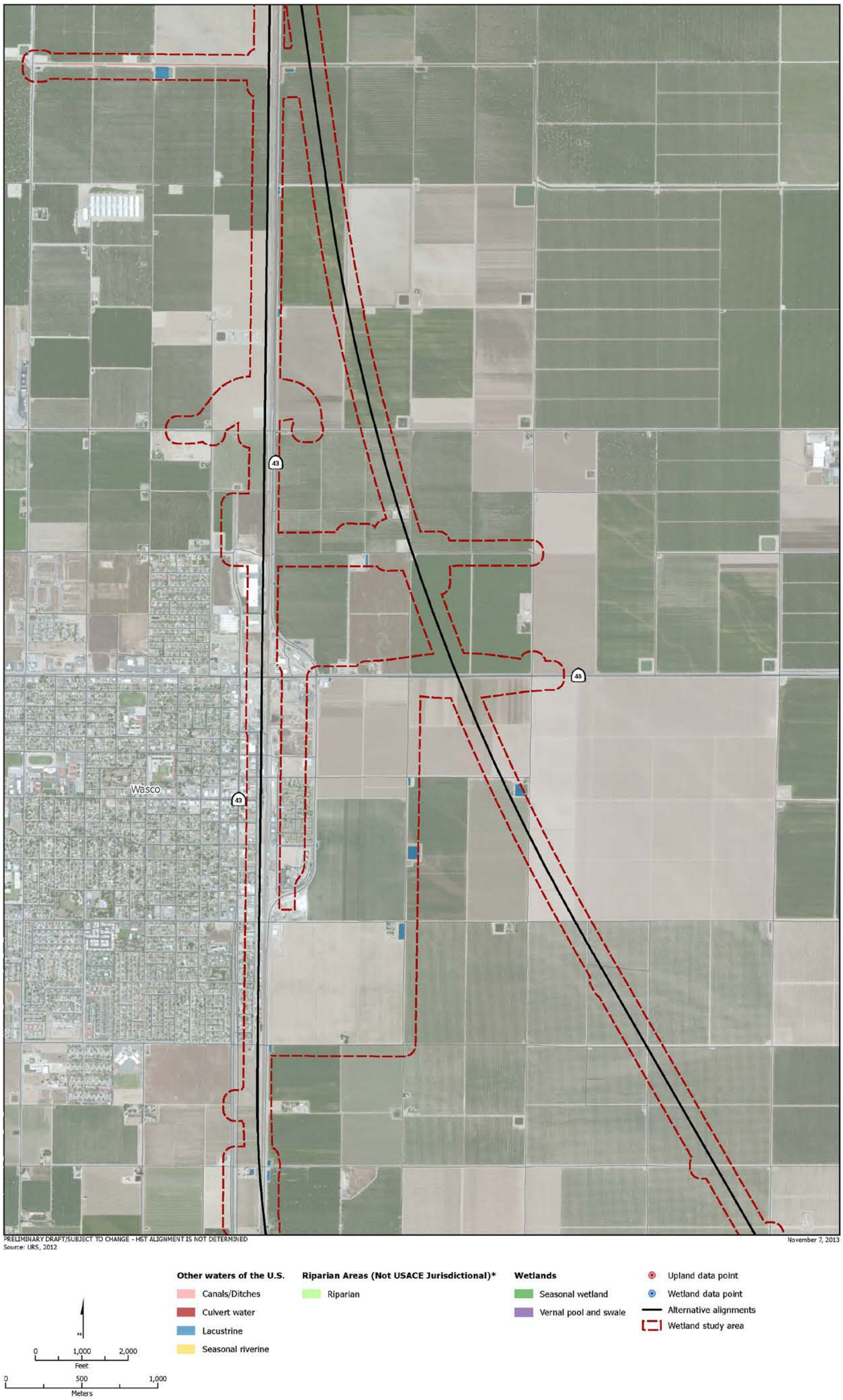
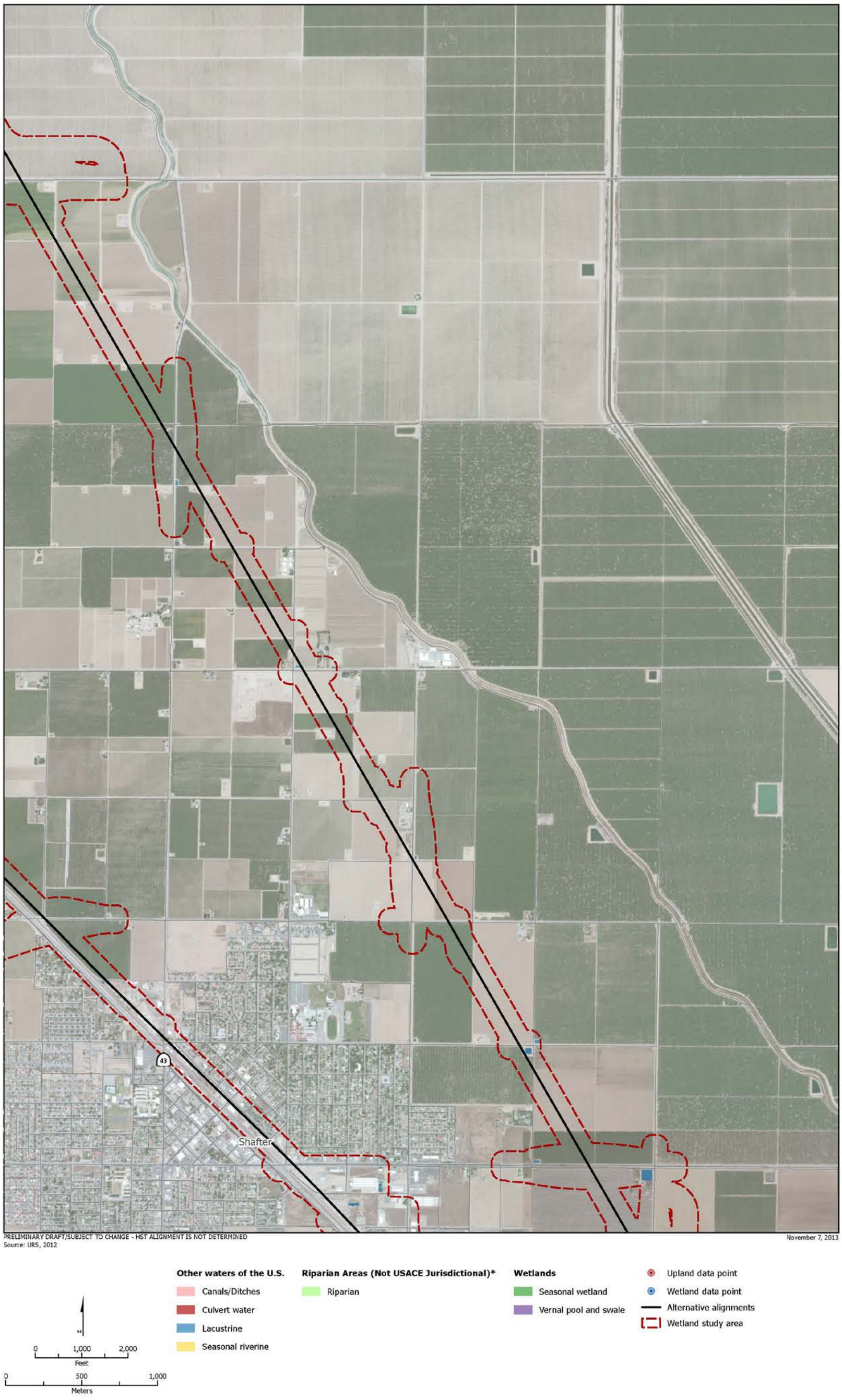


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 25)

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 26)



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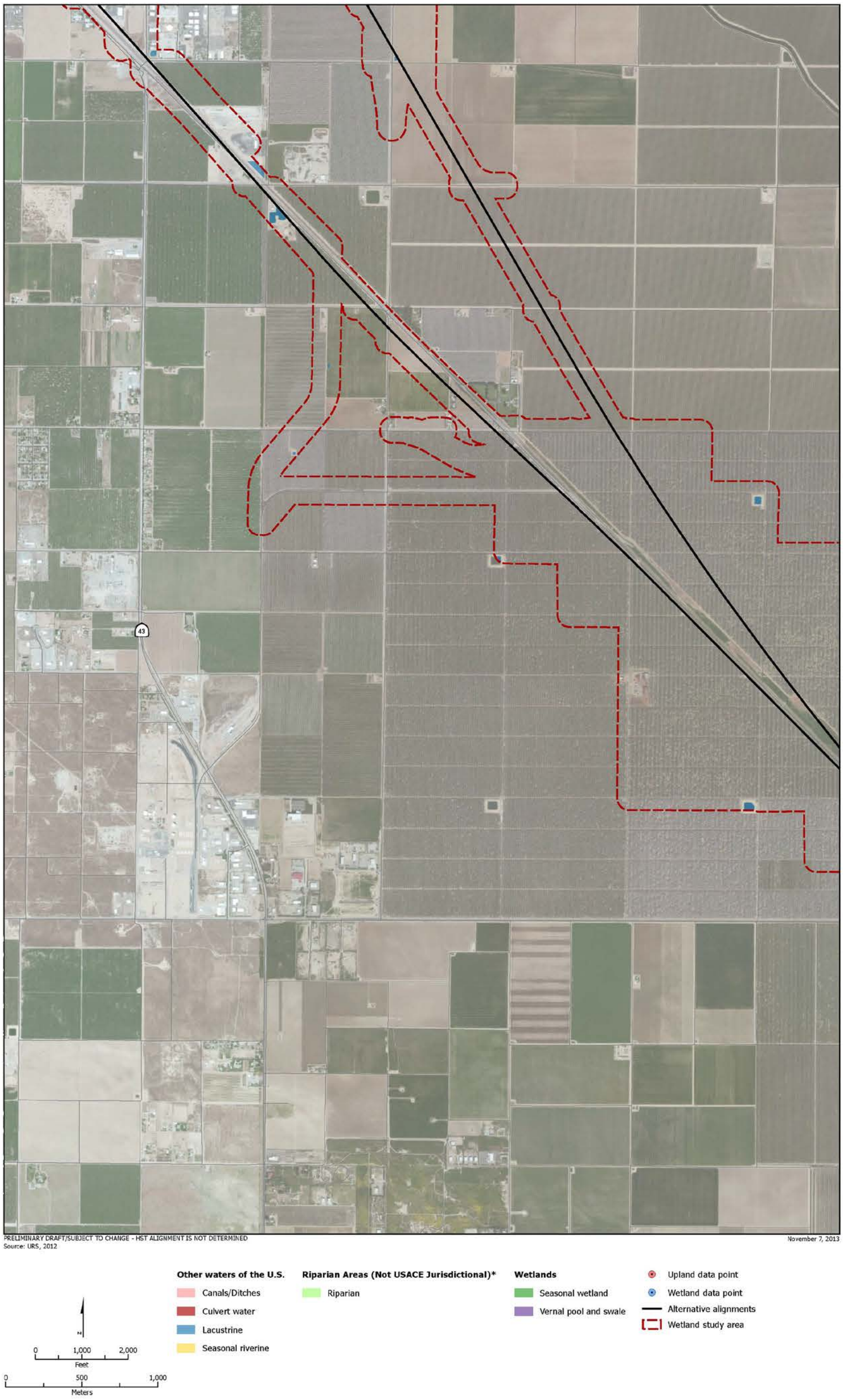
Jurisdictional waters delineation and riparian areas (Sheet 27)



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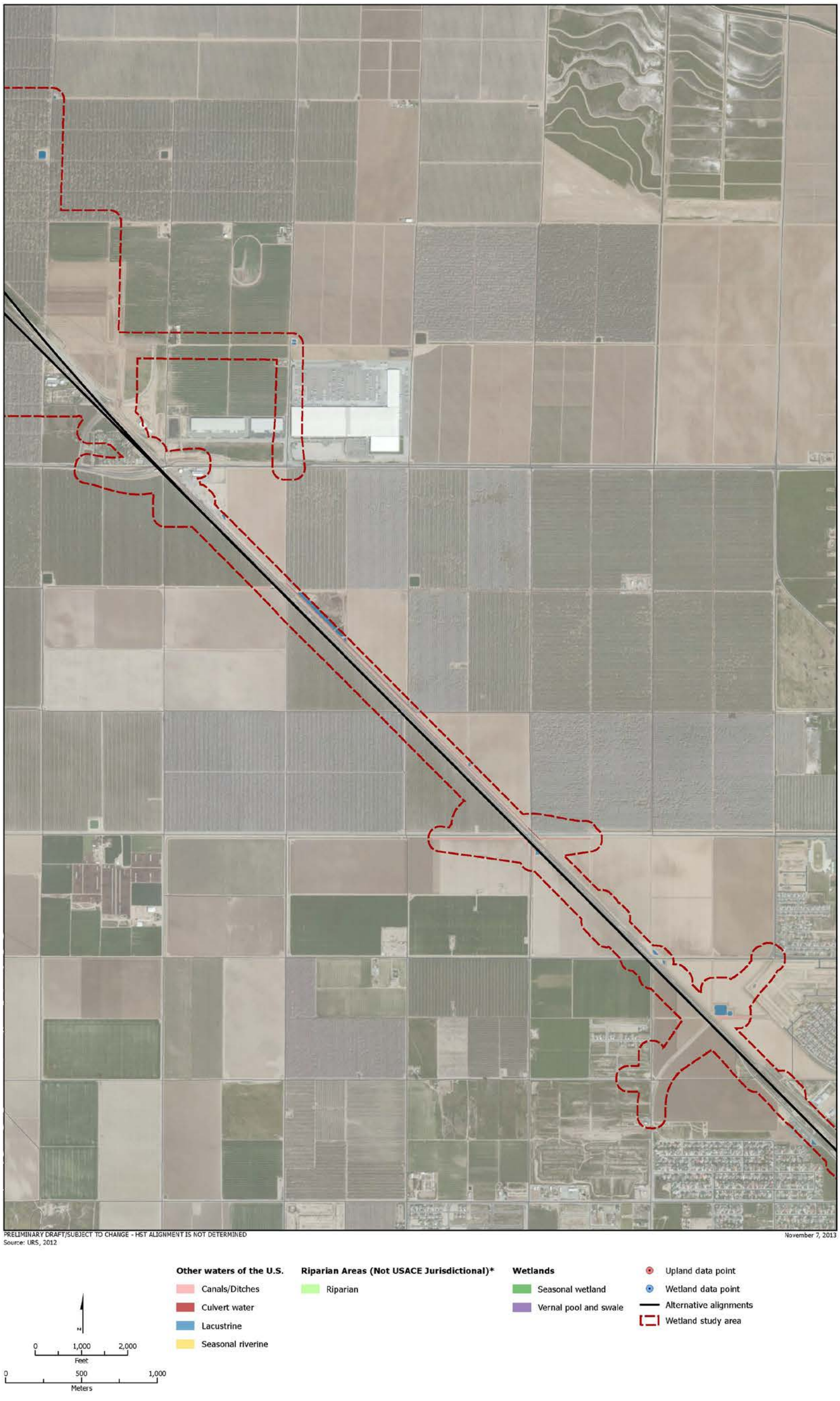
Jurisdictional waters delineation and riparian areas (Sheet 28)



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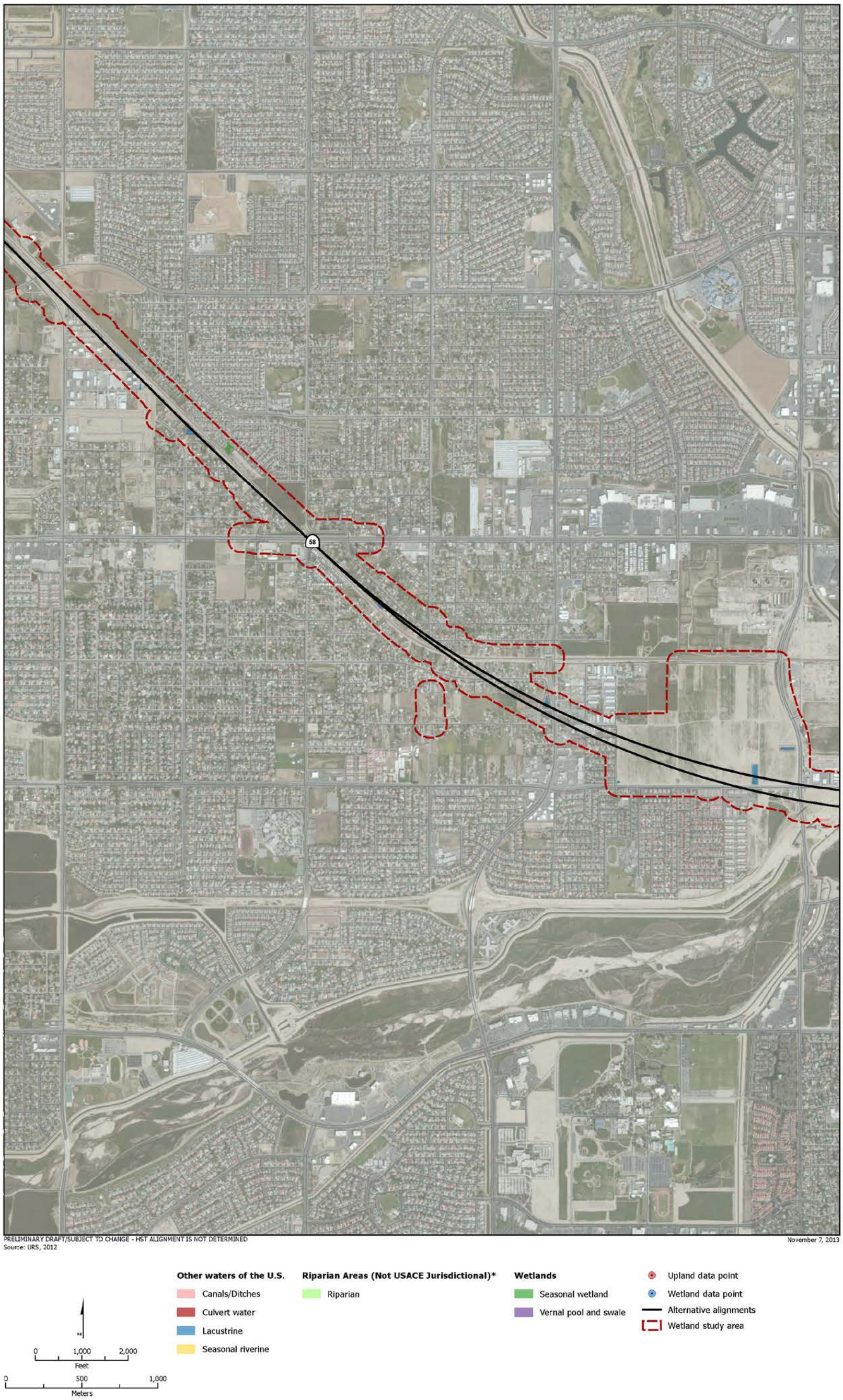
Jurisdictional waters delineation and riparian areas (Sheet 29)



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Jurisdictional waters delineation and riparian areas (Sheet 30)

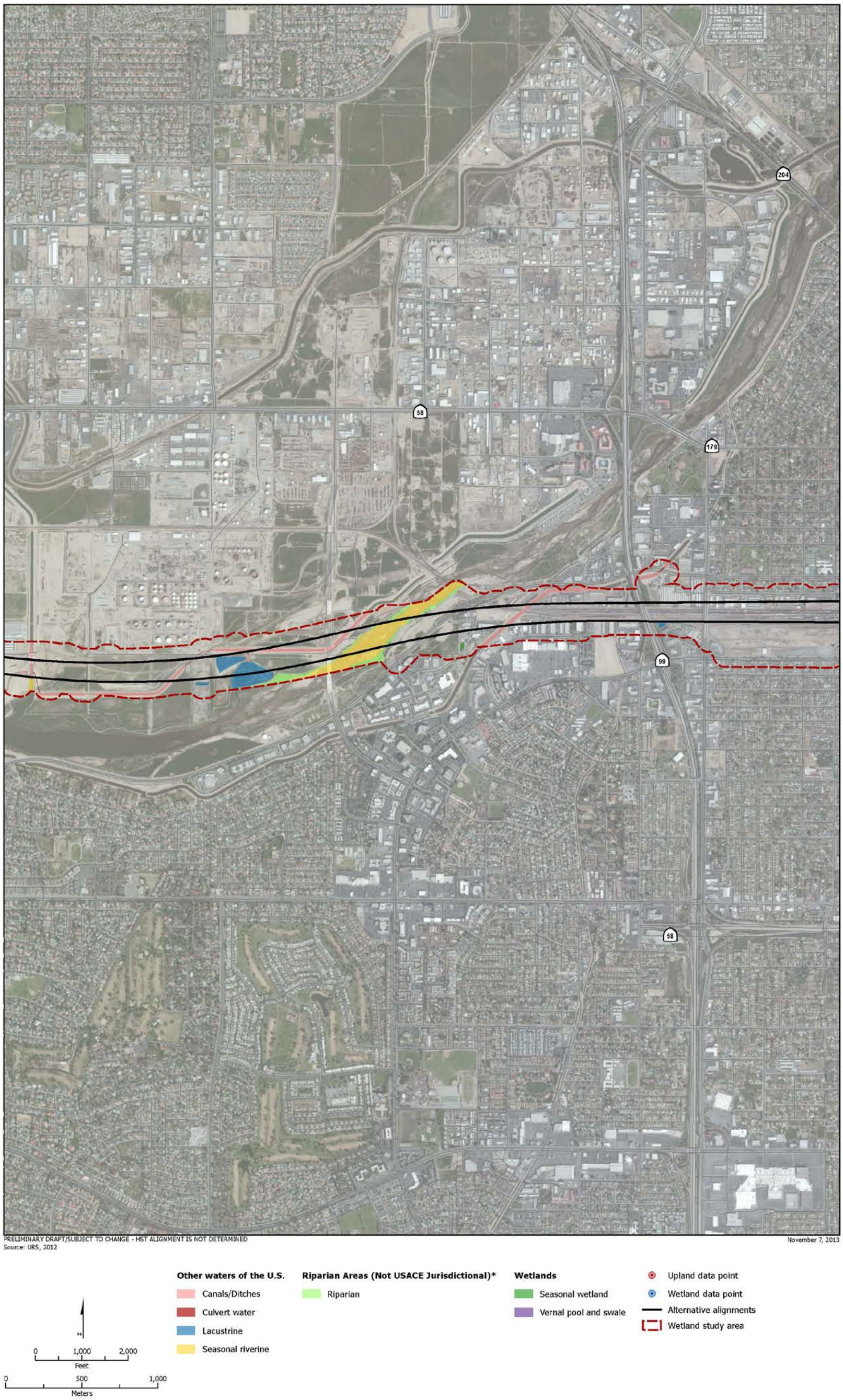


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 31)

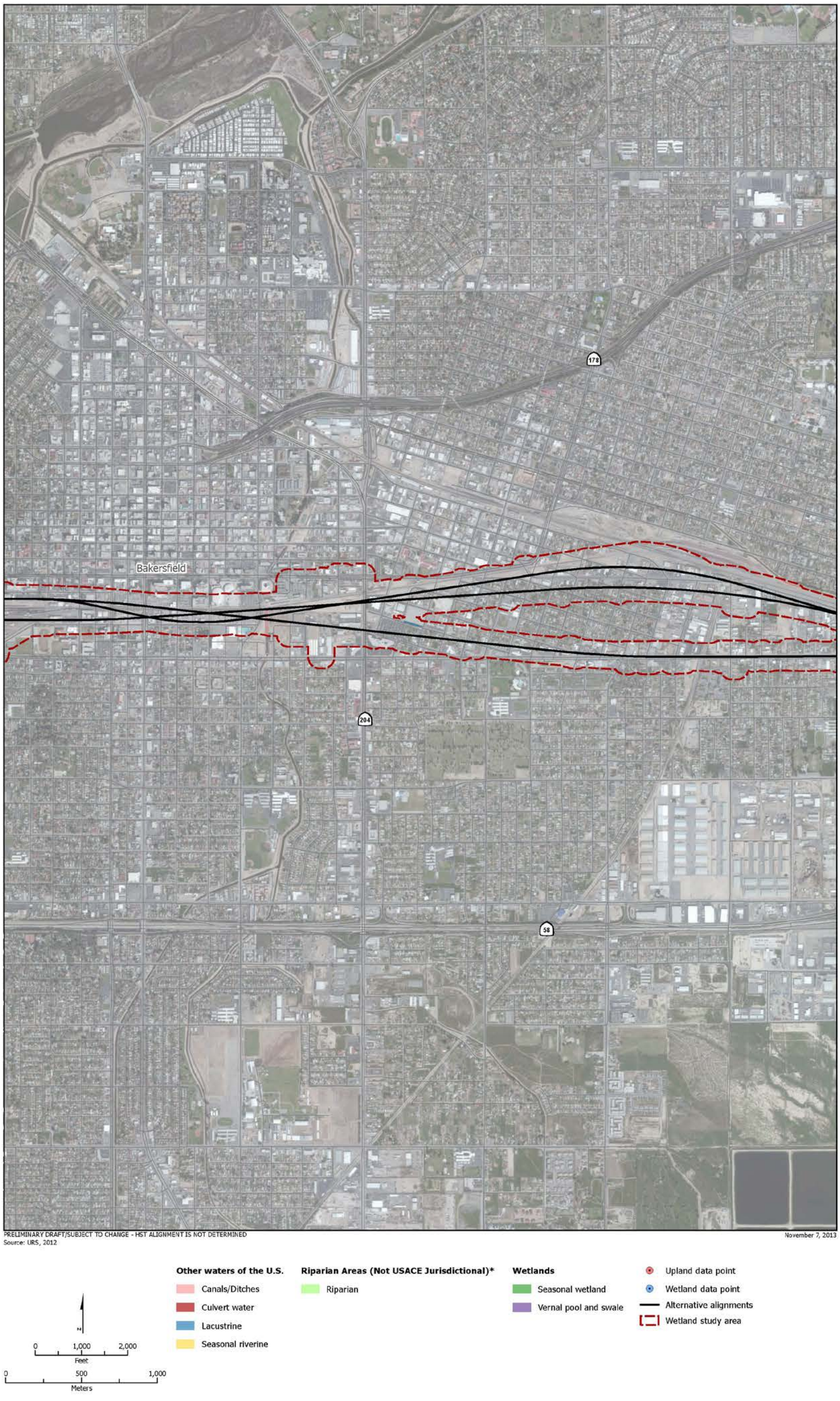


Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 32)

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 33)

Many of the jurisdictional waters in the study area have been leveled, drained, and/or leveed for agricultural purposes (to prevent flooding). The physical and biological characteristics of the substrate within various features are largely dictated by whether the feature is manipulated or natural.

Manipulated features include all jurisdictional water features except vernal pools and swales. These manipulated features contain substrates that have been altered through excavation, filling, dredging and accretion of sediments; these substrates typically range from sandy and coarse-loamy to fine-silty, fine-loamy, and fines (depending on location in the study area). Natural features such as vernal pools and swales have substrates composed of natural alkaline soils, which are harsh environments for microbes and plants and contain low levels of organic matter.

Jurisdictional waters are described in more detail in the *Fresno to Bakersfield Section: Biological Resources and Wetlands Technical Report* (Authority and FRA 2012b) and in the *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* (Authority and FRA 2012a), which provides detailed descriptions of the major surface water features found in the region. The special aquatic resources present in the study area are listed in Table 4-2.

Table 4-2
Special Aquatic Resources in the Study Area for the Fresno to Bakersfield Section

Special Aquatic Resource	Acres
Canals/ditches	199.55
Emergent wetland	0.92
Lacustrine	278.32
Riparian (not USACE jurisdictional)	51.82
Seasonal riverine	58.33
Seasonal wetland	43.56
Vernal pools and swales	95.86
TOTAL	**728.36**
Note: Study area includes the construction and project footprints plus a 250-foot buffer.	

4.2.2.1 Man-Made and Manipulated Aquatic Resources

Canals/Ditches

Canals and drainage and irrigation ditches occur throughout the study area. These man-made or manipulated linear features are concrete-lined or unlined and earthen and range from approximately 10 to 50 feet in width. Canals/ditches are primarily used to transport water for irrigation and agricultural purposes; however, some features provide drainage in a non-agricultural setting. These features are typically devoid of vegetation and lack natural soils, though sediments often deposit at the bottom of the canal or ditch. A series of pumps is often used to transport water between canals, ditches, or under roads and other infrastructure. In general, canals/ditches are in relatively poor ecological condition due to poor landscape position, have a highly manipulated hydrological regime, offer few biological resources to plants and wildlife, and are physically engineered to the extent that they are devoid of natural characteristics.

Emergent Wetland

Emergent wetlands occur in two locations: (1) near the city of Hanford and (2) in Bakersfield. They are characterized by topographic depressions that flood frequently or hold ponded water long enough to support hydrophytic vegetation; they typically feature hydric soils. The presence of vegetation separates emergent wetland features from lacustrine features. The emergent wetlands in the study area appear to be man-made or highly manipulated. They are bounded by earthen walls and receive hydrologic input from surrounding canals, agricultural fields, and urban development. Two emergent wetlands occur near Hanford. One is within the footprints of the Hanford West Bypass 1 and 2 alternatives in a large depression surrounded by riparian vegetation. This emergent wetland appears to receive input from the adjacent canal and may be a remnant of a historical natural drainage system. This emergent wetland offers some habitat for wading birds and waterfowl. The other emergent wetland in the Hanford area occurs outside the project footprints but within the study area. It is adjacent to a dairy farm feedlot and appears to receive inflow from the basins at the feed lot and Guernsey Slough. The emergent wetland in Bakersfield also occurs outside the project footprint but within the study area. It comprises a vegetated portion of a basin. In general, the emergent wetlands are in poor to fair ecological condition due to a poor landscape position, have a highly manipulated hydrologic regime, offer few biological resources to plants and wildlife, and are physically engineered to the extent that they retain few natural characteristics.

Lacustrine

Lacustrine features include retention/detention basins and reservoirs. These features occur throughout the study area. Retention/detention basins are man-made features that are square, rectangular, round, or triangular; are often found with constructed earthen walls; and are devoid of vegetation. These features are closely associated with agriculture activities and in most instances are used as water storage (or retention) facilities. In urban areas, retention/detention basins are used to retain urban storm-water runoff. Surface water in the basins may be seasonal or perennial, depending on the location and the use of the feature. Reservoirs are large, steep-sided, man-made impoundments that may contain either drinking water or irrigation water storage. Reservoirs are similar to, but generally larger than, retention/detention basins. One of reservoirs is the Tulare Lake Bed Mitigation Site, which was developed and is maintained by the Kaweah Delta Water Conservation District for waterfowl. All of the reservoirs are large, perennially open-water features devoid of vegetation; however, these features provide important habitat for wading birds and waterfowl. In general, lacustrine features are in relatively poor ecological condition due to a disturbed environmental setting; have a highly manipulated hydrological regime, offer few biological resources to plants and wildlife, and are physically engineered to the extent that they are devoid of natural characteristics.

Seasonal Wetland

Seasonal wetlands occur in scattered locations throughout the study area, but are concentrated in the area between the cities of Corcoran and Wasco. The majority of the seasonal wetlands in the study area were found within the BNSF right-of-way. They typically occur in disturbed habitats, including fallow agricultural areas, drainage ditches along the BNSF right-of-way, the margins of retention/detention basins, active agricultural fields, and roadside ditches. Seasonal wetlands are predominantly vegetated with hydrophytic plants, occur in topographic depressions, and have soils with sufficient clay content or compaction to support seasonal ponding. In manipulated areas, inundation is hydrologically controlled by pumps, weirs, and/or storm drain systems year-round. In more natural areas, inundation or saturation occurs during the winter and spring seasons as the result of rainfall and surface runoff. During the summer and fall months, seasonal wetlands are dry. Although they share a similar hydrologic regime, seasonal wetlands are distinguished from vernal pools by their lack of the distinctive floristic components and

distinctive claypans or hardpans. In general, seasonal wetlands are in relatively fair ecological condition due to a poor landscape position, function with altered and natural hydrological regimes, provide some biological resources to plants and wildlife, and are physically altered, which reduces their natural characteristics.

4.2.2.2 Sensitive Aquatic Resources

Sensitive aquatic resources are those aquatic features that generally occur in more natural settings and are characterized by primarily natural sources of hydrology. These features are the most sensitive to impacts and provide unique functions and services not easily replaced by other special aquatic resources.

Seasonal Riverine

Seasonal riverine waterways occur as discrete features throughout the study area. They include Kings River Complex, Mussel Slough, Oak Slough, Cross Creek, Tule River, Deer Creek, Poso Creek, Kern River, and other unnamed waterways. Many of these features originate in the Sierra Nevada, where their hydrology is less affected by water developments. Although their hydrology is affected by water storage and hydroelectric development in their headwaters, the upper reaches of these streams are less affected by water developments than the reaches in the study area. By the time these features reach the study area, they are highly manipulated for municipal and agricultural purposes and much of their surface water and groundwater have been diverted, pumped, or captured.

The banks and floodplains of many seasonal riverine waterways in the study area have been channelized, and extensive adjacent riparian vegetation has been removed or confined by surrounding land use. Typically, these features are seasonally dry and have streambeds that are unvegetated and consist of coarse sand or gravel. For these reasons, seasonal riverine features are in fair to good ecological condition due to landscape positions that have connectivity upstream and downstream. They function with altered and natural hydrological regimes, provide some biological resources to plants and wildlife, and are physically altered, which reduces their natural characteristics.

Kings River

The Kings River originates in the Sierra Nevada and flows southwest approximately 125 miles to the Tulare Lake bed. The north, middle, and south forks of the Kings River converge in the foothills upstream of Pine Flat Dam. Pine Flat Reservoir (also referred to as Pine Flat Lake) provides 475,000 acre-feet of flood control storage. Upstream of Pine Flat Dam, the Kings River drains approximately 1,545 square miles (USACE 1999). Downstream of the dam, the Kings River flows through canals and levee systems and splits into multiple channels as water is diverted for irrigation and flood control in the valley.

The middle and south forks of the Kings River, which are within Kings Canyon National Park, are designated as wild and scenic. These reaches of the river are about 50 miles east of the project alternative alignments.

Approximately 1 mile downstream of SR 99 (and 8 miles upstream of where the BNSF Alternative crosses Cole Slough), People's Weir spans the Kings River and diverts water into the Lakeland Canal and Peoples Ditch. Large floods in the 1860s carved a new channel for the Kings River below People's Weir, and Cole Slough became the main channel. The old channel, known as Old River, is usually dry. About 2 miles above where the BNSF Alternative crosses Cole Slough, the channel is divided into Dutch John Slough and Cole Slough by the Dutch John Weir. Water is diverted down each channel, Cole Slough, or Dutch John Slough, depending on water demands.

Cole Slough rejoins Old River at Reynolds Cut, less than 3 miles below where the BNSF Alternative crosses Cole Slough. Reynolds Weir controls flow into Murphy Slough, Liberty Canal, and Grant Canal. The Hanford West Bypass 1 and 2 alternatives cross Murphy Slough, Grant Canal, and the Kings River approximately 2 miles downstream of Reynolds Weir.

Dutch John Cut joins Old River about 2 miles below where the BNSF Alternative crosses the Kings River (also known as Old River at this location). The flow through Dutch John Cut to the Old River becomes the main flow of the Kings River, which continues downstream. Flow from the Kings River eventually reaches the Tulare Lake bed (KRCD and KRWA 2009).

South of the Kings River crossing, the BNSF Alternative alignment crosses Riverside Ditch approximately 0.2 mile south of Old River. The Hanford West Bypass 1 and 2 alternatives cross Riverside Ditch approximately 1 mile south of Kings River.

Originating at People's Weir, Peoples Ditch conveys water southwest through the city of Hanford. The BNSF Alternative crosses Peoples Ditch approximately 3 miles northeast of Hanford, and the Hanford West Bypass 1 and 2 alternatives cross Peoples Ditch about 2 miles south of Hanford.

Last Chance Ditch conveys water southwest from Last Chance Weir, on the Kings River (or Old River) between Dutch John Cut and Reynolds Cut. The Hanford West Bypass 1 and 2 alternatives cross the West Main of Last Chance Ditch approximately 1 mile northwest of the Hanford. These ditches are irrigation canals.

Cross Creek

Cross Creek, a reach of the Kaweah River, is formed from the merging of Cottonwood Creek and St. Johns River in the eastern San Joaquin Valley. Cottonwood Creek flows from the foothills of the Sierra Nevada, and St. Johns River branches off the Kaweah River approximately 3 miles below Terminus Dam. Cross Creek flows southwest approximately 35 miles through Tulare and Kings counties to the Tulare Lake bed. The creek is a Central Valley Flood Protection Board (CVFPB)-designated floodway. Where the BNSF Alternative, the Hanford West Bypass 1 Alternative, and the Hanford West Bypass 2 Alternative cross it just north of the Tulare Lake Bed Mitigation Site and east of SR 43, an encroachment permit from the CVFPB would be required before any work could be conducted at this crossing.

The Tulare Lake Bed Mitigation Site (also known as the Corcoran Reservoir) is approximately 3 miles north of Corcoran and just south of Cross Creek. The BNSF Alternative, the Hanford West Bypass 1 Alternative, and the Hanford West Bypass 2 Alternative would pass adjacent to the northwestern portion of this feature. The Corcoran Elevated and Corcoran Bypass alternatives begin near the Tulare Lake Bed Mitigation Site. The reservoir is operated by the Corcoran Irrigation District and is used for storage and recharge.

At the northeastern city limit of Corcoran, the Corcoran Bypass Alternative would cross Sweet Canal and the BNSF Alternative, and the Corcoran Elevated Alternative would cross Sweet Canal at the southern city limit of Corcoran. This canal is used for distribution of irrigation water and generally runs north to south.

The Lakeland Canal conveys water north to south to the east of the BNSF Alternative near Cross Creek and Corcoran. The Lakeland Canal would cross the BNSF Alternative at two locations: approximately 3 miles northwest of Corcoran and approximately 10 miles southeast of Corcoran.

Tule River

The Tule River originates in the Sierra Nevada and flows to Lake Success before entering the valley. The north, middle, and south forks of the Tule River converge in the foothills upstream of

Lake Success, the lake formed by Success Dam with a capacity of 82,300 acre-feet. The Tule River drainage area upstream from Success Dam covers approximately 393 square miles (USACE 1999). From Lake Success, the Tule River flows generally westward across the valley floor to the Tulare Lake bed. Stream flow data for the Tule River were collected at a USGS gauging station below Success Dam and are summarized in the *Fresno to Bakersfield Section: Hydrology and Water Quality Technical Report* (Authority and FRA 2012d). During summer, the Tule River is often characterized by alternating dry and wet periods, which result when irrigation districts take water from and discharge water to the natural channels. The Friant-Kern Canal also provides flow to the Tule River during summer. Tule River water that reaches the Tulare Lake bed is either stored for irrigation or evaporates (ICF Jones & Stokes 2008). The BNSF Alternative, the Corcoran Elevated Alternative, and the Corcoran Bypass Alternative would cross the Tule River south of Corcoran.

Deer Creek

Deer Creek originates in the southern Sierra watershed and flows west from the foothills of the Sierra Nevada in Tulare County. The creek is joined by Fountain Springs Gulch near Terra Bella. Stream flow data for Deer Creek were collected at a USGS gauging station in the Sierra Nevada foothills; the data are summarized in the *Fresno to Bakersfield Section: Hydrology and Water Quality Technical Report* (Authority and FRA 2012d). Deer Creek flows through the Pixley National Wildlife Refuge (Pixley NWR) on the valley floor and is crossed by the BNSF Alternative and the Allensworth Bypass Alternative. Deer Creek is channelized where it flows through the Pixley NWR and discharges to Homeland Canal approximately 2 miles west of the BNSF Alternative.

Poso Creek

Poso Creek originates in the southern Sierra watershed and flows west from the Sierra Nevada approximately 10 miles north of Bakersfield. Poso Creek receives discharge from the Cawelo Water District's Reservoir B for the purpose of intentional recharge (CVRWQCB 2007b). Poso Creek flows toward the Kern National Wildlife Refuge (Kern NWR), which is approximately 15 miles downstream of the study area (CVRWQCB 2007a). The BNSF Alternative and the Allensworth Bypass Alternative would cross Poso Creek north of Wasco.

Kern River

The Kern River, its forks, and Lake Isabella are the major water features within the Kern River Watershed (ICF Jones & Stokes 2008). The Kern River flows generally southwest through Bakersfield to the Buena Vista Lake bed. The upper reaches of the north and south forks of the Kern River are designated "wild and scenic." These reaches of the river are about 60 miles east of the project alternative alignments. In the valley, the Kern River is bordered by conveyance and diversion canals for much of its length, and its water is diverted for consumption or groundwater recharge (ICF Jones & Stokes 2008).

Isabella Dam, which was constructed in 1953 and is on the Kern River approximately 35 miles northeast of Bakersfield, forms Lake Isabella. The primary purpose of the dam and reservoir is to provide flood control. The dam is operated so that the maximum flow in the Kern River at the Pioneer turnout near Bakersfield does not exceed the capacity of the river channel, which is 4,600 cfs. Lake Isabella has a capacity of approximately 570,000 acre-feet, and provides water for irrigation (Gronberg et al. 1998). Stream flow data for the Kern River downstream of Lake Isabella were collected at USGS gauging stations; the data are summarized in the *Fresno to Bakersfield Section: Hydrology and Water Quality Technical Report* (Authority and FRA 2012d).

The Friant-Kern Canal joins the Kern River in the city of Bakersfield. The BNSF Alternative and the Bakersfield South Alternative cross the Kern River and the Friant-Kern Canal and various

other diversion canals, including the Arvin Edison Canal, Cross Valley Canal, Carrier Canal, Stine Canal, Kern Island Canal, and East Side Canal.

Vernal Pools and Swales

Vernal pools and swales occur in scattered locations throughout the study area, but are concentrated in the area between the towns of Corcoran and Wasco. They form as a result of the saline-sodic soils present in the study area. Vernal pools are shallow depressions with claypan or hardpan bottoms (fine-grain silts or clays) that retain water during the rainy season. These ponded pools support a community of hydrophytic plants endemic to vernal pools. Vernal swales are linear shallow depressions that receive hydrologic input from vernal pools. A network of pools and swales forms a vernal complex; such complexes are found in abundance in the vicinity of Allensworth.

Vernal pools and swales located immediately adjacent to the BNSF Railway tracks were probably man-made, are likely affected by routine maintenance of the right-of-way, and are hydrologically altered. For these reasons, these features are generally in fair ecological condition. The remaining vernal aquatic resources provide a number of aquatic and biological functions and services. In general, these features are in good ecological condition because they are in natural landscapes away from developed land uses; function within a natural hydrological regime (though some features are affected by a number of hydrological barriers [e.g., BNSF Railway right-of-way, SR 43]); provide considerable biological resources to plants and wildlife; and have an unaltered, natural physical structure.

4.2.2.3 Special Areas and Conservation Lands

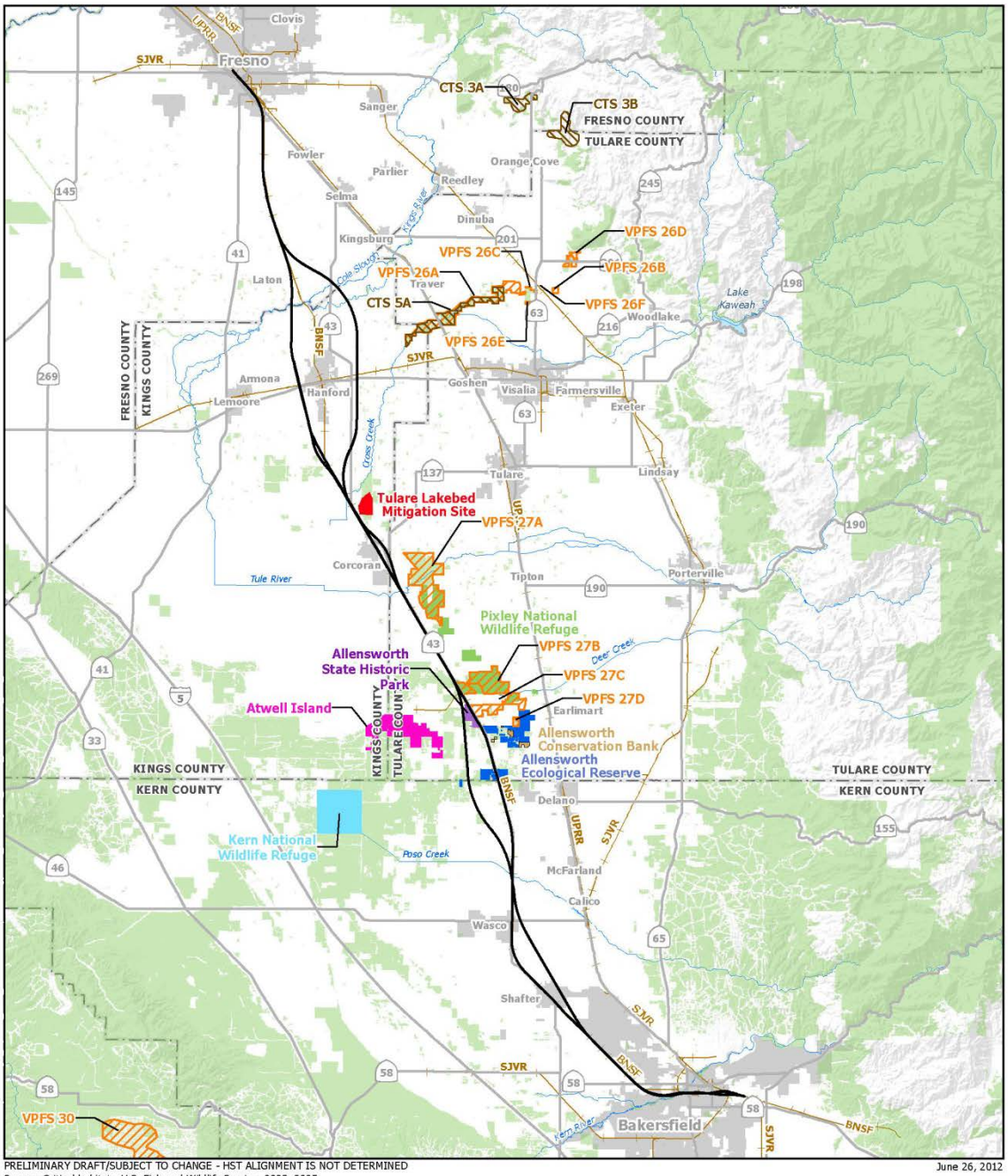
A number of special areas important for biological resources are present in and in the vicinity of the Fresno to Bakersfield alternatives. Some of these areas are identified as part of existing species-specific resource plans, and others are existing public lands. Figure 4-8 depicts the location of these areas in relation to the HST alternatives. A summary of each area is provided below.

Critical Habitat

The federal Endangered Species Act defines critical habitat as designated areas that provide federally listed species with suitable habitat that includes the geographical locations and physical features essential to the conservation of a particular species. The federal ESA defines conservation as “all methods and procedures which are necessary to bring any endangered species or threatened species to the point at which the measures provided pursuant to this chapter [the federal ESA] are no longer necessary” (16 United States Code Section 1532[3]).

Although the Fresno to Bakersfield Section does not overlap any designated or proposed critical habitat units, designated critical habitat for the vernal pool fairy shrimp (*Branchinecta lynchi*) is present in the vicinity of the city of Allensworth, where the BNSF Alternative is within 250 feet of Critical Habitat Unit 27B and Critical Habitat Unit 27C for the vernal pool fairy shrimp. However, the Fresno to Bakersfield Section is separated physically and hydraulically from Critical Habitat Unit 27C by the presence of SR 43 and the BNSF Railway right-of-way and is primarily separated from Critical Habitat Unit 27B by this existing infrastructure.

Where Critical Habitat Unit 27B crosses SR 43 and the BNSF right-of-way, it is composed of ruderal and annual grassland habitat that does not contain the Primary Constituent Elements for this species (i.e., vernal pools, swales, and other ephemeral wetlands and depressions). No direct or indirect impacts on vernal pool fairy shrimp critical habitat are anticipated as a result of the project.



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Source: Critical habitat - U.S. Fish and Wildlife Service, 2003, 2005;
Public lands/Conservation lands - Wildlands, INC; Kaweah delta water conservation district
Natural landscape block - California Essential Habitat Connectivity - W.D. Spencer et al., 2010
Data source: URS, 2012

June 26, 2012

N

0 5 10 Miles

0 10 20 Kilometers

Public lands
- Pixley National Wildlife Refuge
- Kern National Wildlife Refuge
- Allensworth Ecological Reserve
- Allensworth State Historic Park
- Atwell Island

Critical habitat units
- California tiger salamander (CTS)
- Vernal pool fairy shrimp (VPFS)

Conservation easements and banks
- Tulare Lakebed Mitigation Site
- Allensworth Conservation Bank

California Essential Habitat Connectivity
- Natural landscape block
- Alternative alignments
- Stream/River
- County boundary
- Community/Urban area

Figure 4-8
Special areas and conservation lands

Public Lands

Allensworth Ecological Reserve

The California Department of Fish and Game (CDFG) manages the Allensworth Ecological Reserve (Allensworth ER), which consists of a number of fragmented parcels in southern Tulare County and northern Kern County (Figure 4-8). The approximate 5,056 acres in the Allensworth ER contain a number of biological resources, including special-status plant communities, wetlands, and special-status plant and wildlife species. The reserve is open to the public for wildlife viewing (CDFG 2010). A portion of the Allensworth ER immediately west of the SR 43 and the BNSF Railway right-of-way is in the footprint of the BNSF Alternative. The Allensworth Bypass Alternative was designed to avoid impacts to Allensworth ER and the Colonel Allensworth State Historic Park.

Pixley National Wildlife Refuge

The Pixley NWR is in Tulare County, just south of the Tule River (Figure 4-8). The 6,389-acre refuge represents one of the few remaining examples of the grasslands, vernal pools, and playas that once bordered historical Tulare Lake. Over 100 bird and 6 reptile species use the refuge. Approximately 300 acres of managed wetlands provide habitat for migratory waterfowl and shorebirds. The primary management focus of the U.S. Fish and Wildlife Service (USFWS) for the refuge is to maintain and restore native habitats, including wetlands and upland habitat (USFWS 2009). The Pixley NWR is near the HST alternatives (i.e., the BNSF Alternative and the Allensworth Bypass Alternative [1,000 feet west of the Pixley NWR]), but the HST alternatives do not overlap the NWR. The construction of the HST alternatives would not result in direct impacts. Because of the considerable distance and the existing SR 43 and BNSF Railway barriers, no indirect impacts are expected to occur to the Pixley NWR.

Kern National Wildlife Refuge

The Kern NWR is in Tulare County, west of Delano at the southern end of the San Joaquin Valley (Figure 4-8). The 11,249-acre refuge contains seasonal wetlands, a riparian corridor, valley grasslands, alkali playa, and valley sink scrub habitats. Approximately 6,500 acres of managed wetlands provide habitat for wintering and migrating waterfowl and shorebirds. Upland areas (3,600 acres) are reserved as habitat for federally listed species such as the Tipton kangaroo rat, blunt-nosed leopard lizard, and San Joaquin kit fox. The primary management focus of the USFWS for the refuge is to maintain and restore native habitats, including wetlands and historical valley upland habitat (USFWS 2011a). The Kern NWR is 9.8 miles west of the HST alternatives (i.e., the Allensworth Bypass Alternative). The HST alternatives do not overlap the NWR, and the construction of the HST alternatives would not result in direct or indirect impacts on this public land.

Colonel Allensworth State Historic Park

The Colonel Allensworth State Historic Park is in Tulare County, near the town of Allensworth (Figure 4-8), which was the only California town to be founded, financed, and governed by African Americans. The 240-acre historical park contains several homes, a bakery, a blacksmith area, a drugstore, a barber shop, a post office, a library, a hotel, a schoolhouse, a Baptist church, a restaurant, various farm buildings, and several other buildings, which were reconstructed to reflect the 1908 to 1918 historical period (California State Parks 2009). The primary management focus is the preservation, development, and interpretation of resources of the historical community of Allensworth. The BNSF Alternative is on the far eastern boundary of the Colonel Allensworth State Historic Park. The Allensworth Bypass Alternative would occur approximately 0.5 mile west of the Colonel Allensworth State Historic Park was designed to avoid impacts to this important historical resource.

Atwell Island

The Atwell Island Land Retirement Demonstration Project (Atwell Island) lies between the Pixley NWR and the Kern NWR (Figure 4-8). This 7,000-acre area is in Kings and Tulare counties, south of the town of Alpaugh in the southeastern portion of what was once Tulare Lake. Atwell Island contains a number of biological resources, including special-status plant communities, wetlands, and special-status wildlife species. It is an agglomeration of land, water, and other property interests purchased from willing sellers by a federal interagency team. This area is currently managed by the Bureau of Land Management with the primary management goal of restoring native valley grasslands, wetlands, and alkali sink habitats on what was once marginal agricultural land. The project provides habitat corridor connections with the surrounding protected lands of the Pixley NWR, Kern NWR, Allensworth ER, and Sand Ridge (BLM 2011; USDI 2010). Atwell Island is west of SR 43 and is 2 miles west of the Allensworth Bypass Alternative; therefore, the HST alternatives do not overlap this area. Because of the considerable distance to any of the HST alternatives, no direct or indirect impacts are expected to occur to Atwell Island.

Conservation Easements and Banks

Tulare Lake Bed Mitigation Site

The Tulare Lake Bed Mitigation Site (Corcoran Reservoir), a conservation easement in the vicinity of Cross Creek, is near the study area (Figure 4-8). The Tulare Lake Bed Mitigation Site was placed into a conservation easement as mitigation for the Lake Kaweah Enlargement Project, and the mitigation site provides habitat for shorebirds and other migrating water fowl. The site was developed and is maintained by the Kaweah Delta Water Conservation District. The conservation area is approximately 1,300 acres. The Fresno to Bakersfield HST alignment alternatives were designed to avoid the Tulare Lake Bed Mitigation Site.

Allensworth Conservation Bank

Conservation banks are large blocks of land that are preserved, restored, and enhanced for the purpose of providing mitigation for projects that take special-status species, wetlands, or other vegetated biological communities. One conservation bank, the Allensworth Conservation Bank, is in the project vicinity; however, this bank is outside the study area (Figure 4-8).

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Section 5.0
Results: Watershed Profile

5.0 Results: Level 1 Watershed Profile

This section presents and describes the watersheds and aquatic resources present in the areas for the Fresno to Bakersfield Section alternatives for the HST System. The description includes the types, extent, and condition of the aquatic resources present based on the methods described in Section 3.1, Methodology: Watershed Evaluation. This section relies heavily on figures, tables, and charts created to represent a large of amount of data gathered and synthesized. The profile for each watershed is presented within the context of broad, landscape-level ecoregions (i.e., the Coast Ranges, Great Valley, Sierra Nevada Foothills, Sierra Nevada, and Mountains and Valleys).

As a quick summary of methods, the watershed profile uses land use data to characterize the condition of aquatic resources by relating aquatic resource condition to land use types. Aquatic resources within a land use that likely lead to the degradation of aquatic resources (e.g., high-intensity agriculture, developed areas) are considered in poor condition. Similarly, aquatic resources in land use types that may lead to a moderate amount of degradation (e.g., low-intensity agriculture) are in fair condition; aquatic resources in resource types being maintained with little to no degradation (e.g., natural land, open space) are in good condition.

5.1 Watersheds and Ecological Sections

The Fresno to Bakersfield Section occurs within seven HUC-8 watersheds in the Tulare Lake Basin. Significant natural drainage features that intersect with the Fresno to Bakersfield alternative alignments include Kings River, Cross Creek, Tule River, Deer Creek, Poso Creek, and Kern River (Figure 4-3). The names of the HUC-8 watersheds, the major surface water features, and the area (in acres) of each watershed are summarized in Table 5-1. Figure 4-2 shows the Fresno to Bakersfield Section alternatives in the context of the seven watersheds applicable to the proposed project.

Table 5-1
Watersheds in the Fresno to Bakersfield Section

Sub-Basin (HUC-8 Number)	Major Water Features	Watershed Area (acres)	Associated Ecological Sections (acreage)
Upper Dry Watershed (18030009)	Kings River	1,360,736	Central California Coast Ranges (118109ac) Great Valley (1173611ac) Sierra Nevada (3709ac) Sierra Nevada Foothills (65307ac)
Tulare–Buena Vista Lakes Watershed (18030012)	Kings River, Cross Creek, Tule River	2,425,479	Central California Coast Ranges (757215ac) Great Valley (1549906ac) Sierra Nevada (11260ac) Sierra Nevada Foothills (107098ac)

Table 5-1
Watersheds in the Fresno to Bakersfield Section

Sub-Basin (HUC-8 Number)	Major Water Features	Watershed Area (acres)	Associated Ecological Sections (acreage)
Upper Kaweah Watershed (18030007)	Cross Creek	974,463	Great Valley (445951ac) Sierra Nevada (277061ac) Sierra Nevada Foothills (251451ac)
Upper Tule Watershed (18030006)	Tule River	604,989	Great Valley (285401ac) Sierra Nevada (131849ac) Sierra Nevada Foothills (187738ac)
Upper Deer-Upper White Watershed (18030005)	Deer Creek, Friant-Kern Canal	783,532	Great Valley (569641ac) Sierra Nevada (26258ac) Sierra Nevada Foothills (187632ac)
Upper Poso Watershed (1803004)	Poso Creek, Friant Kern Canal	368,615	Great Valley (223262ac) Sierra Nevada (39811ac) Sierra Nevada Foothills (105541ac)
Middle Kern–Upper Tehachapi–Grapevine Watershed (1803003)	Kern River	1,676,358	Central California Coast Ranges (51311ac) Great Valley (830807ac) Sierra Nevada (383228ac) Sierra Nevada Foothills (370762ac) Southern California Mountain and Valley (40250ac)
Total	**--**	**10,509,597**	
HUC-8 = Hydrologic Unit Code 8			

Significant land use changes have occurred in the Great Valley, where over 70% of habitats have been converted to agricultural or urban uses (i.e., high-intensity uses). Although each watershed in the Tulare Lake Basin has its unique hydrological features and habitats, the trends in land conversion and land use are generally consistent across the ecological sections. Most of the historical impacts to the watershed have occurred within the valley, where rivers have been diverted and run into highly controlled canals. In general, land use conversion to high- or low-intensity uses in the Sierra Nevada and its foothills has been limited. In the foothills, changes in land use and impacts to aquatic resources exist, but are much more limited—rivers remain largely contiguous, though dams and reservoirs are prominent additions to the landscape. The higher-elevation headwaters in the Sierra Nevada largely remain unmodified. Chart 5-1 reports natural, low-intensity, and high-intensity land uses in each watershed by ecological section.

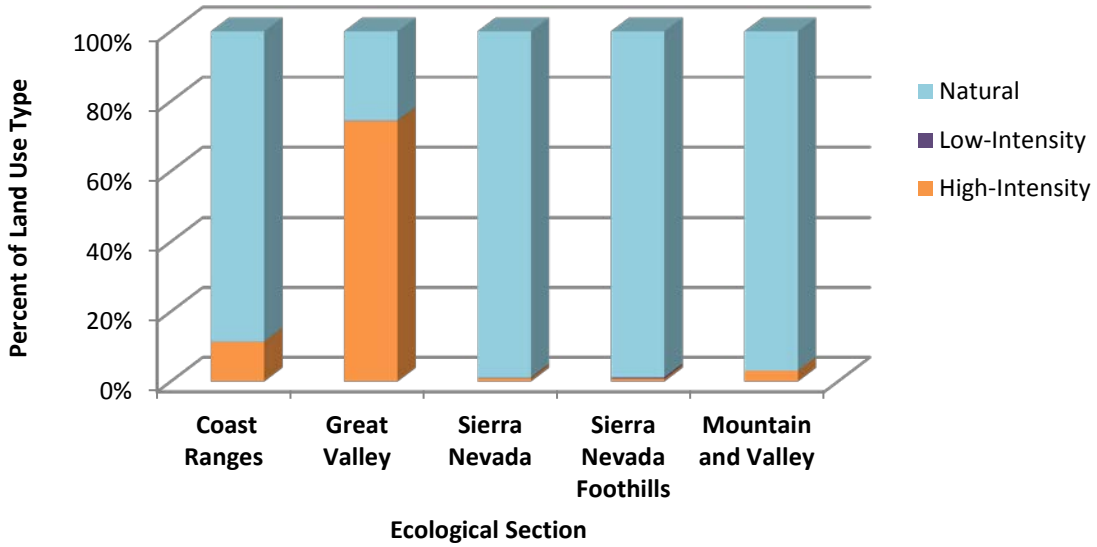


Chart 5-1. Land use types in the Tulare Lake Basin watersheds that intersect the Fresno to Bakersfield Section alternatives, grouped by ecological section.

At the project level, all of the streams and rivers within the Fresno to Bakersfield Section alternative alignments have been dredged, culverted, diverted, dewatered, channelized, or have had their active floodplains severely reduced by levee construction. Therefore, most of the surface water in the project footprint is found in irrigation canals, ditches, or water retention/detention basins; however, surface water is also occasionally found in river channels or precipitation-fed wetlands and vernal pools. The remaining wetlands are largely unrelated to the historical floodplains or regional aquifers.

5.2 Level 1 Watershed Profile

This section describes the profile of each watershed present in the Fresno to Bakersfield Section alternative alignments from north to south. For the watershed profiles, the acreages for vernal pools are based on the Holland Central Valley Vernal Pool Complexes data layer, which identifies vernal pool landscapes (not vernal pool areas). These data layers artificially inflate the amount of vernal pool resources, because they contain both upland and aquatic habitats. Nonetheless, given the sensitivity of vernal pools, the upland communities offer important overall contributions to the vernal pools and their overall health.

5.2.1 Upper Dry Watershed

The Upper Dry Watershed occurs in the northwest portion of the Tulare Lake Basin, south of the San Joaquin River (Figures 5-1a and 5-1b). Major water features within this watershed include the Friant-Kern Canal and the North Fork of the Kings River. The latter is the only potential hydrologic outlet for entire Tulare Lake Basin; in high water years, flood releases from the Pine Flat Dam are directed to the north fork, to the San Joaquin River, and eventually to San Francisco Bay (KRCD and KRWA 2009). The Pine Flat Dam demarcates the upper and lower regions of the Kings River (EPA 2007). The water provided by the greater Kings River system contributes to one of the most productive agricultural regions in the United States and continues to be one of the most fertile farming regions in the world (KRCD and KRWA 2009).

The Fresno to Bakersfield Section spans about 118 miles. Approximately 23 miles of the alignment lies within the Upper Dry Watershed. The part of the alignment within this watershed

begins in urban Fresno and heads south through the Great Valley Ecological Section. This part of the watershed has been highly modified, developed, and farmed. Land use around the projected alignment consists mostly of urban areas, vineyards, cropland, and orchards (Figure 5-1a).

Within the Great Valley Section of the Upper Dry Watershed, most of the waterways have been converted to canals and ditches (Figure 5-1b). Chart 5-2 shows the distribution of aquatic features (in millions of linear feet and thousands of acres) by condition (good, fair, and poor) by Tulare Lake Basin ecological section. In the valley, high-intensity land uses are prominent and likely result in the mostly poor ecological condition of the various linear aquatic features. In the coast and foothill sections, the situation is reversed; most of the linear aquatic features are considered good because they fall within natural land uses.

Most of the remaining vernal pools and emergent wetlands in the Great Valley section are within natural land contexts, though they are mostly far to the west and east of the alternative alignments (just south of the San Joaquin River and along the base of the Sierra Nevada Foothills). Other water features are mostly within the urban or agricultural matrix (Table 5-2). In the Sierra Nevada Foothills, about half of the vernal pools are within high-intensity land uses, but most other water features, except for the forested/shrub wetland and lake features, are within natural land uses. In the Sierra Nevada, all of the aquatic features are within natural land uses.

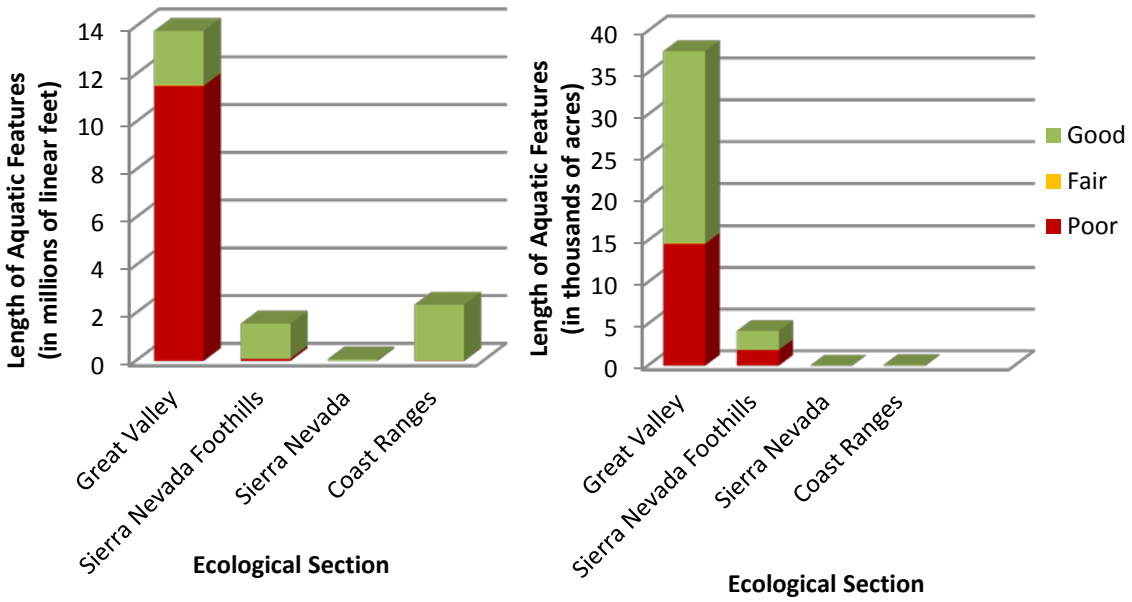


Chart 5-2
Length of aquatic features by condition (in linear feet and acres) within the Upper Dry Watershed, grouped by ecological section.

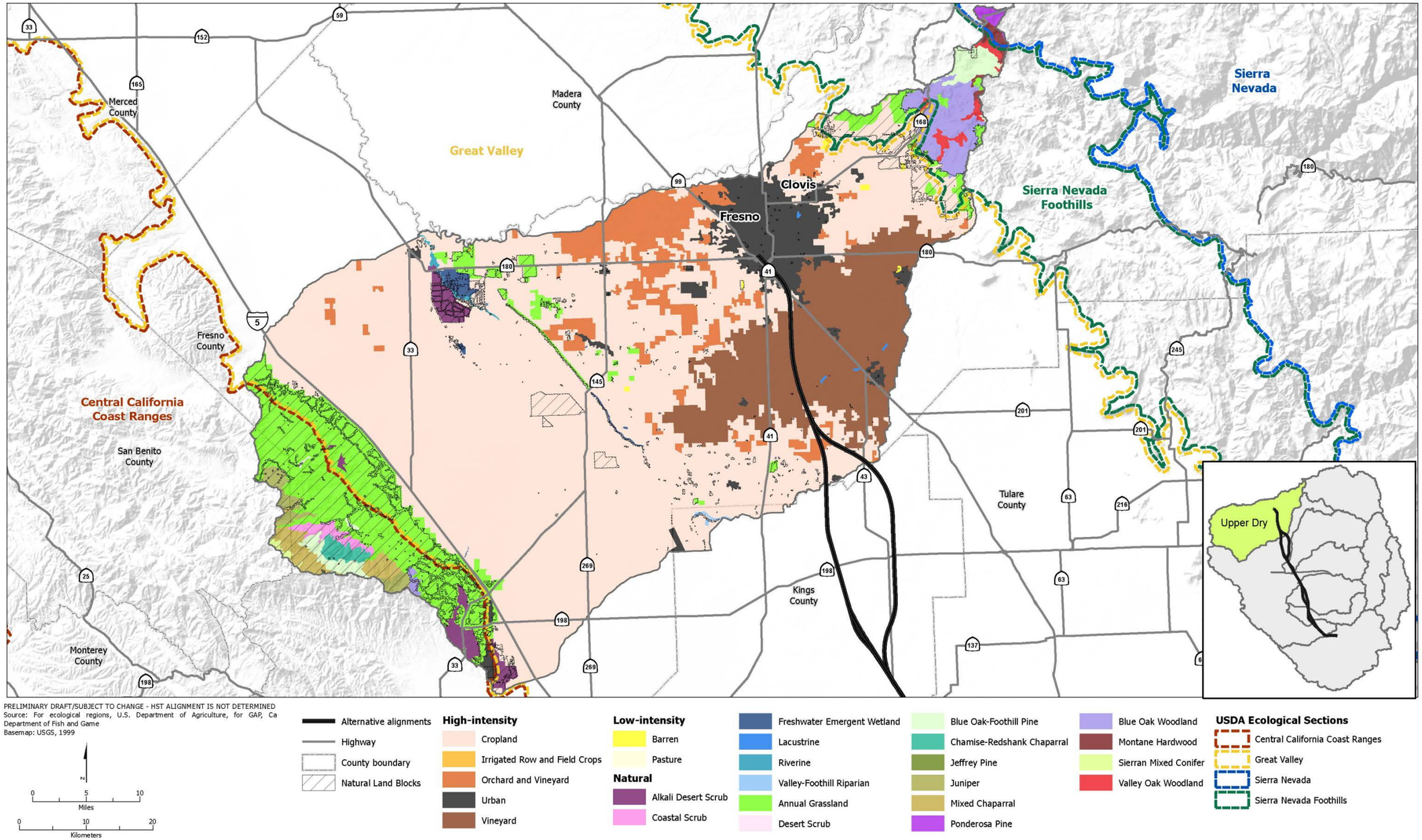


Figure 5-1a
Land use in the Upper Dry Watershed

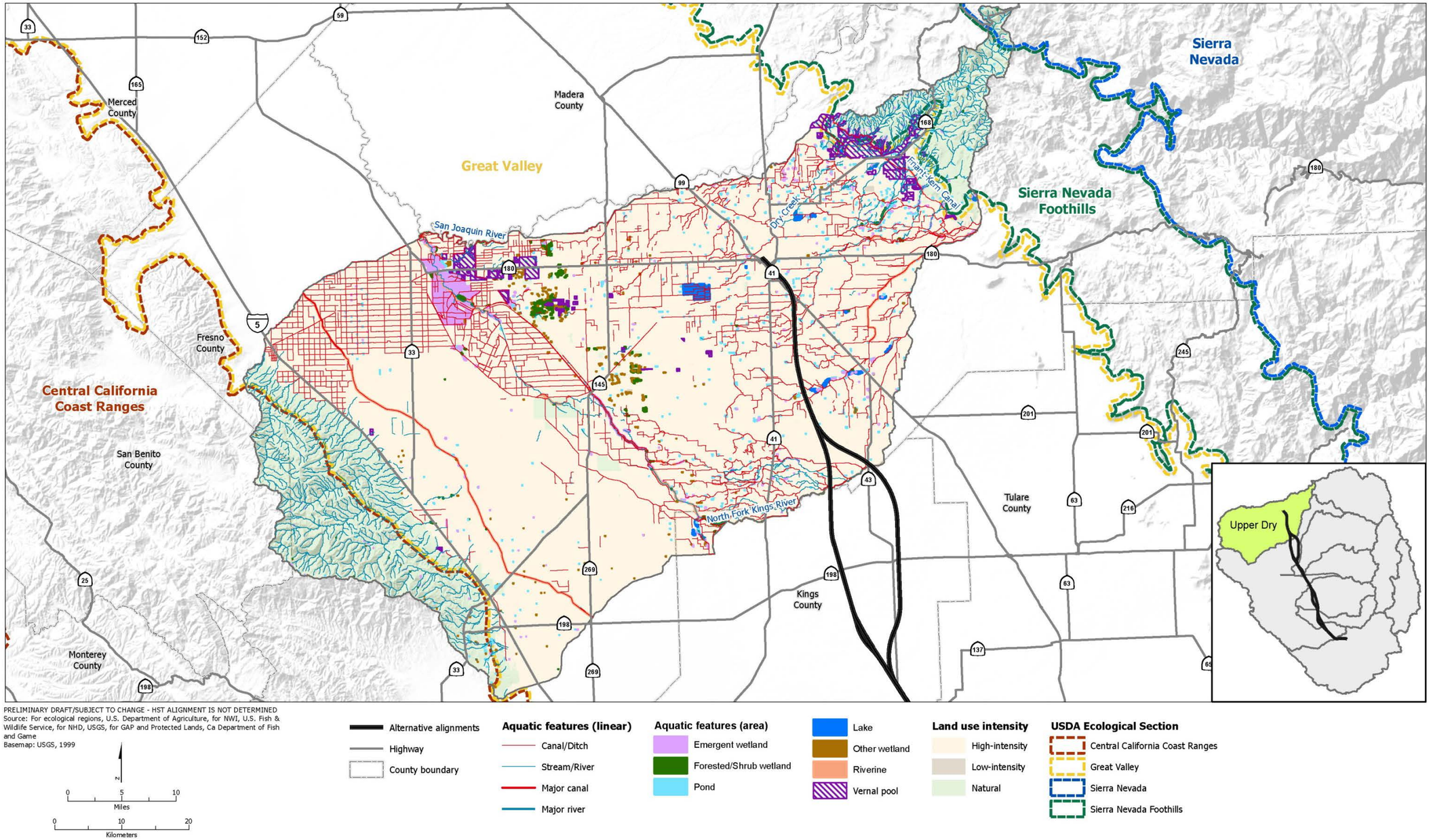


Figure 5-1b
Aquatic features in the Upper Dry Watershed

Table 5-2
Condition of Aquatic Features in the Great Valley Section of the Upper Dry Watershed

Water Feature (Area Measure)	Poor		Fair		Good		Total
	Acres/ Linear Feet	Percentage	Acres/ Linear Feet	Percentage	Acres/ Linear Feet	Percentage	
Canal/Ditch (LF)	10,218,791.3	93%	10,555.5	<1%	725,772.8	7%	10,955,119.7
Stream/River (LF)	1,304,141.7	46%	9,553.3	<1%	1,547,874.6	54%	2,861,569.6
Emergent Wetland (Ac)	1,421.7	13%	0.4	<1%	9,599.1	87%	11,021.2
Forested/Shrub Wetland (Ac)	956.3	54%	—	—	822.4	46%	1,778.7
Lake (Ac)	2,567.8	89%	—	—	312.8	11%	2,880.6
Other Wetlands (Ac)	484.3	60%	7.9	1%	319.0	39%	811.2
Pond (Ac)	1,311.6	84%	1.8	<1%	239.1	15%	1,552.5
Riverine (Ac)	1,404.2	55%	10.6	<1%	1,150.6	45%	2,565.5
Vernal Pool (Ac)	6,504.5	38%	8.2	<1%	10,453.6	62%	16,966.4

LF = linear feet
Ac = acres

5.2.2 Tulare–Buena Vista Lakes Watershed

The Tulare–Buena Vista Lakes Watershed includes the lower reaches of Kings River below the Pine Flat Dam. Major tributaries within the watershed include Mill Creek and Hughes Creek. The Kings River splits into multiple channels in the Centerville Bottoms and continues to run generally east to west across the valley floor. The Kings River used to terminate at Tulare Lake, and most of the historical Tulare Lake bed occurs within the Tulare–Buena Vista Lakes Watershed. Since 1898, most of the water in the Kings River has been diverted for agricultural and municipal use before it reaches the Tulare Lake (KRCD 2003). Figures 5-2a and 5-2b are generated from the National Wetlands Inventory dataset, which still classifies the Tulare Lake as an extant lake even though it is currently farmed and is rarely inundated.

This watershed intersects the Fresno to Bakersfield alternatives at three points: first, within the northern half, near Hanford; second, in roughly the midpoint of the section, near Corcoran; and third, from Wasco to the outskirts of Bakersfield. Over 40 miles of the 118-mile Fresno to Bakersfield section is within the Tulare–Buena Vista Lakes Watershed. In all of these areas within the watershed, the alternative alignments lie along the valley floor in areas of high-intensity land use (Figure 5-2a). Land use is primarily croplands, with an alignment intersecting urban Shafter and some orchards in the southernmost region of this watershed. Only the northernmost section of the alternative alignments crosses a continuous water body, the Kings River, within the watershed.

Many of the aquatic features in the Great Valley Section of the Tulare–Buena Vista Lakes Watershed are in high-intensity land uses that likely result in the poor ecological condition of the aquatic features. Canals and ditches are mostly found within agricultural lands. Riverine features, lakes, and freshwater ponds are mostly in urban or agricultural areas (Figure 5-2b). Chart 5-3 shows that most of the aquatic features in the Great Valley are within high-intensity landscapes. Linear features in the Coastal Ranges (i.e., streams and rivers) are primarily in natural land contexts.

Table 5-3 shows that within the Great Valley, canals, ditches, ponds, and lakes are in areas of high-intensity land uses, and vernal pools, emergent wetlands, and streams/rivers are in more natural contexts. Some of the vernal pools are in protected open space—many occur within the Pixley NWR, which is east of the alternative alignments (see Figure 4-8).

Aquatic features in the Sierra Nevada and the Sierra Nevada Foothills are in largely (>97%) natural land uses. The Coast Ranges are relatively pristine, and the streams and rivers there are in good condition. The canals, ditches, and lakes in this ecological region are in poor condition, though the proportions of these features are much reduced in comparison with the Great Valley. The aquatic features in the Sierra Nevada and the Sierra Nevada Foothills are largely associated with low-intensity land use. These ecological regions are far removed from the potential effects of the HST System.

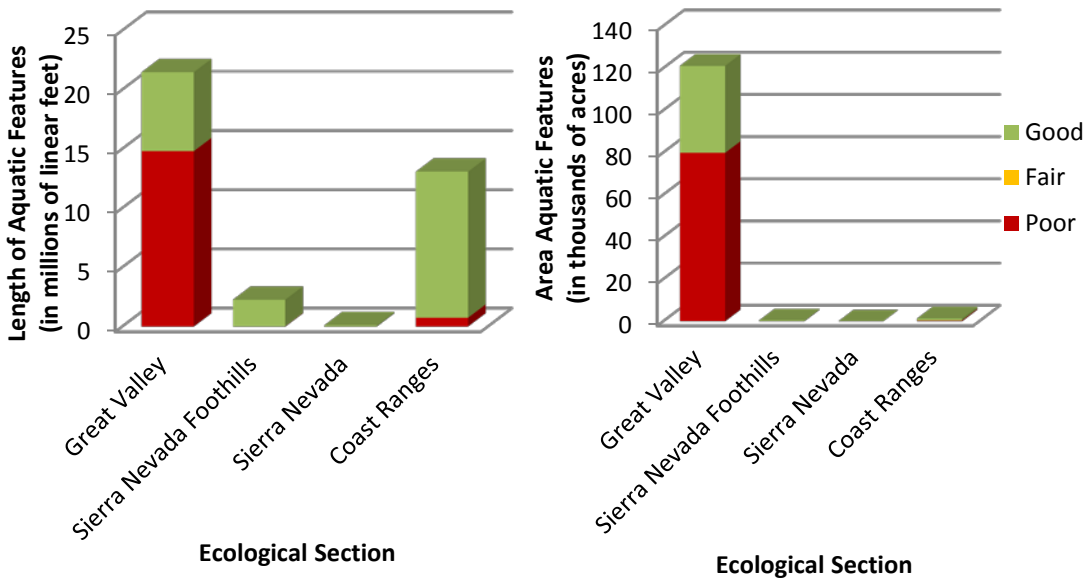


Chart 5-3
Area of aquatic features by conditions (in acres and linear feet) within the Tulare–Buena Vista Lakes Watershed, grouped by ecological section.

Table 5-3
Condition of Aquatic Features in the Great Valley Section of the Tulare–Buena Vista Lakes Watershed

Water Feature (Area Measure)	Poor		Fair		Good		Total
	Acres/Linear Feet	Percentage	Acres/Linear Feet	Percentage	Acres/Linear Feet	Percentage	
Canal/Ditch (LF)	12,898,130.2	86%	—	—	2,039,436.4	14%	14,937,566.6
Stream/River (LF)	1,918,882.7	29%	2,812.4	<1%	4,628,218.2	71%	6,549,913.3
Emergent Wetland (Ac)	2,089.4	15%	1.5	<1%	12,198.3	85%	14,289.3
Forested/Shrub Wetland (Ac)	1,427.3	65%	—	—	763.1	35%	2,190.4
Lake (Ac)	68,779.5	81%	—	—	16,147.0	19%	84,926.5
Other Wetlands (Ac)	640.5	39%	—	—	997.3	61%	1,637.8
Pond (Ac)	1,587.2	70%	0.8	<1%	691.1	30%	2,279.1
Riverine (Ac)	3,545.1	77%	—	—	1,050.3	23%	4,595.3
Vernal Pool (Ac)	1,847.2	16%	—	—	9,426.4	84%	11,273.5

LF = linear feet
Ac = acres

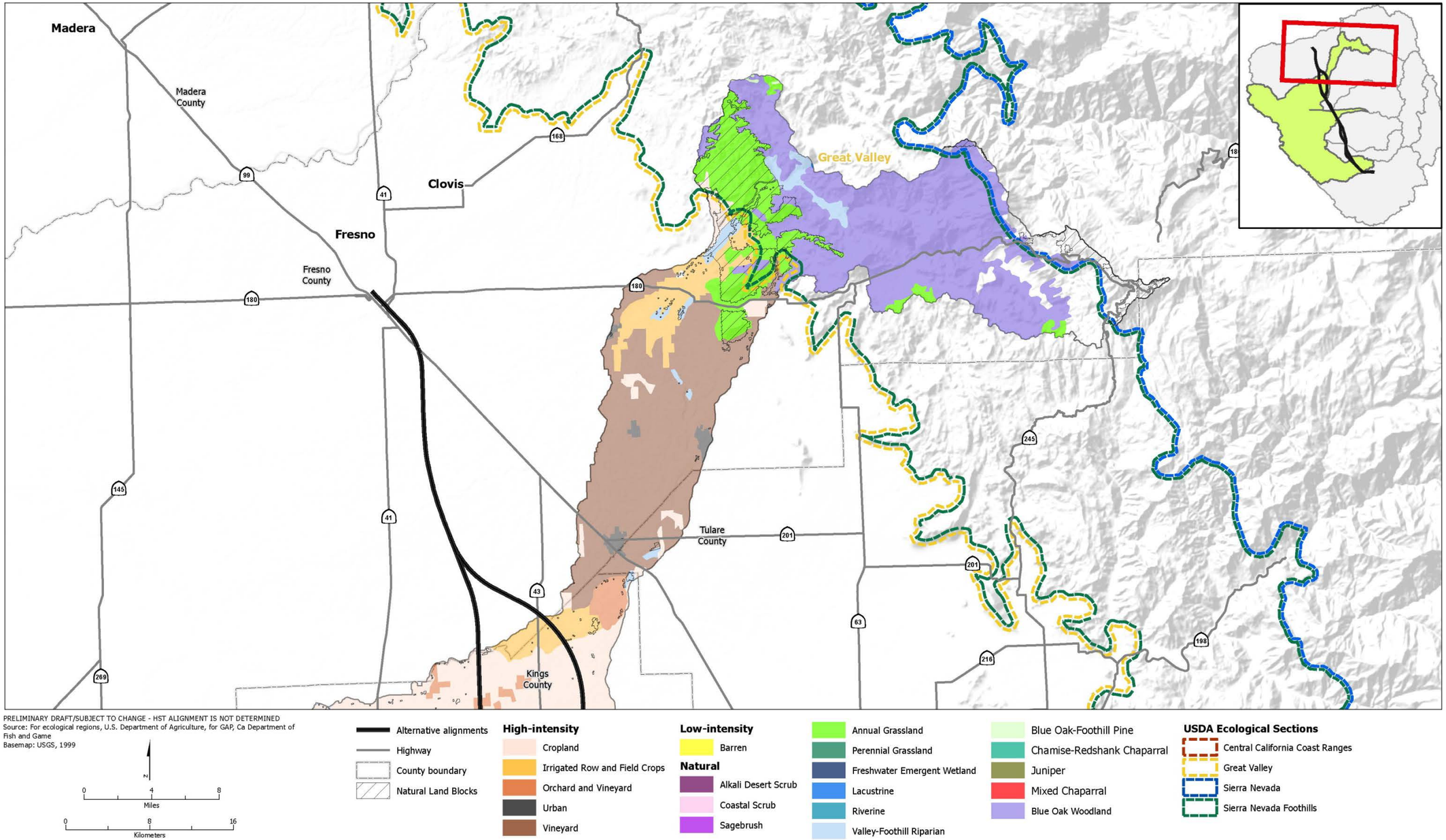


Figure 5-2a
Land use in the Tulare–Buena Vista Lakes Watershed (Sheet 1 of 3)

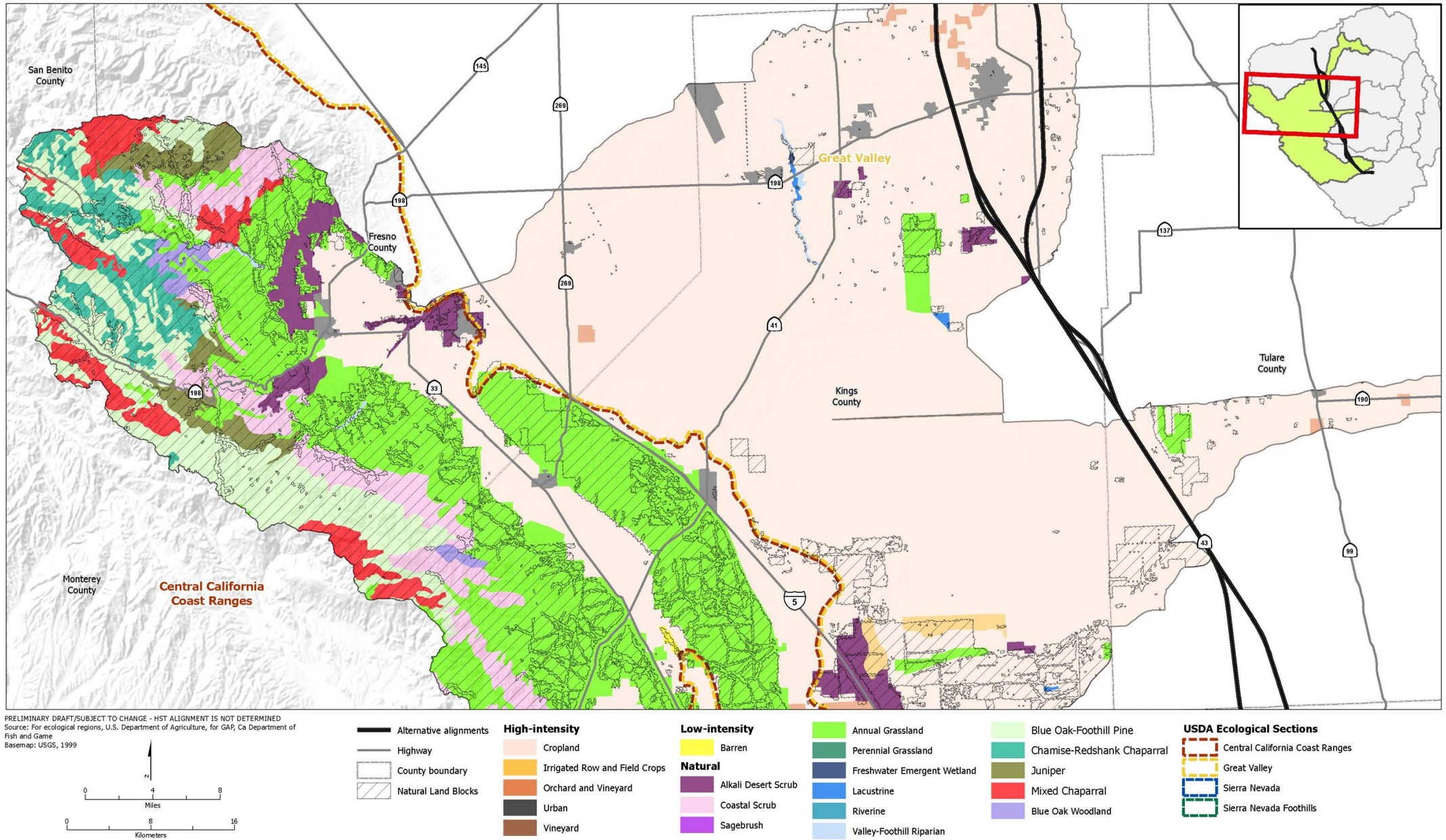
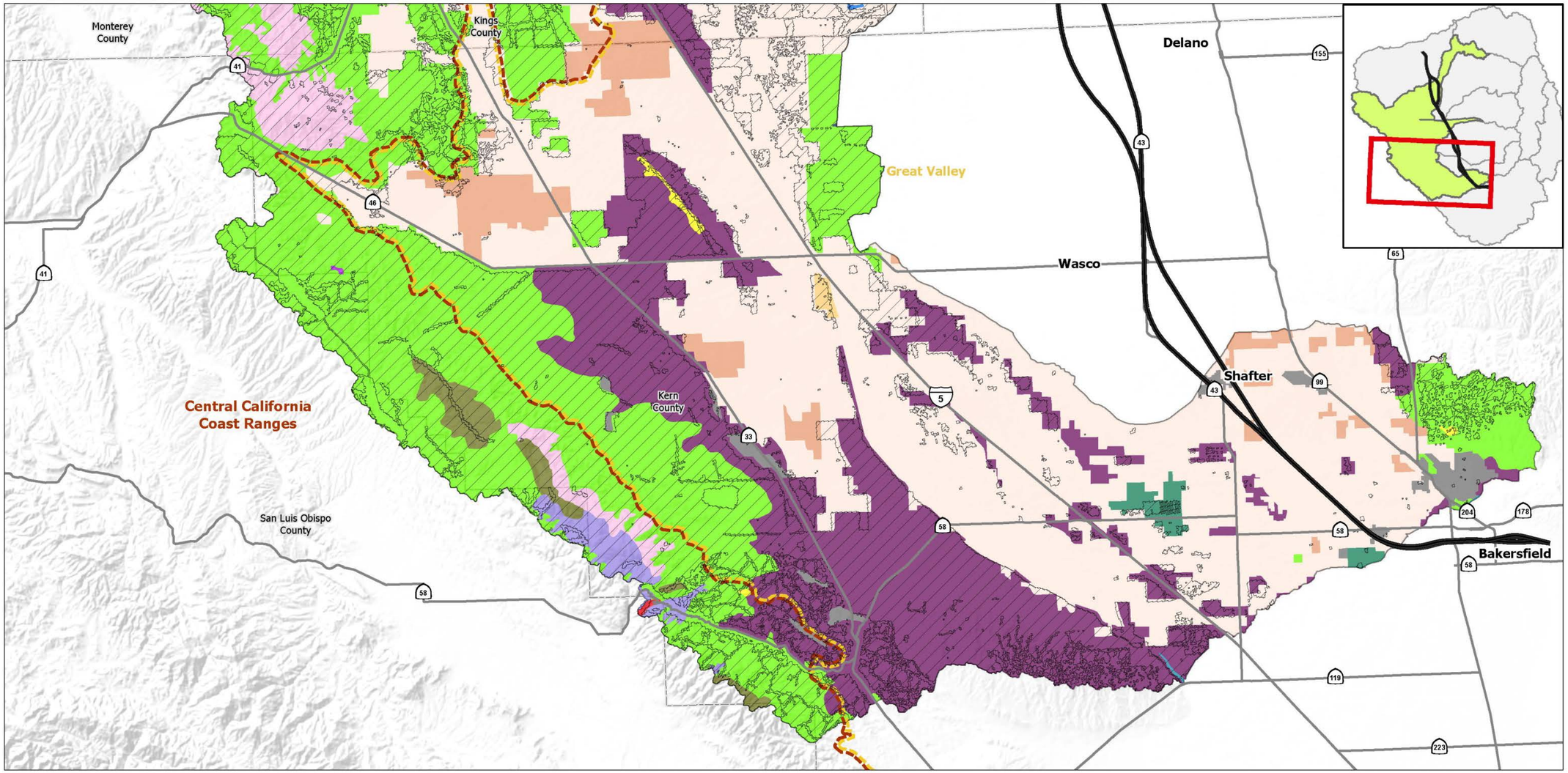


Figure 5-2a
Land use in the Tulare–Buena Vista Lakes Watershed (Sheet 2)



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Source: For ecological regions, U.S. Department of Agriculture, for GAP, Ca Department of Fish and Game
Basemap: USGS, 1999

N

0 4 8 Miles

0 8 16 Kilometers

Alternative alignments
Highway
County boundary
Natural Land Blocks

High-intensity
Cropland
Irrigated Row and Field Crops
Orchard and Vineyard
Urban
Vineyard

Low-intensity
Barren

Natural
Alkali Desert Scrub
Coastal Scrub
Sagebrush
Annual Grassland
Perennial Grassland
Freshwater Emergent Wetland
Lacustrine
Riverine
Valley-Foothill Riparian
Blue Oak-Foothill Pine
Chamise-Redshank Chaparral
Juniper
Mixed Chaparral
Blue Oak Woodland

USDA Ecological Sections
Central California Coast Ranges
Great Valley
Sierra Nevada
Sierra Nevada Foothills

Figure 5-2a
Land use in the Tulare–Buena Vista Lakes Watershed (Sheet 3)

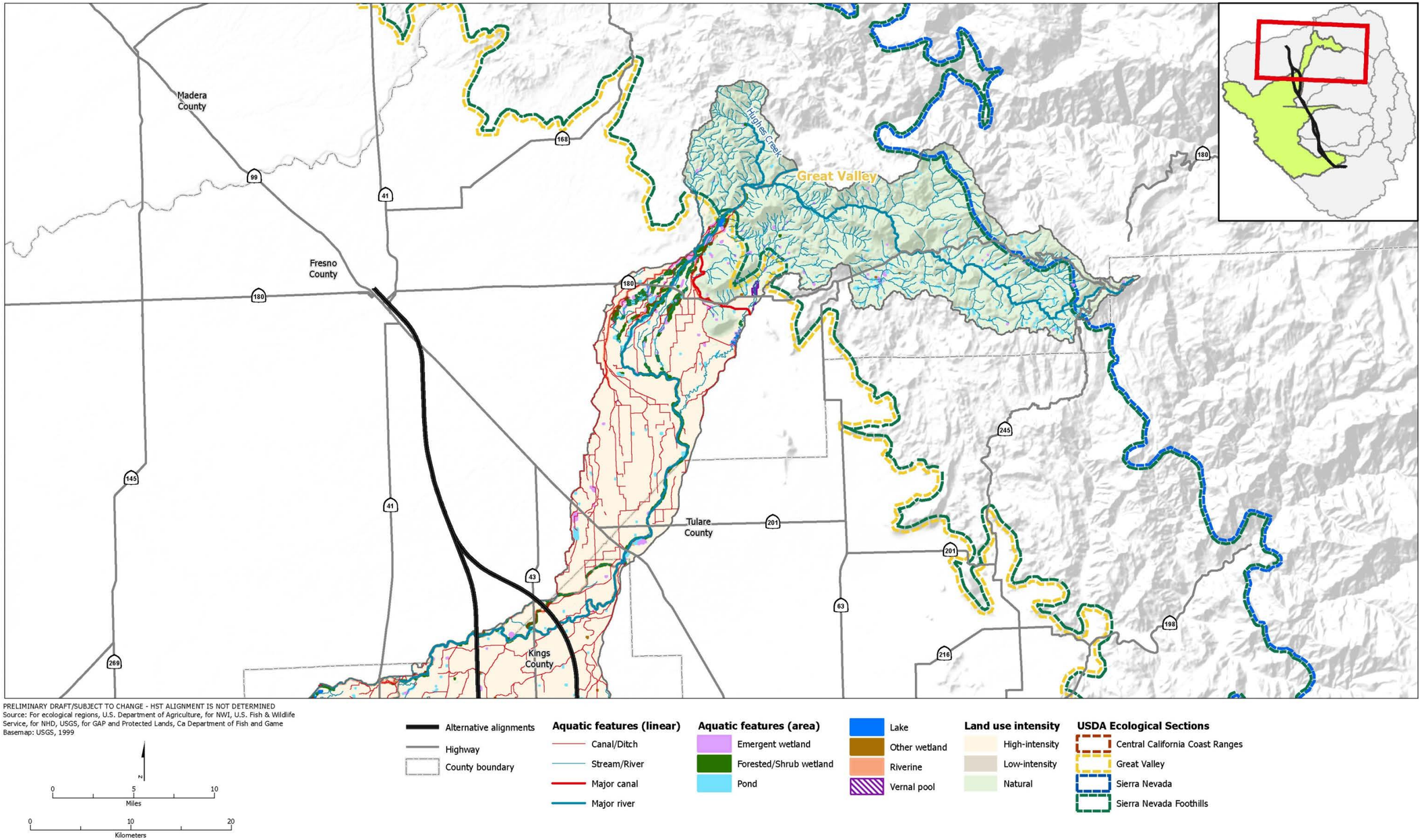


Figure 5-2b
Aquatic features in the Tulare–Buena Vista Lakes Watershed (Sheet 1 of 3)

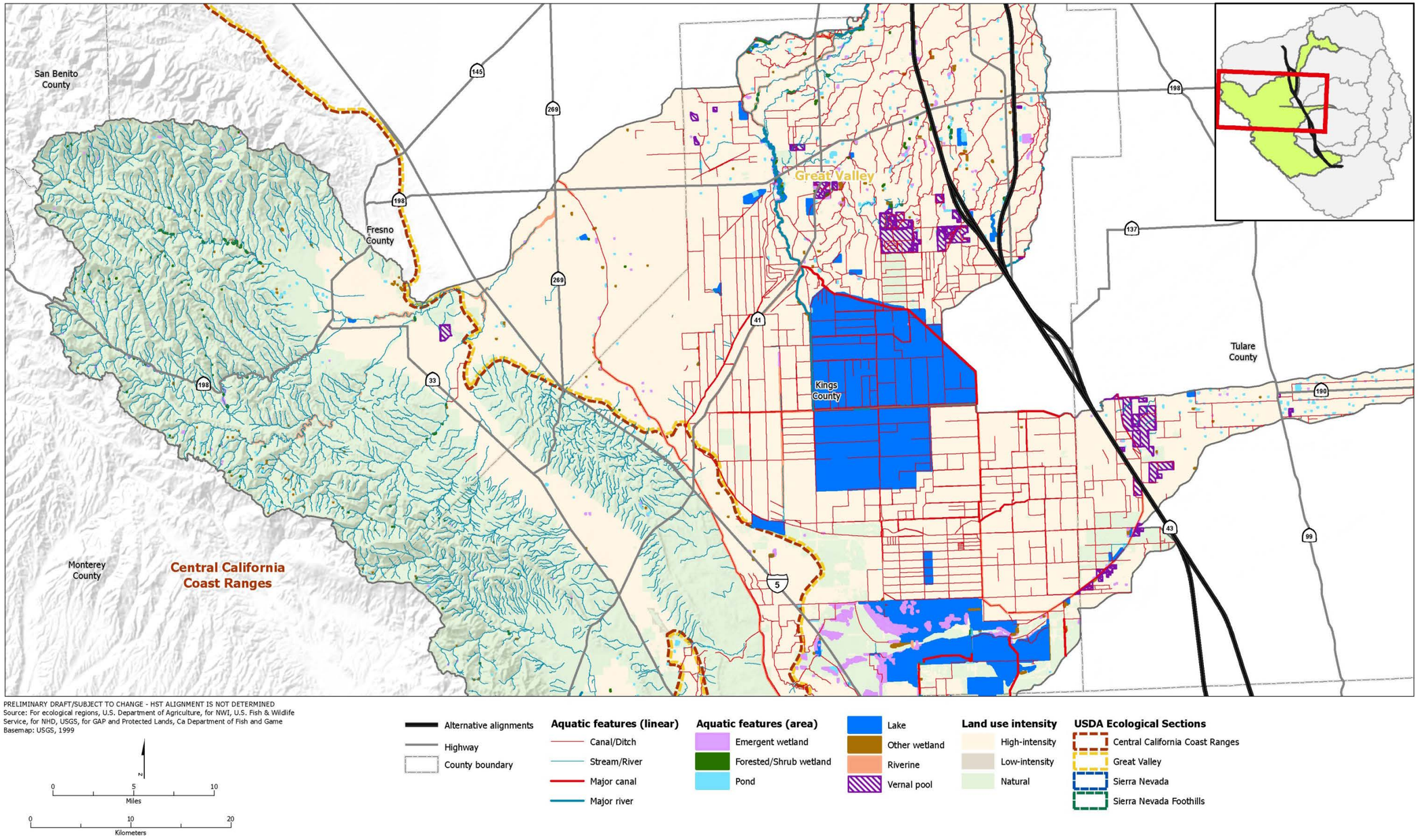


Figure 5-2b
Aquatic features in the Tulare–Buena Vista Lakes Watershed (Sheet 2)

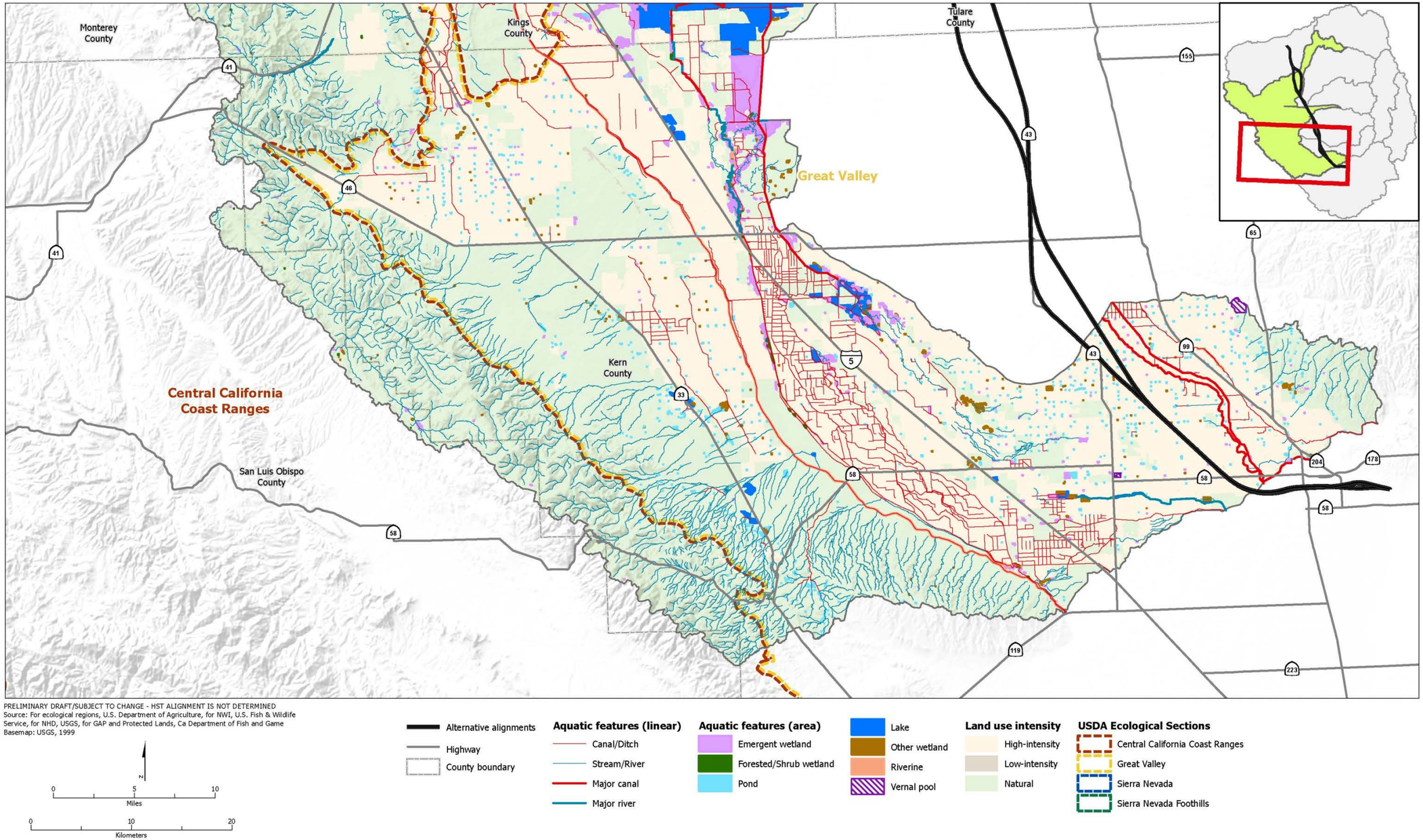


Figure 5-2b
Aquatic features in the Tulare–Buena Vista Lakes Watershed (Sheet 3)

5.2.3 Upper Kaweah Watershed

The Upper Kaweah Watershed includes the headwaters and main stems of the Kaweah River. Terminus Dam, built by 1962, splits the river into its upper and lower reaches. Water from the Kaweah begins to be diverted by a series of ditches just downstream of Terminus Dam. These diversion ditches continue to move water out of the Kaweah River and its tributaries throughout the watershed. At 3 miles downstream of the dam, the main river splits into the St. John's River and the Lower Kaweah River. The St. Johns River eventually becomes Cross Creek and terminates in the historical Tulare Lake bed (EPA 2007).

The Fresno to Bakersfield alternative alignments intersect with the southern tip of the Upper Kaweah Watershed along the valley floor. About 9.5 miles of the 118-mile Fresno to Bakersfield Section lay within this watershed. The land use in this area is primarily cropland and urban (Figure 5-3a). Aquatic features in this area include canals and ditches, though a vernal pool complex occurs adjacent to the HST alignment (Figure 5-3b).

Chart 5-4 shows most of the linear aquatic features within the Great Valley are in high-intensity land uses that likely result in poor ecological condition. Linear aquatic features in the Sierra Nevada and the Sierra Nevada Foothills remain in natural land contexts and host aquatic features likely in good ecological condition.

Table 5-4 shows that most (83%) of the vernal pools in the Great Valley are found in natural land uses, as are the emergent and forested wetlands. Many aquatic features in the Great Valley are found in high-intensity land uses, especially the canals and ditches that supply water to agricultural fields: 94% of these aquatic features are in poor ecological condition. The land use conditions in the Sierra Nevada and the Sierra Nevada Foothills are mostly natural and are considered to be in good condition.

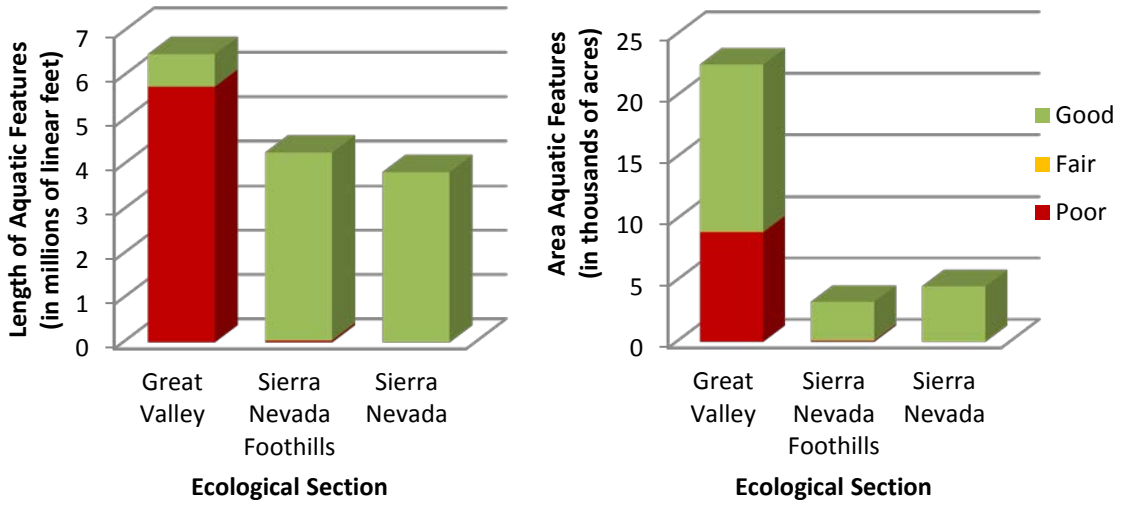


Chart 5-4
Area aquatic feature by conditions (in acres and linear feet) within the Upper Kaweah Watershed grouped by ecological section.

Table 5-4
Condition of Aquatic Features in the Great Valley Section of the Upper Kaweah Watershed

Water Feature (Area Measure)	Poor		Fair		Good		Total
	Acres/ Linear Feet	Percentage	Acres/ Linear Feet	Percentage	Acres/ Linear Feet	Percentage	
Canal/Ditch (LF)	4,447,834.1	94%	1,213.2	<1%	295,872.7	6%	4,744,920.0
Stream/River (LF)	1,314,006.5	75%	1,802.7	<1%	431,609.9	25%	1,747,419.1
Emergent Wetland (Ac)	337.7	36%	2.0	<1%	586.8	63%	926.5
Forested/Shrub Wetland (Ac)	53.8	23%	11.4	5%	170.7	72%	235.8
Lake (Ac)	4,315.8	82%	—	—	971.4	18%	5,287.2
Other Wetlands (Ac)	40.6	27%	—	—	107.7	73%	148.3
Pond (Ac)	815.2	83%	13.5	1%	153.1	16%	981.8
Riverine (Ac)	1,020.4	83%	6.2	1%	206.5	17%	1,233.1
Vernal Pool (Ac)	2,370.0	17%	—	—	11,366.5	83%	13,736.6

LF = linear feet
Ac = acres

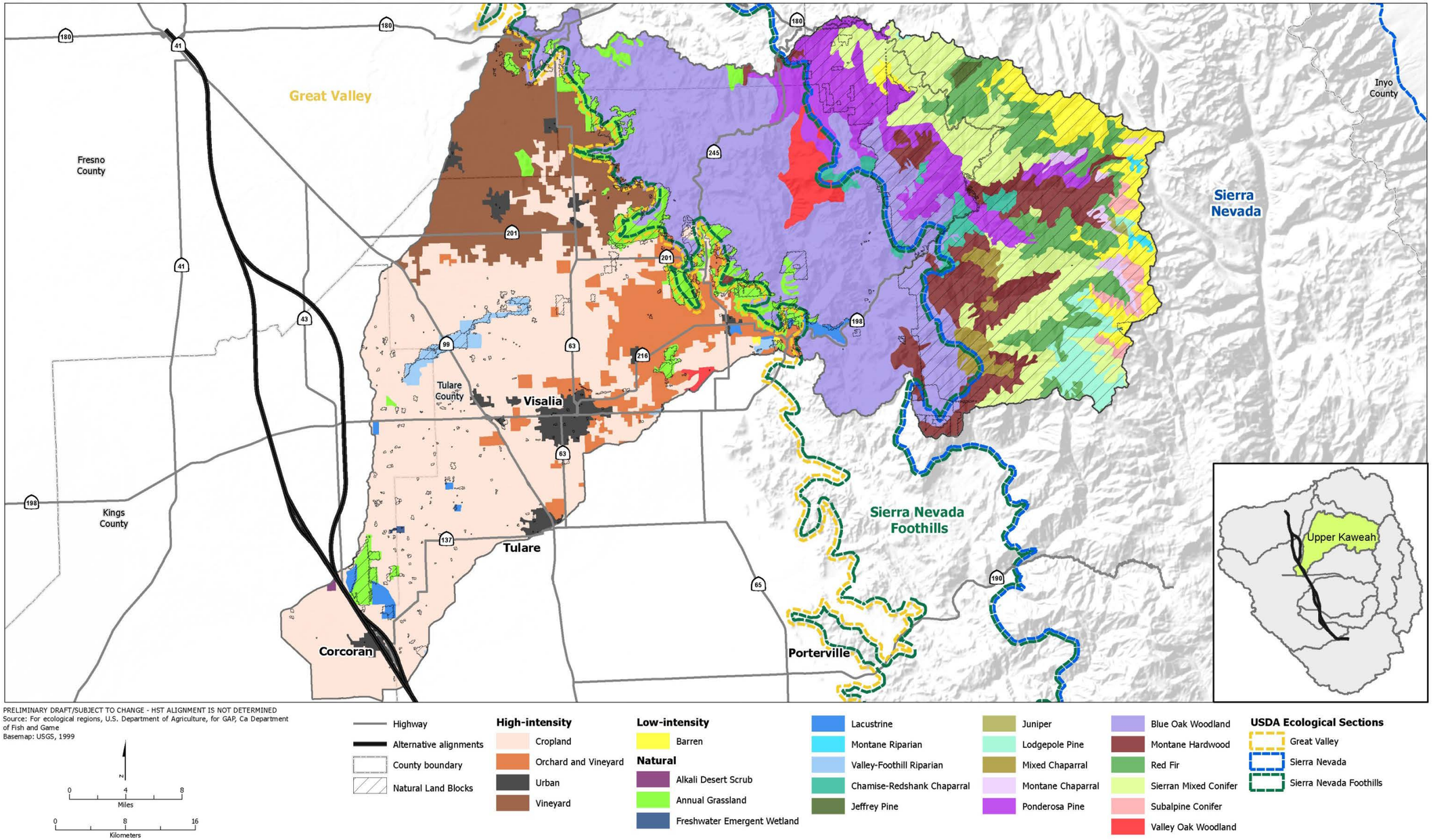


Figure 5-3a
Land use in the Upper Kaweah Watershed

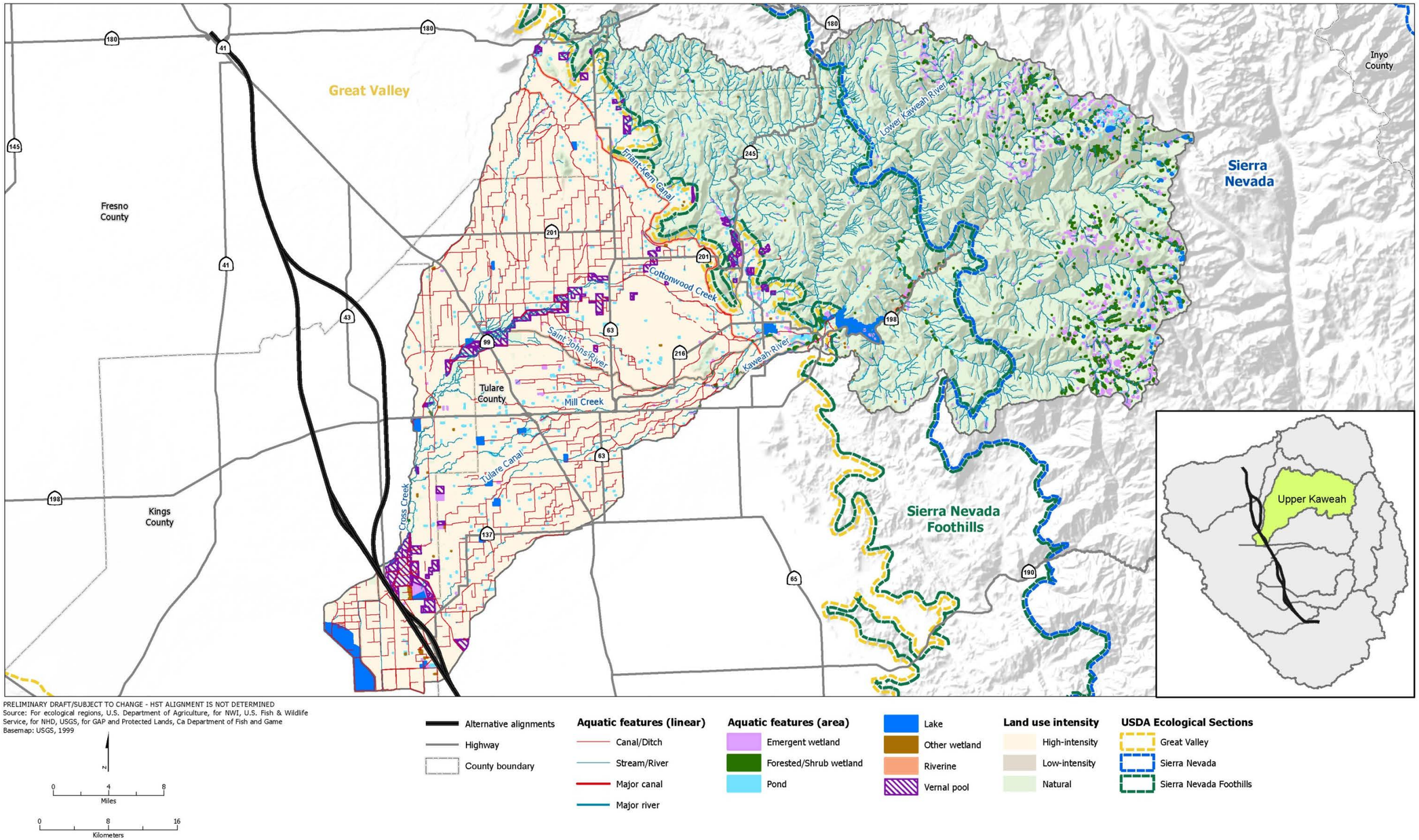


Figure 5-3b
Aquatic features in the Upper Kaweah Watershed

5.2.4 Upper Tule Watershed

The Upper Tule Watershed primarily consists of the Tule River and its tributaries and reaches. Success Dam retains waters from the upper regions of the Tule River, supplies irrigation water, and minimizes the risk of flooding downstream. Diversion ditches move flows from the river to canals just downstream of the dam. The Friant-Kern Canal inputs water into the Tule River in most years.

The Fresno to Bakersfield alternative alignments only intersect a tiny fragment of the Upper Tule Watershed, at the southern end of the watershed. Only about 1 mile of the 118-mile Fresno to Bakersfield Section occurs within the Upper Tule Watershed. Land use in this area is dominated by cropland (Figure 5-4a). The only aquatic feature that the alternative alignments intersect in this area is the terminus of Tule River as it enters the Tule Lake Basin (Figure 5-4b). This section of the river is generally dewatered, because water only reaches the Tule Lake Basin in extremely wet years.

Most of the linear aquatic features in the Great Valley section of the Upper Tule Watershed are within high-intensity land uses (Chart 5-5). Wetland acreages within the Great Valley are in mostly natural land uses (Chart 5-5). These features are far removed from the effects of the HST alternative alignments because most lie well to the east of the 1-mile segment of HST alignment in this watershed.

The canal/ditches, ponds, and riverine features are mostly within high-intensity land uses in the Great Valley (Table 5-5). In the Sierra Nevada and the Sierra Nevada Foothills ecological sections, nearly all aquatic features are within either low-intensity or natural land uses.

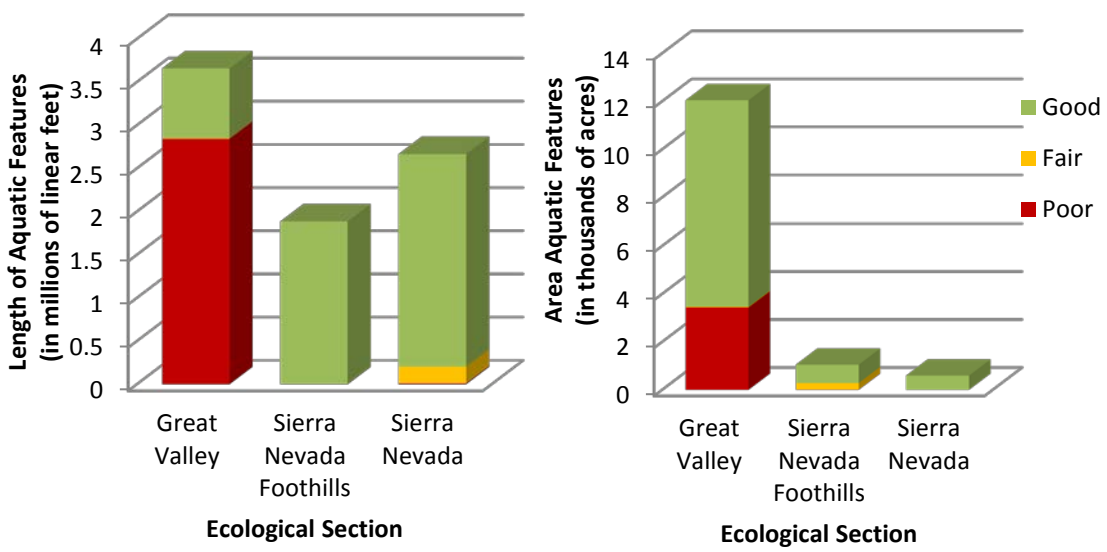


Chart 5-5
Area of aquatic features by conditions (in acres and linear feet) within the Upper Tule Watershed grouped by ecological section

Table 5-5
Condition of Aquatic Features in the Great Valley Section of the Upper Tule Watershed

Water Feature (Area Measure)	Poor		Fair		Good		Total
	Acres/ Linear Feet	Percentage	Acres/ Linear Feet	Percentage	Acres/ Linear Feet	Percentage	
Canal/Ditch (LF)	1,908,047.6	92%	564.6	<1%	163,154.4	8%	2,071,766.6
Stream/River (LF)	936,686.5	59%	6,629.0	<1%	644,195.2	41%	1,587,510.6
Emergent Wetland (Ac)	342.4	42%	18.6	2%	461.5	56%	822.5
Forested/Shrub Wetland (Ac)	124.1	60%	3.5	2%	78.0	38%	205.5
Lake (Ac)	425.5	15%	—	—	2,377.5	85%	2,803.0
Other Wetlands (Ac)	14.6	51%	—	—	14.2	49%	28.8
Pond (Ac)	765.2	87%	—	—	113.5	13%	878.7
Riverine (Ac)	905.3	97%	7.2	1%	23.0	2%	935.5
Vernal Pool (Ac)	861.0	14%	—	—	5,510.2	86%	6,371.2

LF = linear feet
Ac = acres

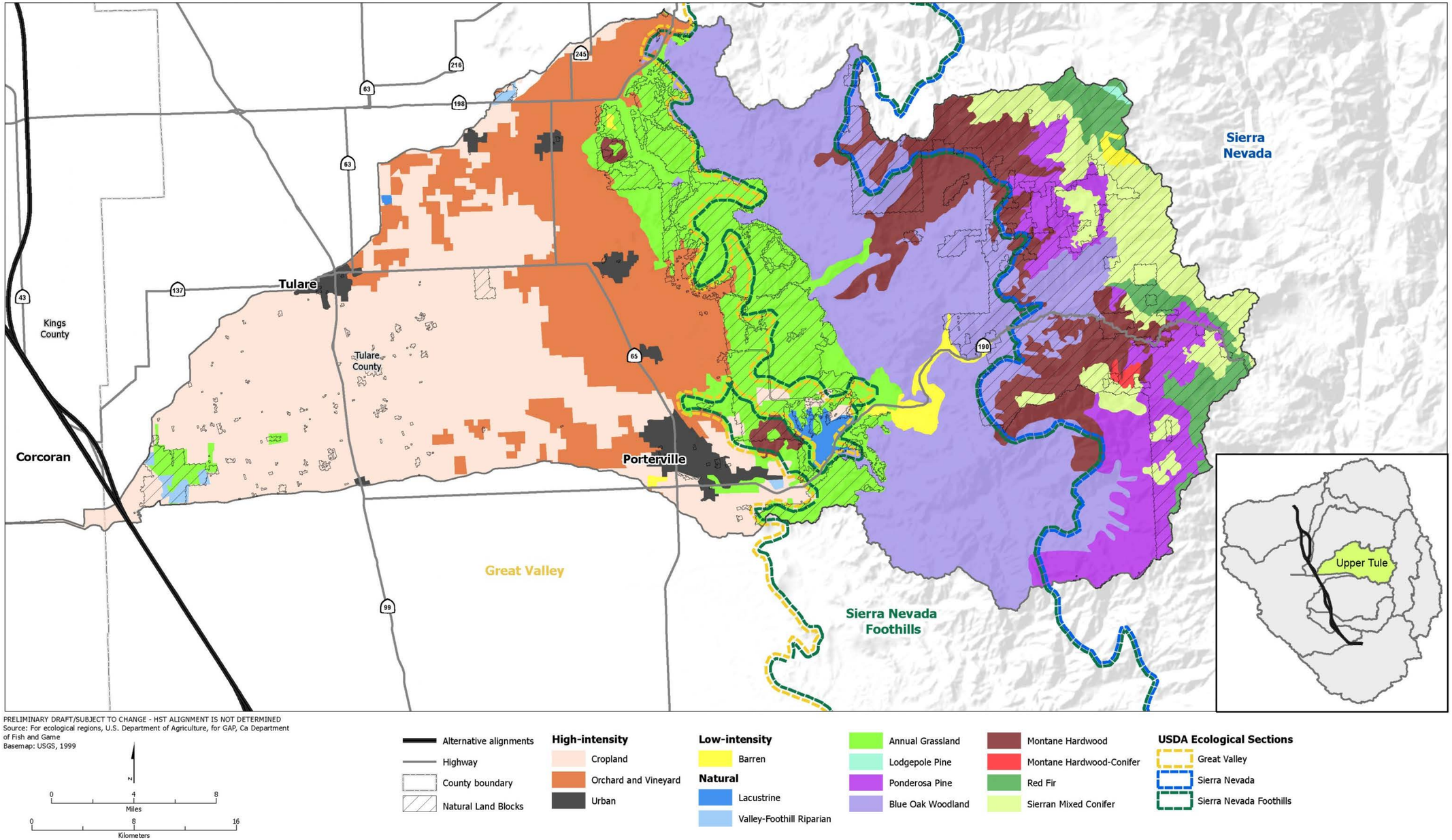


Figure 5-4a
Land use in the Upper Tule Watershed

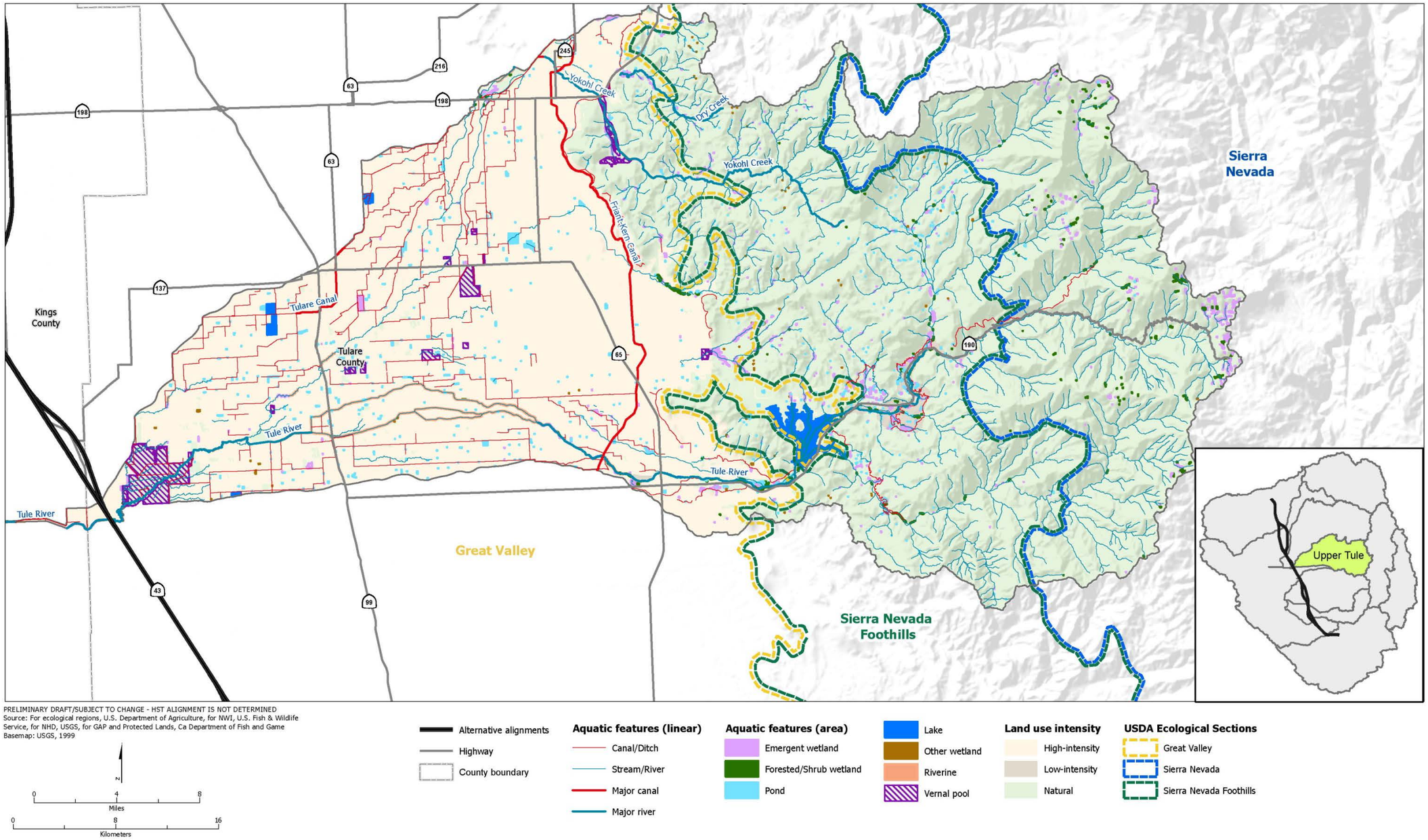


Figure 5-4b
Aquatic features in the Upper Tule Watershed

5.2.5 Upper Deer–Upper White Watershed

Deer Creek and the White River bring water from the Sierra Nevada to the Tulare Lake Basin in the Upper Deer–Upper White Watershed; both of these aquatic sources once flowed into the Tulare Lake bed but now are intermittent drainages on the Great Valley floor (EPA 2007). The Friant-Kern Canal crosses both Deer Creek and the White River as it runs north to south through the watershed. This watershed includes the Allensworth ER and the Pixley NWR area and some of the last remaining vernal pool complexes in the southern San Joaquin Valley.

The vernal pool ecosystems depend more on precipitation than on water carried from the headwaters. Vernal pools have developed in mostly isolated depressions that receive water from precipitation, local surface and shallow subsurface water, or sheet flow. Groups of adjacent pools are connected hydrologically via vernal swales and form complexes. Water is retained in these depressions by a shallow perching layer (largely claypans), and the water is unconnected or only partially connected to deeper groundwater layers (Holland 2009a). The vegetation, hydrology, and soils of these pools are unique because they occur in an alkali-scrub–type habitat rather than in true grassland, which is where the vernal pools to the north occur (Solomeshch et al. 2007).

The Fresno to Bakersfield Section alternative alignments intersect with the western portion of the Upper Deer–Upper White Watershed along the Great Valley floor. Approximately 21 miles of the 118-mile Fresno to Bakersfield section occurs in this watershed. Land use in this area includes significant areas of both natural lands and cropland (Figure 5-5a). Vernal pool features are mapped in both natural and high-intensity land uses and extend from Pixley NWR south and west across the HST alternative alignments (Figure 5-5b). Extant but fragmented natural areas occur along the Great Valley floor; these areas are primarily associated with Pixley NWR, Allensworth ER, and adjacent unprotected areas. Canals and ditches in the Great Valley section are in high-intensity land uses (i.e., croplands).

Chart 5-6 shows that most of the aquatic features that are in poor condition occur in the Great Valley. Relative to the other watersheds, proportionally more of the linear feet and acres in the Upper Deer–Upper White Watershed are in low-intensity land uses. This result may reflect the presence of protected wetlands in federal and state conservation areas. Linear features in the Sierra Nevada and the Sierra Nevada Foothills are in natural land uses.

Table 5-6 depicts the same trend: most aquatic features in the Sierra Nevada and the Sierra Nevada Foothills are in natural land use contexts. The situation in the Great Valley is more complex, with the ponds and canals/ditches in high-intensity land uses, and wetlands and vernal pools in mostly natural land uses.

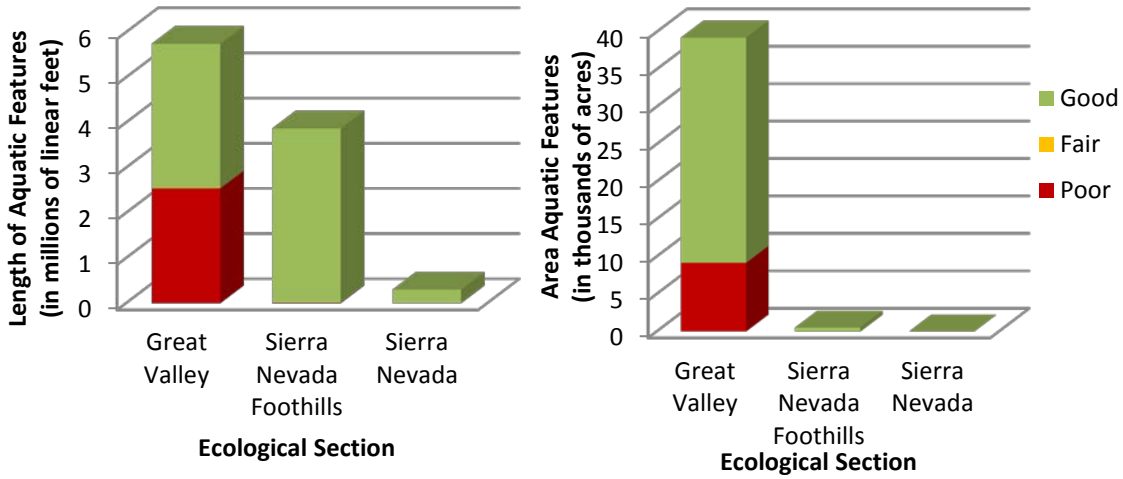


Chart 5-6
Area of aquatic features by conditions (in acres and linear feet) within the Upper Deer–Upper White Watershed grouped by ecological section.

Table 5-6
Condition of Aquatic Features in the Great Valley Section of the Upper Deer–Upper White Watershed

Water Feature (Area Measure)	Poor		Fair		Good		Total
	Acres/Linear Feet	Percentage	Acres/Linear Feet	Percentage	Acres/Linear Feet	Percentage	
Canal/Ditch (LF)	1,330,929.7	66%	2,957.0	<1%	683,751.5	34%	2,017,638.2
Stream/River (LF)	1,214,118.7	33%	—	—	2,515,305.3	67%	3,729,424.0
Emergent Wetland (Ac)	516.6	8%	—	—	5,594.4	92%	6,111.0
Forested/Shrub Wetland (Ac)	15.8	6%	—	—	245.4	94%	261.2
Lake (Ac)	766.8	19%	—	—	3,352.7	81%	4,119.6
Other Wetlands (Ac)	263.0	51%	—	—	254.1	49%	517.0
Pond (Ac)	570.4	92%	0.8	<1%	45.7	7%	616.9
Riverine (Ac)	410.0	59%	4.4	1%	282.8	41%	697.1
Vernal Pool (Ac)	6,626.9	25%	—	—	20,309.5	75%	26,936.4

LF = linear feet
Ac = acres

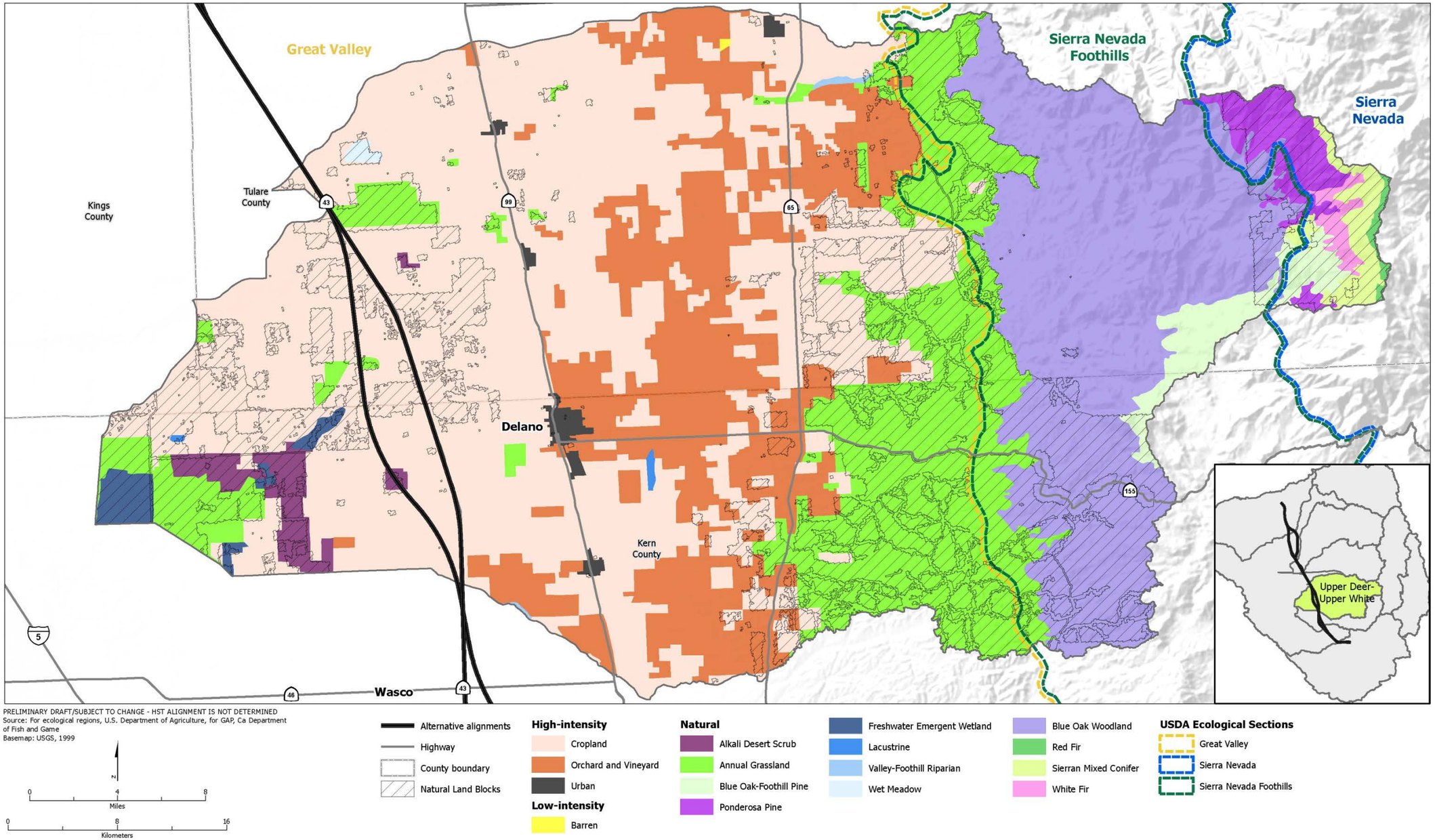


Figure 5-5a
Land use in the Upper Deer–Upper White Watershed

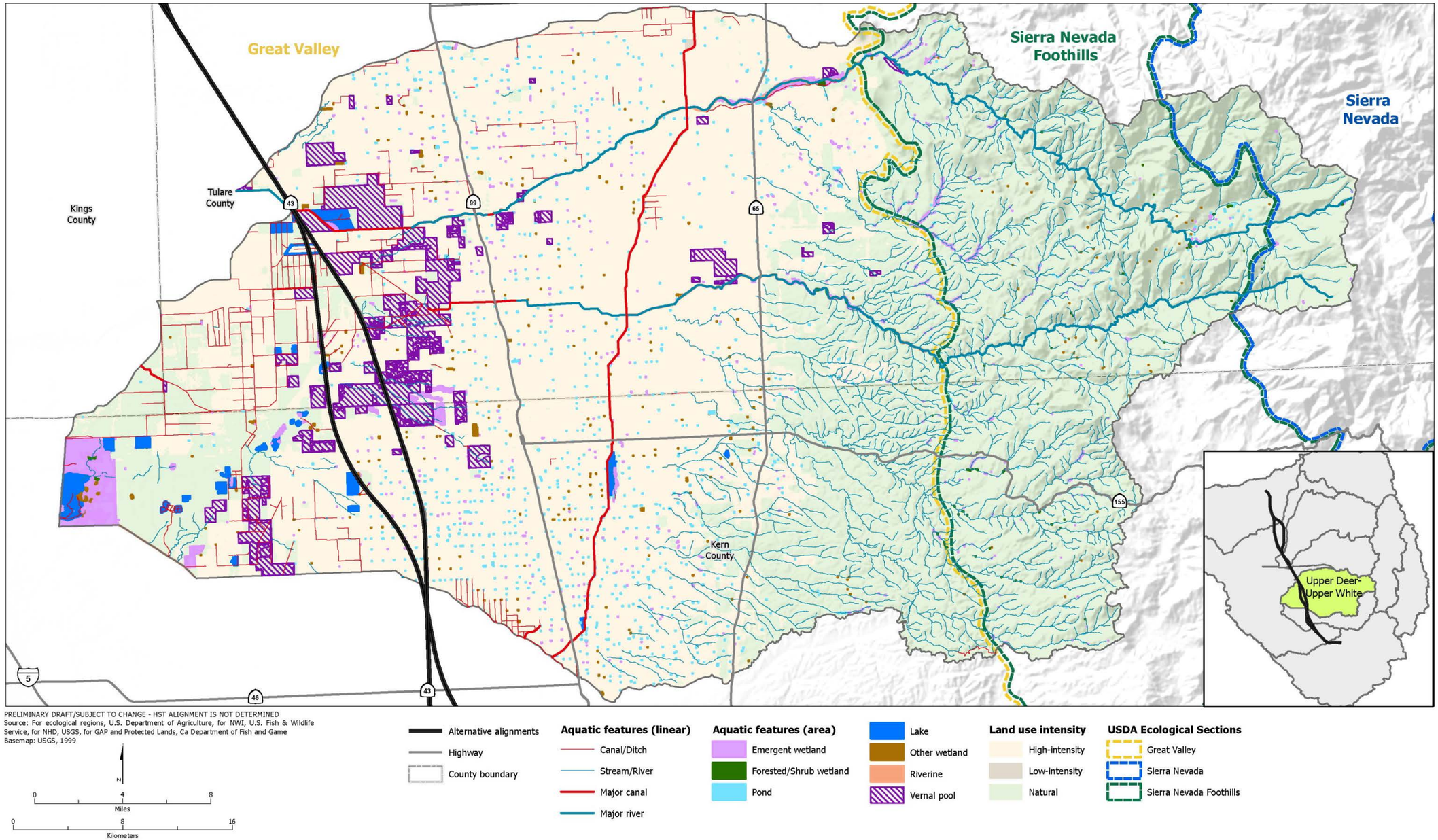


Figure 5-5b
Aquatic features in the Upper Deer–Upper White Watershed

5.2.6 Upper Poso Watershed

The Upper Poso Watershed features a single main creek, Poso Creek, which drains from its headwaters into the Central Valley, heading southwest. Poso Creek flows toward the Kern NWR, which is approximately 15 miles downstream of the study area (CVRWQCB 2007a).

The Fresno to Bakersfield alternative alignments are in the Great Valley Ecological Section of the Upper Poso Watershed. About 12 miles of the 118-mile Fresno to Bakersfield Section lay within this watershed. The areas within the watershed affected by the HST alternative alignments include urban Wasco and surrounding croplands and orchards (Figure 5-6a). The projected alignments will cross Poso Creek and modified ditches and canals (Figure 5-6b). The aquatic linear features and wetland acreages within the Sierra Nevada and the Sierra Nevada Foothills ecological sections are within natural habitat. Unlike most of the other watersheds profiled, most of the linear feet of aquatic features and wetland acreages in the Great Valley are in natural land uses (Chart 5-7).

The aquatic features in poor condition in the Great Valley are mostly canals, ditches, ponds and riverine features. Forested wetlands, streams and rivers, and vernal pools are found in low-intensity land contexts along the valley floor. All wetland features in the Sierra Nevada and the Sierra Nevada Foothills ecological sections are in good or fair areas (Table 5-7).

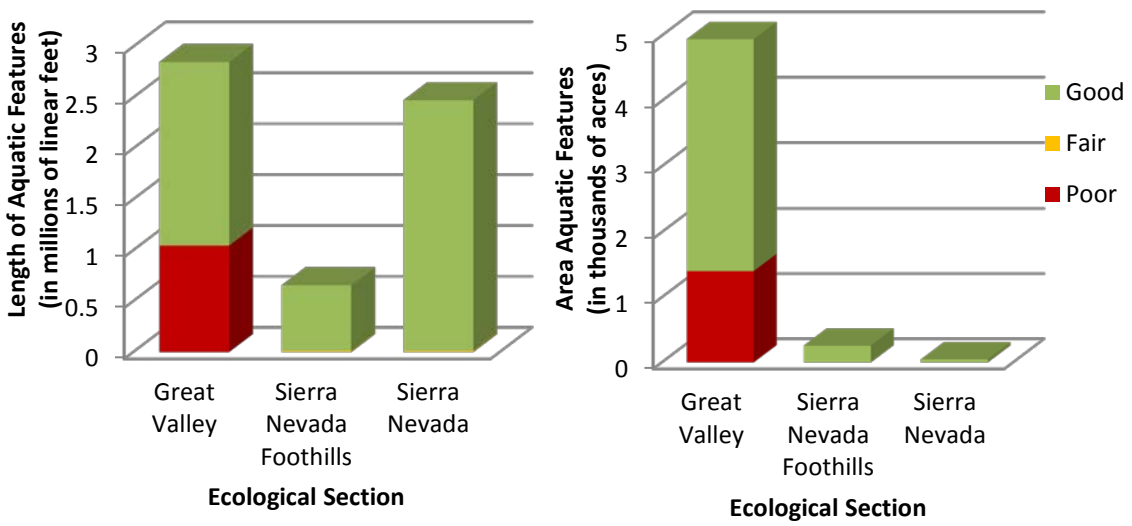


Chart 5-7
Area of aquatic features by condition (in acres and linear feet) within the Upper Poso Watershed grouped by ecological section.

Table 5.7
Condition of Aquatic Features in the Great Valley Section of the Upper Poso Watershed

Water Feature (Area Measure)	Poor		Fair		Good		Total
	Acres/Linear Feet	Percentage	Acres/Linear Feet	Percentage	Acres/Linear Feet	Percentage	
Great Valley							
Canal/Ditch (LF)	733,818.4	94%	—	—	44,889.0	6%	778,707.3
Stream/River (LF)	312,687.4	15%	—	—	1,757,952.0	85%	2,070,639.4
Emergent Wetland (Ac)	110.1	27%	—	—	292.1	73%	402.2
Forested/Shrub Wetland (Ac)	16.8	3%	—	—	531.5	97%	548.3
Lake (Ac)	402.2	62%	—	—	248.1	38%	650.2
Other Wetlands (Ac)	35.7	8%	—	—	405.8	92%	441.5
Pond (Ac)	277.9	88%	—	—	37.3	12%	315.2
Riverine (Ac)	426.4	78%	—	—	117.2	22%	543.6
Vernal Pool (Ac)	133.9	7%	—	—	1,911.1	93%	2,045.1

LF = linear feet
Ac = acres

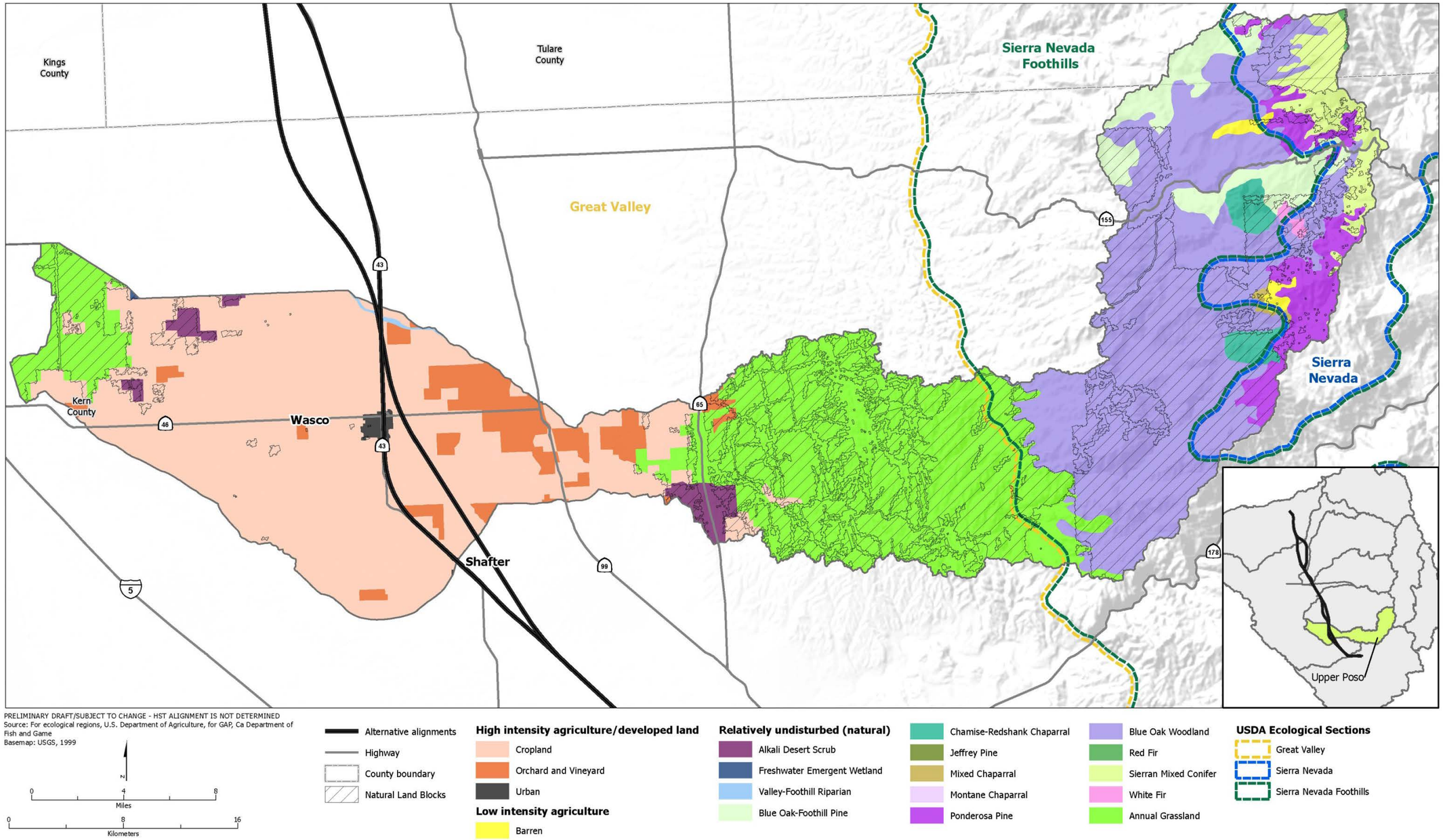


Figure 5-6a
Land uses in the Upper Poso Watershed

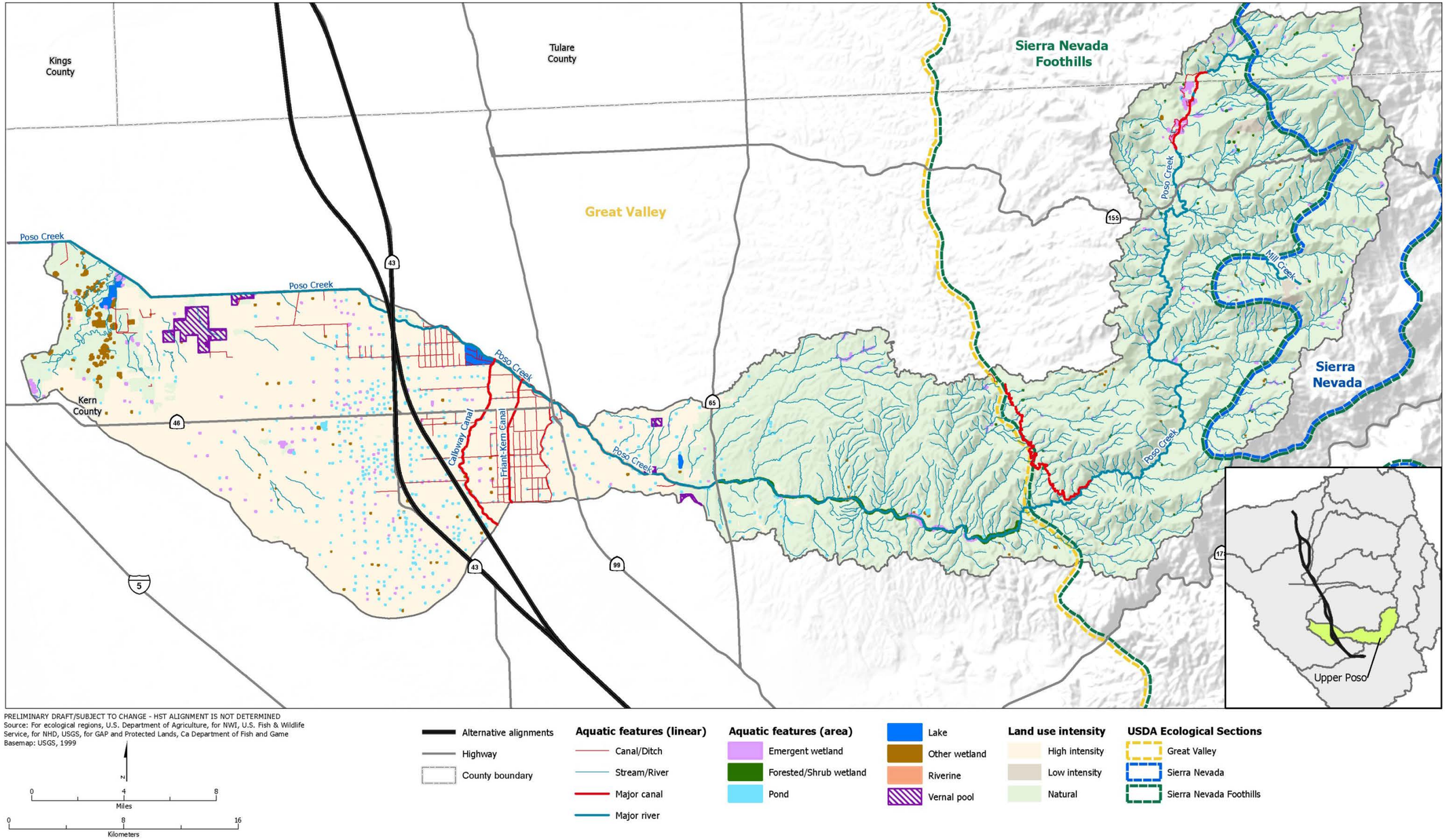


Figure 5-6b
Aquatic features in the Upper Poso Watershed

5.2.7 Middle Kern–Upper Tehachapi–Grapevine Watershed

The Kern River runs along the northern areas of the Middle Kern–Upper Tehachapi–Grapevine Watershed. The Kern River is second only to the Kings River in amount of runoff it drains and has the largest drainage basin of all the major Tulare Lake Basin rivers. The waters of the Upper Kern River are held back by Isabella Dam, at the junction of the south fork and the main stem of the river (EPA 2007). Below the dam, near Bakersfield, the Kern River flows are distributed into a series of canals. High-water flows that are not used for groundwater recharge eventually terminate in historical Buena Vista Lake. The Friant-Kern Canal terminates at the Kern River (EPA 2007).

The Fresno to Bakersfield Section alternative alignments only intersect this watershed in urban Bakersfield (Figure 5-7a), though the alignments do cross the Kern River (Figure 5-7b). About 8 miles of the 118-mile Fresno to Bakersfield Section occurs in the Middle Kern–Upper Tehachapi–Grapevine Watershed.

This watershed encompasses five ecological sections, though the areas affected by the alternative alignments are restricted to the Great Valley Ecological Section. Like most of the other watersheds profiled, the aquatic linear and wetland acreages in the Sierra Nevada, Sierra Nevada Foothills, Coast Ranges, and Mountain and Valley ecological sections are generally in low-intensity and natural land uses. The wetlands within the Great Valley Ecological Section have been altered to a greater degree (Chart 5-8).

The canals and ditches and vernal pools in the valley are in poor land contexts (Table 5-8). Most of the forested wetlands and stream/rivers in the valley are in natural land contexts. Unlike most of the other watersheds, the vernal pools in the Sierra Nevada Ecological Section are mostly in poor landscapes. This discrepancy possibly reflects the vernal pools in agricultural development and urbanization around the city of Tehachapi, near SR 202.

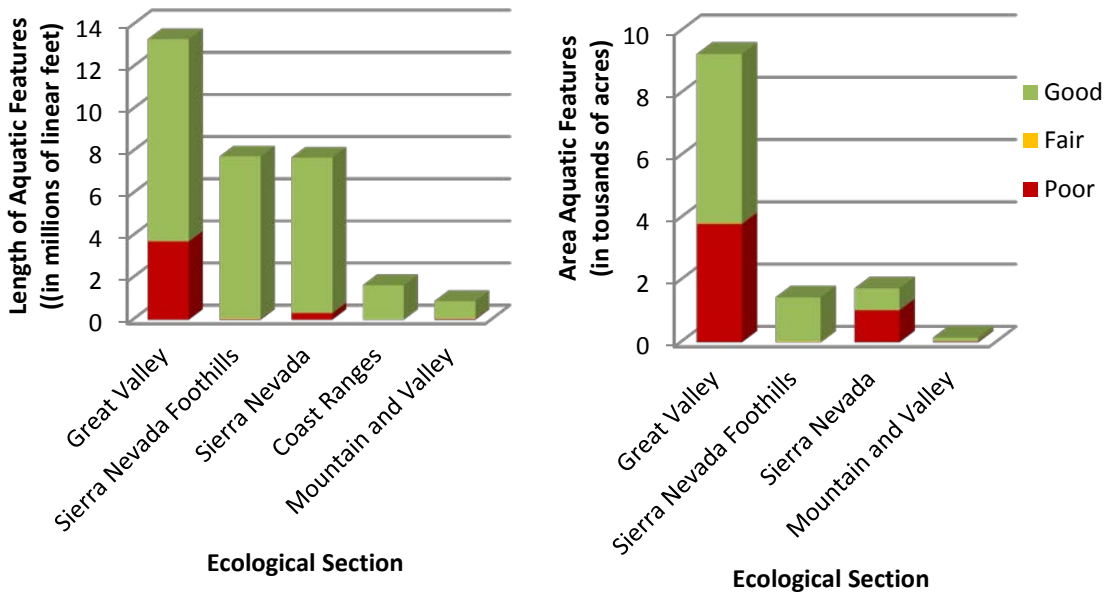


Chart 5-8
Area aquatic features by condition (in acres and linear feet) within the Middle Kern–Upper Tehachapi–Grapevine Watershed grouped by ecological section.

Table 5-8
Condition of Aquatic Features in the Great Valley Section of the Middle Kern–Upper Tehachapi–Grapevine Watershed

Water Feature (Area Measure)	Poor		Fair		Good		Total
	Acres/ Linear Feet	Percentage	Acres/ Linear Feet	Percentage	Acres/ Linear Feet	Percentage	
Great Valley							
Canal/Ditch (LF)	2,736,732.2	82%	—	—	617,199.7	18%	3,353,931.9
Stream/River (LF)	982,332.0	10%	5,211.4	<1%	8,976,064.3	90%	9,963,607.8
Emergent Wetland (Ac)	369.2	55%	1.7	<1%	304.0	45%	674.9
Forested/Shrub Wetland (Ac)	101.1	19%	4.9	1%	436.1	80%	542.2
Lake (Ac)	1,420.7	47%	—	—	1,576.8	53%	2,997.5
Other Wetlands (Ac)	482.1	32%	11.8	1%	1,008.6	67%	1,502.6
Pond (Ac)	765.7	67%	0.3	<1%	369.6	33%	1,135.7
Riverine (Ac)	606.3	26%	—	—	1,731.0	74%	2,337.3
Vernal Pool (Ac)	60.2	79%	—	—	15.8	21%	76.0

LF = linear feet
Ac = acres

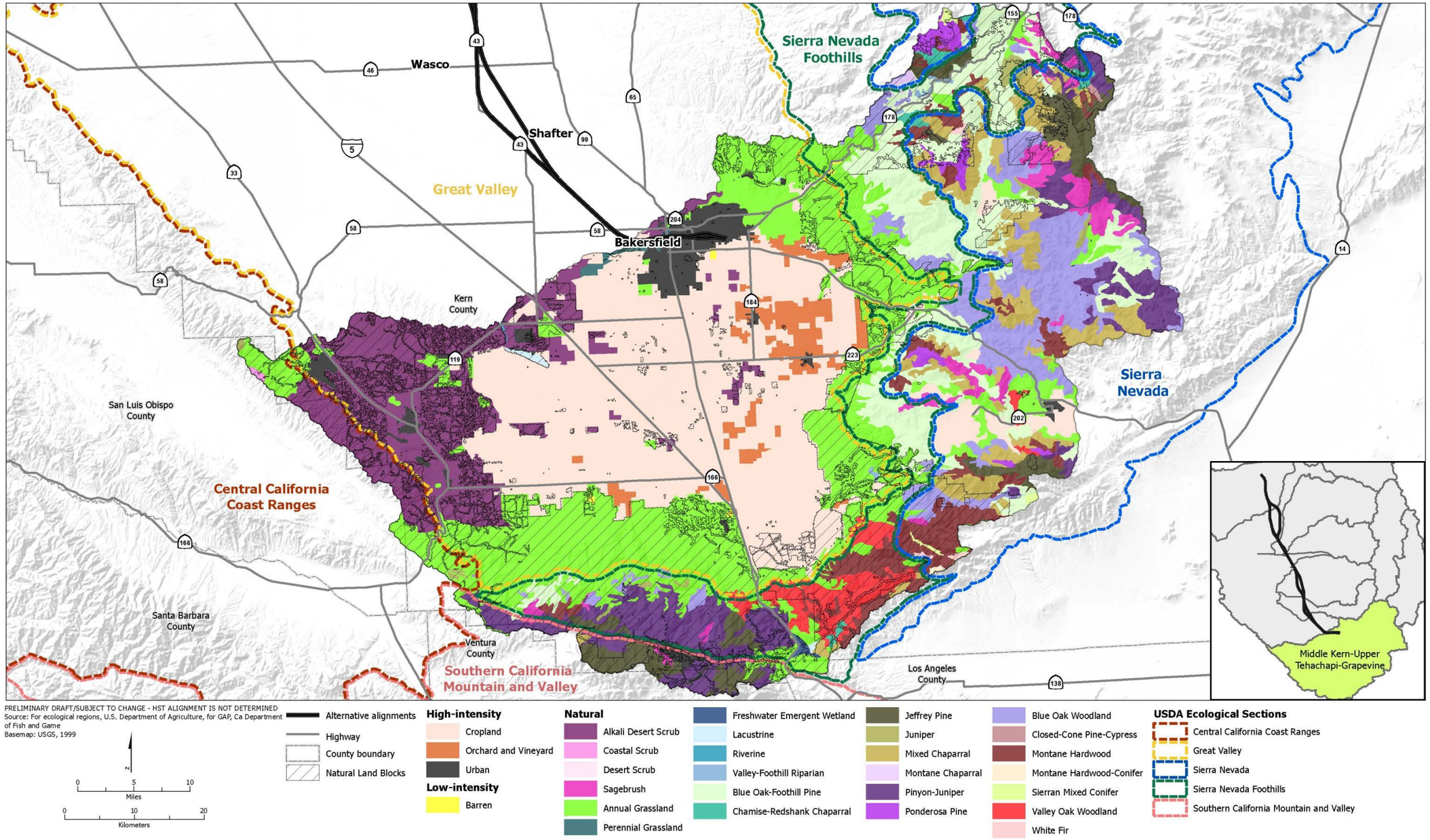


Figure 5-7a
Land use in the Middle Kern–Upper Tehachapi–Grapevine Watershed

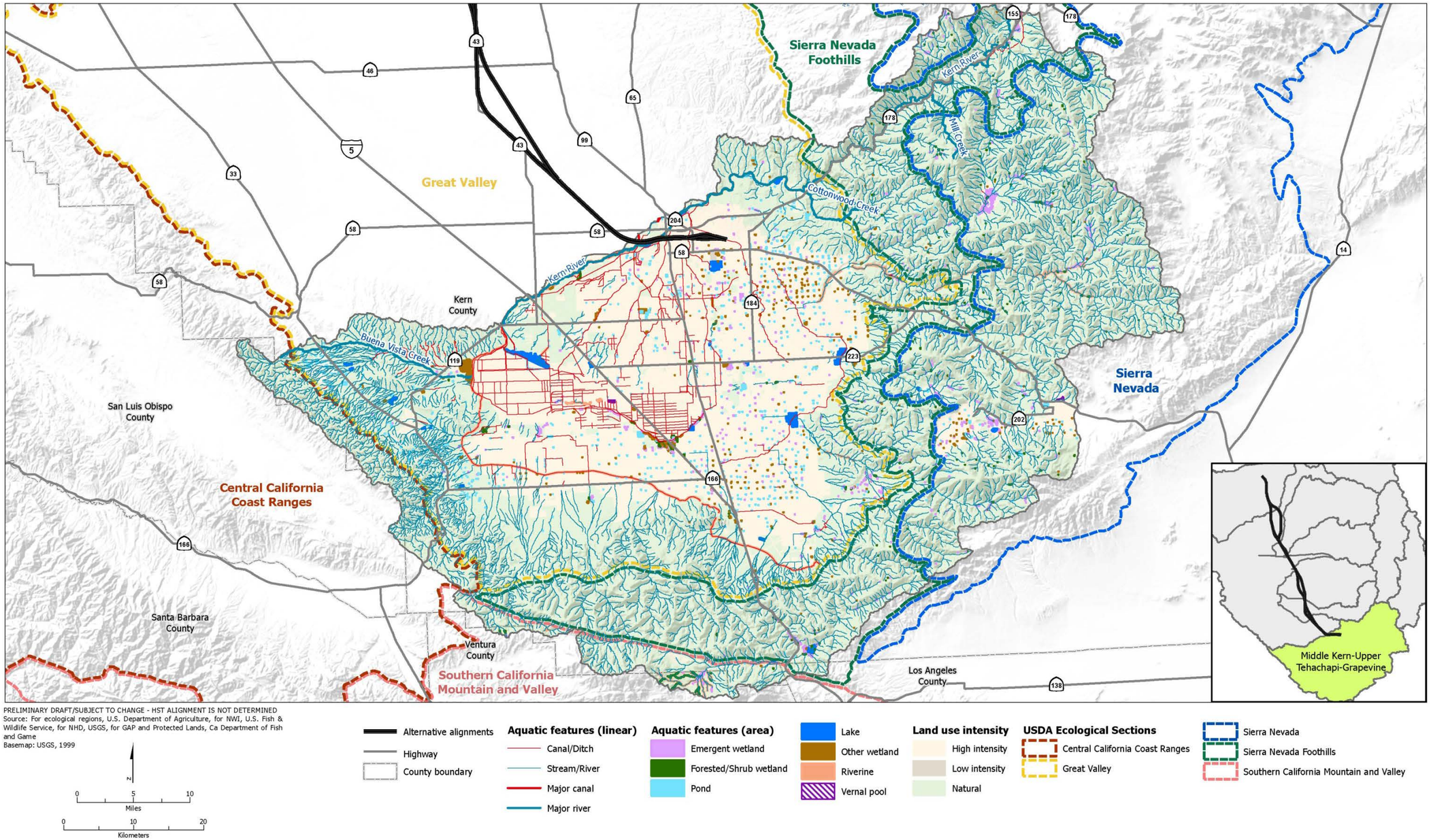


Figure 5-7b
Aquatic features in the Middle Kern–Upper Tehachapi–Grapevine Watershed

5.3 Watershed Profile Discussion

The watersheds within the Tulare Lake Basin cover a large and diverse area of California. In a few instances, differences in the features and conditions of the watersheds are identified through the development and presentation of the watershed profiles. On a larger, landscape level, the similarities across the watersheds in the Tulare Lake Basin are relatively consistent across the ecological sections. The profiles of each of the watersheds in the study area for the Fresno to Bakersfield Section alternatives share many similarities across the Tulare Lake Basin.

The headwaters of all of the watersheds profiled are mostly protected. In the Sierra Nevada, the Sierra Nevada Foothills, and the Coast Ranges ecological sections, impacts that degrade the quality of aquatic features are mostly dams and their associated reservoirs. Proportionally, these ecological sections do not contribute nearly as much linear feet and acreage of aquatic features as the Great Valley Ecological Section.

Most of the impacts to aquatic resources occur in the Central Valley: throughout the Tulare Lake Basin and across all the watersheds profiled, the valley has largely been manipulated through the conversion of land to agricultural, urban development, and transportation uses. These conversions have resulted in the loss, manipulation, and degradation of aquatic resources through upper watershed impoundments, removal of riparian vegetation, and other hydrological manipulations (e.g., pumping, siphoning, diverting, filling, dredging, plowing of aquatic resources). These activities have resulted in the extensive reduction of riparian habitat, the accretion of streams, and the loss of Tulare Lake, Buena Vista Lake, and Kern Lake as well as other sensitive aquatic features (emergent wetlands, vernal pools and swales).

Furthermore, the historical and current land use patterns have blurred the boundaries of the watersheds through the construction of extensive networks of irrigation canals and ditches. As water moves to the Great Valley, increasing amounts of water are diverted from natural stream and river systems to highly modified canals and ditches. In the Great Valley Ecological Section, high-intensity land uses have had two primary effects on aquatic features: linear features have been converted into canals and ditches and (2) where water historically flowed east to west from the headwaters into the valley floor, the Great Valley is now primarily demarcated by two north to south features, the California Aqueduct and the Friant-Kern Canal. Although not reflected in this analysis, the acreages of aquatic features in the Great Valley have been drastically decreased from their historical distributions. This decrease is perhaps most dramatically evident in the loss of the four historical lake basins: the Tulare, Goose, Buena Vista, and Kern lakes. To illustrate the blurred boundaries between the watersheds, Table 5-9 summarizes the NHD-named linear features that occur in more than one watershed for more than 0.5 mile.

Table 5-9
Summary of NHD-Named Features That Occur in Multiple Watersheds

NHD-Named Feature	HUC-8 Watershed						
	Upper Dry	Tulare–Buena Vista Lakes	Upper Kaweah	Upper Tule	Upper Deer–Upper White	Upper Poso	Middle Kern–Upper Tehachapi–Grapevine
Alta East Branch Canal		X	X				
Calloway Canal		X	X	X		X	X
Cameron Creek			X	X			
Cole Slough	X	X					

Table 5-9
Summary of NHD-Named Features That Occur in Multiple Watersheds

NHD-Named Feature	HUC-8 Watershed						
	Upper Dry	Tulare–Buena Vista Lakes	Upper Kaweah	Upper Tule	Upper Deer–Upper White	Upper Poso	Middle Kern–Upper Tehachapi–Grapevine
Cross Creek		X	X				
Deep Creek Cut			X	X			
East Branch Cross Creek			X	X			
East Branch Lakeside Ditch		X	X				
Enterprise Canal	X	X					
Fowler Switch Canal	X	X					
Friant-Kern Canal		X	X	X	X	X	X
Kimble Ditch		X	X				
Lewis Ditch		X	X				
McCall Ditch	X	X					
Middle Branch Cross Creek			X	X			
Mill Ditch	X	X					
North Fork Kings River	X	X					
Outlet Canal	X	X					X
Poplar Ditch	X	X		X			
Poso Canal	X	X			X		
Poso Creek	X	X			X	X	
Railroad Ditch	X		X	X			
Settlers Ditch		X	X				
South Branch Summit Lake Ditch	X	X					
Taylor Canal		X		X			
Tulare Lake Canal		X		X			
Tule River		X		X			
Wilbur Ditch		X		X			
Total	12	23	13	12	3	3	3

NHD = National Hydrography Dataset
HUC-8 = Hydrologic Unit Code 8

Due to the linear nature and north-to-south orientation of the Fresno to Bakersfield Section, impacts to aquatic features occur across all seven watersheds. Many of these watersheds and their respective aquatic features are minimally disturbed by the project (the total disturbance from the project in all watersheds in the Great Valley is approximately 0.25%). A number of the

Fresno to Bakersfield alternatives have relatively small footprints within a few different watersheds. For example, the footprints of the Hanford West Bypass 1 and 2 alternatives occur in three watersheds (the Upper Dry, Tulare–Buena Vista Lakes, and Upper Kaweah watersheds) but cover an area of less than 0.1% of the total area of these watersheds.

Some of the differences between the watersheds are important to note for the purposes of impact evaluation and mitigation planning. The vernal pool landscapes, which are sensitive, difficult to replace, and generally in good condition, are primarily in the Upper Deer–Upper White Watershed (26,936 acres). The vernal pool landscapes in the three other watersheds with the most vernal pool landscapes are as follows: Upper Dry Watershed (16,966 acres), Tulare–Buena Vista Lakes Watershed (11,237 acres), Upper Kaweah Watershed (13,736 acres). Although the vernal pool landscapes are not as prevalent in these three other watersheds, they occupy six times the total land area as the Upper Deer–Upper White Watershed (4,760,678 vs. 783,532 acres). Al though the Upper Deer–Upper White Watershed is not the largest watershed, the vernal pool landscapes are most prevalent (densest) in this watershed, and it has a high percentage of vernal pool landscapes in good condition (75%).

The Fresno to Bakersfield Section of California HST System occurs entirely within the Great Valley Ecological Section. The project impact profile and the subsequent compensatory mitigation are similar across all seven watersheds, except perhaps the Upper Deer–Upper White Watershed. The Upper Deer–Upper White Watershed contains a significantly greater area (acres) of vernal pool landscapes (both in terms of number of acres and percentage of total watershed area) and for this reason should be a focus of compensatory mitigation efforts.

The 2008 Mitigation Rule states a preference for mitigation using a watershed approach, but acknowledges that for linear projects, where impacts are distributed across multiple watersheds, more ecological functions and values may be created, enhanced, or restored in fewer, consolidated mitigation projects. Because of the degraded condition of aquatic resources in the region, the focus of the compensatory mitigation should be consolidated mitigation projects, which would provide the best opportunity to benefit the region, such as restoring the historical Tulare Lake and associated emergent wetlands. The compensatory mitigation may also be consolidated in the watershed or watersheds that would experience significant ecological loss of aquatic resources in excellent or good condition.

Section 6.0
Results: Impact Evaluations

6.0 Results: Level 2 Impact Evaluation

This section describes the impacts of the Fresno to Bakersfield Section on aquatic resources, the existing conditions of those resources, the findings of the relative condition assessment of these resources, the post-project condition of those resources, and the compensatory mitigation required to offset negative effects to those resources. The impact evaluation is conducted for each of the Fresno to Bakersfield Section alternatives. The impact profile has three components: direct-permanent impacts, direct-temporary impacts (in areas where the impact would occur only during construction), and the indirect-bisected and indirect impacts within the construction and project footprints (250-foot buffer). This section uses tables and figures to describe, illustrate, and summarize the results of the data analysis methodology described in Section 3.2, Methodology: Existing Conditions, Section 3.3, Methodology: Impact Calculations, and Section 3.4, Methodology: Post-Project Condition.

Using the Level 1 Watershed Profiles developed in Chapter 5 and Level 2 condition assessment and impact evaluation, a comparison was made to determine whether the impacted aquatic resources along each alternative alignment are "typical" of the watershed or whether the impacts would result in significant adverse impacts on sensitive aquatic resources that are rare or unique to the watershed.

The Level 2 Impact Evaluation was largely developed through GIS-based modeled outputs, which established a set of projections, along with a select set of modifications (where features don't follow the projections based on best professional judgment). The projections and modifications are described in detail in Chapter 3. The development of the model allows for relatively quick recalculation of impacts, existing conditions, and post-project conditions as the alternative alignments and the engineer's design evolves. The data used—and included in this report—are based on the footprints associated with the June 2012 engineering design in the *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* (Authority and FRA 2012a).

Additional information and details regarding existing conditions (i.e., the results of CRAM) can be found in Appendix A. This report summarizes the methods used, the field work, and the overall CRAM scores and attribute scores for the aquatic resources in the study area.

The Compensatory Mitigation Plan provides a summary of the compensatory mitigation requirements and identifies potential compensatory mitigation properties and options. The Compensatory Mitigation Plan also identifies the mechanism, long-term management, and instruments the Authority will use to offset the loss of aquatic resources such that no net loss of aquatic functions or values will be incurred as a result of the Fresno to Bakersfield Section.

6.1 Impacts on Aquatic Resources

Impacts to special aquatic resources are described in a number of technical reports and planning documents including the *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* (FRA and Authority 2012a), *Fresno to Bakersfield Biological Resources and Wetlands Technical Report* (Authority and FRA 2012b), and the Checkpoint C Summary Report (Authority and FRA 2012e). Central to all discussion regarding impacts to the aquatic resources is the step wise process to first take steps to avoid impacts to aquatic resources, minimize those impacts that cannot be avoided, document the extent of aquatic resource encroachment and mitigate to the extent that there is no net loss of aquatic functions or services. The step wise process to avoid and minimize impacts to aquatic resources is well documented in Chapter 2 of the *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* (Authority and FRA 2012a), the *Fresno to Bakersfield Section: Checkpoint C Summary Report* (Authority and FRA 2012e), and the *Fresno to Bakersfield Section: Section 404 Individual Permit Application* (Authority and FRA 2012f).

6.1.1 Watershed Evaluation

As discussed in Section 5.3, Watershed Profile Discussion, the watersheds present in the Fresno to Bakersfield Section of the HST have similar types of features and environmental conditions. The watershed boundaries have largely been blurred through high-intensity land conversion and development, leaving few aquatic features in natural landscapes within the Great Valley. It is difficult to present a meaningful comparison of watershed-level impacts because of the north-south orientation and linear nature of the HST project, and the numerous (9) HST alternatives under consideration. Because the watersheds are similar, the presentation and analysis of impacts by watershed does not provide for a meaningful comparison of information that would be used to make project decisions. Where differences in watershed profile arise, those impacts are presented and discussed separately throughout this subsection. This is the case primarily for the concentrations and impacts to vernal pool features in the Upper Deer–Upper White Watershed.

However, understanding project impacts by watershed may be useful in mitigation planning and understanding where impacts to sensitive aquatic resources (or those in good condition) occur. While a comparison by alternative is not possible, Table 6-1 provides the range of potential project impacts that could occur to given type of aquatic resource by watershed. A range is presented because there are several HST alternatives that occur in each watershed, and depending on which alternative is ultimately selected as the least environmental damaging practicable alternative, the impacts to a given watershed would vary. This table should only be used for a coarse understanding of the watersheds and the distribution and types of features that are present and the understanding of the range of potential direct and indirect impacts.

In general, the range and of potential impacts to manipulated or man-made aquatic resources are similar across all watersheds. Of important note, vernal pool and swale impacts primarily occur in the Upper Deer–Upper White Watershed, where there are concentrations and extensive vernal pool landscapes, as described in Section 5.2.5, Upper Deer–Upper White Watershed, and Section 5.3, Watershed Profile Discussion. Other watersheds may experience loss of vernal pools but these losses are small and less significant when compared against those in the Upper Deer–Upper White Watershed. Because all watersheds contain a dominant seasonal riverine feature that runs east-west and the Fresno to Bakersfield Section runs north-south, impacts to seasonal riverine feature are similar across the watersheds.

Table 6-1
Range of Direct and Indirect Impacts to Aquatic Resources by Watershed

Watershed	Impact Type	Range of Impact Acreage by Aquatic Resource (acres)							
		Emergent Wetland	Vernal Pools and Swales	Seasonal Wetland	Canals/ Ditches	Lacustrine	Seasonal Riverine	Riparian[A]	Total
Upper Dry	Direct	—	—	0.67	4.05–4.13	1.15–1.15	0.00–0.39	0.00–0.95	5.87–7.29
	Indirect	—	0.05	—	4.94–5.29	12.14	0.00–0.79	0.00–2.64	17.13–20.91
Tulare–Buena Vista Lakes	Direct	—	0.60	0.66–0.67	20.85–28.21	10.09–11.67	0.41–1.50	0.73–2.54	33.34–45.19
	Indirect	0.00–0.92	4.13–4.58	6.63	41.47–50.77	13.90–28.96	2.77–12.85	6.41–17.66	75.31–122.37
Upper Kaweah	Direct	—	0.00–1.09	—	5.89–11.38	0.00–0.72	0.22–2.52	—	6.11–15.72
	Indirect	—	0.00–1.32	1.55–5.48	7.74–17.61	0.79–5.20	1.17–1.28	—	11.25–30.89
Upper Tule	Direct	—	0.00–1.19	0.00–0.43	1.04–1.27	0.65–3.67	0.24–0.28	0.38–0.71	2.31–7.55
	Indirect	—	0.00–0.74	0.01–1.20	0.20–0.44	<0.01–2.57	0.80–2.72	1.02–1.84	2.03–9.51
Upper Deer–Upper White	Direct	—	1.07–9.44	0.12–0.70	4.92–6.20	18.38–21.25	0.14–0.14	0.12–0.31	24.75–38.04
	Indirect	—	11.08–33.77	13.52–49.79	6.66–7.45	89.98–104.15	0.70–0.79	0.65–0.72	122.59–196.67

Table 6-1
Range of Direct and Indirect Impacts to Aquatic Resources by Watershed

Watershed	Impact Type	Range of Impact Acreage by Aquatic Resource (acres)							
		Emergent Wetland	Vernal Pools and Swales	Seasonal Wetland	Canals/ Ditches	Lacustrine	Seasonal Riverine	Riparian[A]	Total
Upper Poso	Direct	—	—	—	0.11–2.18	1.31–3.48	0.10–0.16	0.33–0.83	1.85–6.65
	Indirect	—	—	—	0.85–3.33	2.40–6.15	0.49–0.85	1.87–3.34	5.61–13.67
Middle Kern–Upper Tehachapi–Grapevine	Direct	—	—	0.00–0.11	2.39–3.92	0.90–2.10	1.48–2.24	0.25–0.82	5.01–9.19
	Indirect	0.00–<0.01	0.05–0.13	—	9.63–11.88	3.72–7.96	12.40–19.98	3.66–8.16	29.46–48.11

Notes:
— = No impact or not applicable
[A] Riparian areas are not jurisdictional waters of the U.S.

6.1.2 Alternative Evaluation

To assist in determining the least environmentally damaging practicable alternative, that is, the LEDPA, impacts to aquatic features must be described in terms of the Fresno to Bakersfield Section alternatives. Impacts are presented in a manner that allows for a comparison of the alternatives. Under the BNSF Alternative, the acreage reflects the total impact that would occur along the only end-to-end alternative. The BNSF Alternative is made up of eight segments (BNSF–Fresno, BNSF–Hanford East, BNSF–Through Corcoran, BNSF–Pixley, BNSF–Through Allensworth, BNSF–Through Wasco-Shafter, BNSF–Monmouth, and BNSF–Bakersfield North), five of which have alternatives (BNSF–Hanford East, BNSF–Through Corcoran, BNSF–Through Allensworth, BNSF–Through Wasco-Shafter, and BNSF–Bakersfield North) and three of which do not have alternatives (BNSF–Fresno, BNSF–Pixley, and BNSF–Monmouth). The three segments that do not have alternatives are referred to as "common components" and would be part of the project regardless of which alternatives are selected. The segments of the BNSF Alternative and their corresponding alternatives are listed in Table 6-2.

Table 6-2
Segments of the BNSF Alternative and Their Corresponding Alternatives

BNSF Alternative–Segment	Corresponding Alternative
BNSF–Fresno	No alternative
BNSF–Hanford East	Hanford West Bypass 1 (at-grade and below-grade options) Hanford West Bypass 2 (at-grade and below-grade options)
BNSF–Through Corcoran	Corcoran Elevated Corcoran Bypass
BNSF–Pixley	No alternative
BNSF–Through Allensworth	Allensworth Bypass
BNSF–Through Wasco-Shafter	Wasco-Shafter Bypass
BNSF–Monmouth	No alternative
BNSF–Bakersfield North	Bakersfield South Bakersfield Hybrid

The amount of encroachments on aquatic resources varies among the alternatives (Table 6-3). This table only lists the potential impacts to aquatic resources from a given alternative; the table does not include or consider the associated watershed. To compare the other project alternatives and design options for each of the other alternatives, the table contains two numbers: the first number is the amount of impact anticipated for the given alternative, and the second number is the change (or delta) when this number is compared against the corresponding segment of the BNSF Alternative. Comparison tables differentiate impact acreages between an alternative alignment and its corresponding segment of the BNSF Alternative: positive (+) differences indicate that the alternative alignment results in a greater number of impact acres than its corresponding segment of the BNSF Alternative; negative (-) differences indicate that the alternative alignment results in a smaller number of impact acres than its corresponding segment of the BNSF Alternative.

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Table 6-3
Comparison of Impacts on Aquatic Resources by Alternative

Aquatic Resource Type	Impact Type [a]	Alternative										
		BNSF Alternative Impact Acreage	Hanford West Bypass 1—At-Grade Option	Hanford West Bypass 1—Below-Grade Option	Hanford West Bypass 2—At-Grade Option	Hanford West Bypass 2—Below-Grade Option	Corcoran Elevated	Corcoran Bypass	Allensworth Bypass	Wasco-Shafter Bypass	Bakersfield South	Bakersfield Hybrid
			Impact Acreage / Difference Compared with Corresponding BNSF Area [b]									
Emergent wetland	Direct-Permanent	—	—	—	—	—	—	—	—	—	—	—
	Direct-Temporary	—	—	—	—	—	—	—	—	—	—	—
	Indirect	<0.01	0.59 / +0.59	0.59 / +0.59	0.92 / +0.92	0.92 / +0.92	—	—	—	—	— / -<0.01	<0.01 / 0.00
Seasonal wetland	Direct-Permanent	1.32	0.01 / +0.01	0.01 / +0.01	—	—	0.05 / +0.05	0.43 / +0.43	0.12 / -0.43	—	0.01 / -0.11	0.01 / -0.12
	Direct-Temporary	*0.82*	—	—	—	—	—	—	*— / -0.16*	—	—	—
	Indirect	40.13	0.45 / +0.45	0.45 / +0.45	0.45 / +0.45	0.45 / +0.45	2.14 / -0.05	0.13 / -2.06	10.75 / -22.69	—	0.55 / -0.08	0.55 / -0.08
Vernal pools and swales	Direct-Permanent	11.59	—	—	—	—	1.09 / -0.46	1.19 / -0.36	1.05 / -8.37	—	—	—
	Direct-Temporary	—	—	—	—	—	—	—	—	—	—	—
	Indirect Bisected	23.88	—	—	—	—	4.76 / -0.73	— / -5.49	1.73 / -15.52	—	—	—
	Indirect	38.61	—	—	—	—	1.78 / +1.19	1.56 / +0.97	11.58 / -20.75	—	—	—
Canals/Ditches	Direct-Permanent	44.81	14.35 / +7.45	13.21 / +6.31	10.54 / +3.64	9.40 / +2.50	9.29 / -4.93	8.37 / -5.85	5.84 / -1.28	1.98 / -1.86	2.27 / +0.43	2.96 / +1.12
	Direct-Temporary	*3.50*	*0.11 / -0.39*	*0.11 / -0.39*	*0.21 / -0.29*	*0.21 / -0.29*	*0.90 / +0.02*	*1.02 / +0.14*	—	*0.06 / +0.04*	*1.03 / +0.46*	*0.98 / +0.41*
	Indirect	75.18	21.61 / +8.75	20.86 / +8.00	21.53 / +8.68	20.78 / +7.92	19.16 / +8.24	14.13 / +3.20	24.12 / -0.72	5.82 / -1.99	11.89 / +2.26	11.63 / +1.99
Lacustrine (Retention/Detention Basins and Reservoirs)	Direct-Permanent	33.27	0.53 / -0.35	0.35 / -0.54	0.51 / -0.37	0.32 / -0.56	4.00 / -0.78	3.64 / -1.14	16.28 / -3.97	2.80 / -1.41	1.82 / -0.32	1.82 / -0.32
	Direct-Temporary	*7.53*	—	—	—	—	—	*3.55 / +3.55*	*2.45 / +1.14*	*1.10 / -1.50*	*1.91 / -0.64*	*1.91 / -0.64*
	Indirect	139.66	6.34 / +1.91	0.79 / -3.64	17.61 / +13.18	12.05 / +7.62	11.37 / +0.11	8.09 / -3.16	104.37 / +14.06	6.52 / -5.23	4.35 / -4.16	4.04 / -4.47
Seasonal riverine	Direct-Permanent	5.88	0.71 / -3.31	0.52 / -3.50	1.12 / -2.91	0.93 / -3.09	0.24 / 0.00	0.14 / -0.10	0.14 / -0.14	—	0.83 / -0.50	0.83 / -0.50
	Direct-Temporary	*0.92*	*0.50 / +0.50*	*0.50 / +0.50*	*0.50 / +0.50*	*0.50 / +0.50*	—	*0.14 / +0.14*	*0.10 / +0.08*	—	*0.65 / -0.26*	*0.64 / -0.26*
	Indirect	36.63	5.32 / -8.81	4.74 / -9.40	5.40 / -8.73	4.81 / -9.32	0.80 / -0.17	2.72 / +1.75	1.27 / -0.28	—	12.40 / -7.58	12.40 / -7.58
Riparian (not USACE jurisdictional)	Direct-Permanent	4.08	0.86 / -1.60	0.92 / -1.54	0.86 / -1.60	0.92 / -1.54	0.38 / -0.01	0.24 / -0.15	0.28 / -0.83	—	0.46 / +0.34	0.46 / +0.34
	Direct-Temporary	*0.24*	*0.82 / +0.74*	*0.82 / +0.74*	*0.82 / +0.74*	*0.82 / +0.74*	—	*0.47 / +0.47*	*0.17 / +0.14*	—	*0.34 / +0.22*	*0.36 / +0.24*
	Indirect	30.94	9.09 / -8.56	9.04 / -8.61	9.09 / -8.56	9.04 / -8.61	1.02 / -0.11	1.84 / +0.70	2.59 / -1.40	—	3.67 / -4.49	3.66 / -4.50

Table 6-3
Comparison of Impacts on Aquatic Resources by Alternative

Aquatic Resource Type	Impact Type [a]	Alternative										
		BNSF Alternative Impact Acreage	Hanford West Bypass 1—At-Grade Option	Hanford West Bypass 1—Below-Grade Option	Hanford West Bypass 2—At-Grade Option	Hanford West Bypass 2—Below-Grade Option	Corcoran Elevated	Corcoran Bypass	Allensworth Bypass	Wasco-Shafter Bypass	Bakersfield South	Bakersfield Hybrid
			Impact Acreage / Difference Compared with Corresponding BNSF Area [b]									
TOTAL AQUATIC RESOURCE IMPACTS	Direct-Permanent	100.95	16.47 / +2.20	15.02 / +0.75	13.03 / -1.24	11.57 / -2.70	15.04 / -6.13	14.00 / -7.17	23.70 / -15.01	4.78 / -3.28	5.39 / -0.18	6.08 / +0.52
	Direct-Temporary	*13.01*	*1.44 / +0.85*	*1.44 / +0.85*	*1.54 / +0.96*	*1.54 / +0.96*	*0.90 / +0.02*	*5.18 / +4.31*	*2.72 / +1.20*	*1.16 / -1.46*	*3.92 / -0.22*	*3.89 / -0.25*
	Indirect-Bisected	23.88	—	—	—	—	4.76 / -0.73	— / -5.49	1.73 / -15.52	—	—	—
	Indirect	361.16	43.41 / -5.66	36.47 / -12.61	55.01 / +5.93	48.06 / -1.01	36.27 / +9.21	28.47 / +1.41	154.68 / -31.78	12.34 / -7.21	32.87 / -14.05	32.28 / -14.64

Notes:
— = No impact or not applicable
[a] Indirect impacts are calculated within a 250-foot buffer of the project footprint, which includes areas of permanent and temporary impacts.
[b] The "Difference Compared with Corresponding BNSF Area" represents the difference in impact acreages between an alternative alignment and its corresponding segment in the BNSF Alternative: positive (+) differences indicate that the alternative alignment results in greater impact acres than its corresponding segment in the BNSF Alternative; negative (-) differences indicate that the alternative alignment results in fewer impact acres than its corresponding segment in the BNSF Alternative.
Impact calculations in this table include alignment alternatives and station alternatives, but do not include the HMF site alternatives.
All impacts were calculated based on 15% engineering design construction footprint.

For example, under the BNSF Alternative in Table 6-3, 11.59 acres of vernal pools would be affected by direct-permanent impacts, and the use of the Allensworth Bypass Alternative would result in 1.05 acres of direct-permanent impacts, a net decrease of 8.37 acres (i.e., -8.37 acres) when compared with the corresponding segment of the BNSF Alternative (BNSF–Through Allensworth).

The impact acreages presented in Table 6-4 represent the impacts of various construction elements (e.g., the HST track, the HST stations, roadway work). Table 6-4 shows the types of aquatic resources that would be directly affected by specific construction elements. Canals/ditches and lacustrine features would be affected by nearly all types of construction elements because they are common in the areas affected by the project. Seasonal wetlands, seasonal riverine/riparian, and vernal pools and vernal swales would be affected by fewer types of construction elements because they are less common in the areas affected by the project and because efforts were made as a part of project design to avoid these features where possible. Three construction elements would have no direct impact on aquatic resources: BNSF yard relocation, pedestrian bridge, and stations.

Table 6-4
Summary of Aquatic Resource Impacts by Construction Element

Construction Element	Vernal Pools/Vernal Swales	Seasonal Riverine/ Riparian	Seasonal Wetlands	Canals/ Ditches	Lacustrine
BNSF yard relocation	—	—	—	—	—
Canal relocation	—	X		X	X
Construction area	—	X	X	X	X
Drainage basin	—	—	—	X	—
Freight rail relocation	—	—	X	X	X
Heavy maintenance facility	—	—	X	X	X
HST track	X	X	X	X	X
Interlocking site	—	—	—	X	X
Natural gas relocation	—	—	X	X	X
Petroleum line relocation	—	—	—	X	X
Pedestrian bridge	—	—	—	—	—
Radio site	X	—	—	X	X
Remove base and surfacing	—	—	—	X	X
Roadway work (closures, overpass and underpass)	X	X	X	X	X
Stations	—	—	—	—	—
Temporary construction easements	—	X	—	X	X
Traction power sub-station	X	X	X	X	X
Transmission line relocation	X	X	—	X	X
Total elements affected	**5**	**7**	**7**	**15**	**14**

6.1.2.1 Direct Impacts

Direct impacts include the permanent or temporary conversion of aquatic resources. Direct impacts on aquatic resources would result from the construction activities, including the construction of the various permanent project components (e.g., embankments, rail bed, road overcrossings, aerial structure footings) and the temporary project areas required to accommodate construction operations (i.e., access and laydown areas). Most aquatic features in temporary project areas would be restored after the construction activities are completed.

Direct-permanent impacts are the impacts that would result from the use of heavy machinery to re-contour the landscape and place permanent fill materials (e.g., culverts, dirt, engineering structures) in both man-made aquatic resources (e.g., lacustrine features, canals/ditches) and natural features (e.g., season wetlands, vernal pools, vernal swales, seasonal riverine). The contouring and placement of fill in these aquatic resources would result in the permanent loss of jurisdictional waters; potentially irreversible impacts on the physical, chemical, and biological characteristics of aquatic substrates and food webs; and a potential increase in erosion and sediment transport into adjacent aquatic areas.

Direct-permanent impacts on jurisdictional waters would occur during construction of bridges and elevated structures over seasonal riverine features and wetlands as well as canals/ditches and retention/detention basins. These direct impacts would not result in the fill of aquatic features. Instead, they would result in the potential degradation of aquatic features. Table 6-5 lists the major seasonal riverine features that would be affected by the project, the alternatives in which the impacts would occur, the approximate crossing widths, and the crossing methods. All the seasonal riverine features that the project would affect run generally east to west; therefore, impacts on these features would occur under the BNSF Alternative and the other corresponding alternatives. The No Project Alternative would avoid impacts on these features, but would affect other aquatic resources. The approximate crossing widths vary by feature and by alternative, ranging from 140 feet for Deer Creek and Poso Creek to 1,625 feet for the Kings River. The crossing method for all seasonal riverine features is either by bridge or aerial structure. Direct-permanent impacts would result from the shading of aquatic resources by elevated structures (where the aerial structure is near the ground), from the placement of piles to support the aerial structures and bridges, and from the removal of vegetation during construction. These impacts would reduce the condition of affected aquatic features but would not result in the fill or removal of these features.

Direct-temporary impacts on jurisdictional waters refer to the temporary placement of fill during construction on either man-made or natural aquatic resources. Construction staging areas are required to be adjacent to or in seasonal riverine features to facilitate construction of elevated structures. Construction staging areas are also planned where bridges are proposed at at-grade crossings. Temporary fill would be placed during the construction of access roads and staging/equipment storage areas, where required. This fill would result in a temporary loss of jurisdictional waters; potential impacts on the physical, chemical, and biological characteristics of aquatic substrates and food webs; and a potential increase in erosion and sediment transport into adjacent aquatic areas.

Table 6-5
Summary of Seasonal Riverine Impacts

Water Body	Alternative(s)	Approximate Crossing Width (feet)	Crossing Method
Kings River	BNSF Alternative, Hanford West Bypass 1, Hanford West Bypass 2	300 to 1,625	Bridge or aerial structure
Cross Creek	BNSF Alternative, Hanford West Bypass 1, Hanford West Bypass 2	150 to 200	Aerial structure
Tule River	BNSF Alternative, Corcoran Elevated, Corcoran Bypass	300	Bridge or aerial structure
Deer Creek	BNSF Alternative, Allensworth Bypass	140	Aerial structure
Poso Creek	BNSF Alternative, Allensworth Bypass, and road crossing	140	Bridge or aerial structure
Kern River [1]	BNSF Alternative, Bakersfield South, Bakersfield Hybrid	1,500	Aerial structure

[1] HST alternative alignments do not cross the Kern River perpendicularly; therefore, approximate crossing width is greater than the perpendicular width of Kern River.

Direct-permanent and direct-temporary impacts on jurisdictional waters (i.e., natural and man-made features) would also include the removal or modification of local hydrology and the redirection of flow within aquatic resources. In the case of man-made features, these impacts would remove or disrupt the limited biological functions that these features provide. In natural areas, these activities would remove or disrupt the hydrology, vegetation, wildlife use, water quality conditions, and other biological functions provided by the resources. Discussion of specific impacts on major surface water features is provided in Section 3.8, Hydrology and Water Resources, in the *Fresno to Bakersfield Section: Revised Draft EIR / Supplemental Draft EIS* (Authority and FRA 2012a).

Construction material that may be placed on aquatic resources includes imported well-graded soils, sub-ballast (coarse-grained material), ballast (crushed stone), and slab (concrete). Culverts placed in aquatic resources would be constructed of pre-cast, reinforced-concrete pipe or concrete box culverts. At the locations of bridges and elevated structures, cast-in-place or precast reinforced-concrete girders or piles may be placed in aquatic resources. Other materials would be used as part of construction and operation of the HST System but are not expected to be placed in jurisdictional waters. The origin of these materials has yet to be determined, but they would be supplied by local sources from existing permitted quarries to the extent practicable. Fill material would be suitable for construction purposes and free from toxic pollutants in toxic amounts in accordance with Section 307 of the Clean Water Act.

Many of the jurisdictional waters (e.g., canals/ditches and seasonal riverine) are heavily managed by local irrigation districts to serve public water needs and agricultural production. As a result, these jurisdictional waters support few natural biological functions and values. The biological functions of these man-made features include limited habitat for wildlife and a capacity for water storage and/or release. A number of these jurisdictional waters have been previously degraded or affected by various existing roads and the existing BNSF Railway infrastructure. The construction of the HST alternatives would eliminate or further degrade these man-made jurisdictional waters.

6.1.2.2 Indirect Impacts

Indirect impacts on aquatic resources could occur outside of the construction and project footprints and could be separated from the direct impacts in time and space. Potential indirect impacts on jurisdictional waters include a number of water-quality-related impacts: erosion, siltation, and runoff into natural and man-made or manipulated water features downstream of the footprint. Indirect impacts could occur on aquatic features as a result of both construction and operation of the HST System. The acreages of indirect impacts on jurisdictional waters reported in this document represent the combined sum of indirect impact acreages for both construction and operation impacts. The long-term indirect impacts on jurisdictional waters are more extensive than—and tend to encompass—the short-term construction impacts.

Construction of an at-grade embankment could result in changes in hydrology that have long-term indirect impacts on the surrounding aquatic resources. For many of the man-made or manipulated features, indirect impacts would be minor, and hydrologic changes would be minimal. However, for natural features such as seasonal wetlands and vernal pools and swales, the impacts may result in significant changes in the natural hydrological regime. In some areas, the hydroperiod may be either reduced or extended where sheet flow is limited.

Because vernal pools and vernal swales are sensitive to disturbance, where they straddle the project footprints, they could be permanently, albeit indirectly, disturbed, if the underlying layer is disturbed or hydrological sheet flow or rain collection is altered significantly. As described in Section 3.3, Methodology: Impact Calculations, these indirect impacts are categorized and calculated separately to account for these significant and potentially more substantive indirect impacts.

Seasonal riverine features would be spanned on an elevated structure or bridged, so the indirect impacts on seasonal riverine and riparian areas would include the removal of the riparian trees and reduced contribution to and ability to recycle nutrients. Although changes in shading and water temperature may occur, because a bridge or elevated structure would provide more shade than currently provided by the riparian trees, the water temperature would likely be lower. These indirect impacts would affect adjacent aquatic resources up to 250 feet from the project-related disturbances.

6.2 Existing Conditions

The existing conditions of the aquatic resources in the study area were determined through the use of the CRAM and relative condition extrapolation based on feature type and aerial photographic interpretation. This section presents the CRAM scores from the condition assessment as well as an assessment of the direct and indirect impacts to aquatic resources based on relative condition across HST alternatives.

6.2.1 CRAM Results

A total of 42 assessment areas (AAs) were assessed within the Fresno to Bakersfield Section using CRAM. A summary of the CRAM scores for each CRAM wetland type is presented in Table 6-6. Figure 6-1 shows the locations of the CRAM AAs in the Fresno to Bakersfield Section. A complete summary of the CRAM results is provided in Appendix A. The CRAM scores of AAs within the Fresno to Bakersfield Section ranged from 27.8 to 82.7.

Table 6-6
Range of Index and Attribute Scores by CRAM Type and Wetland Type

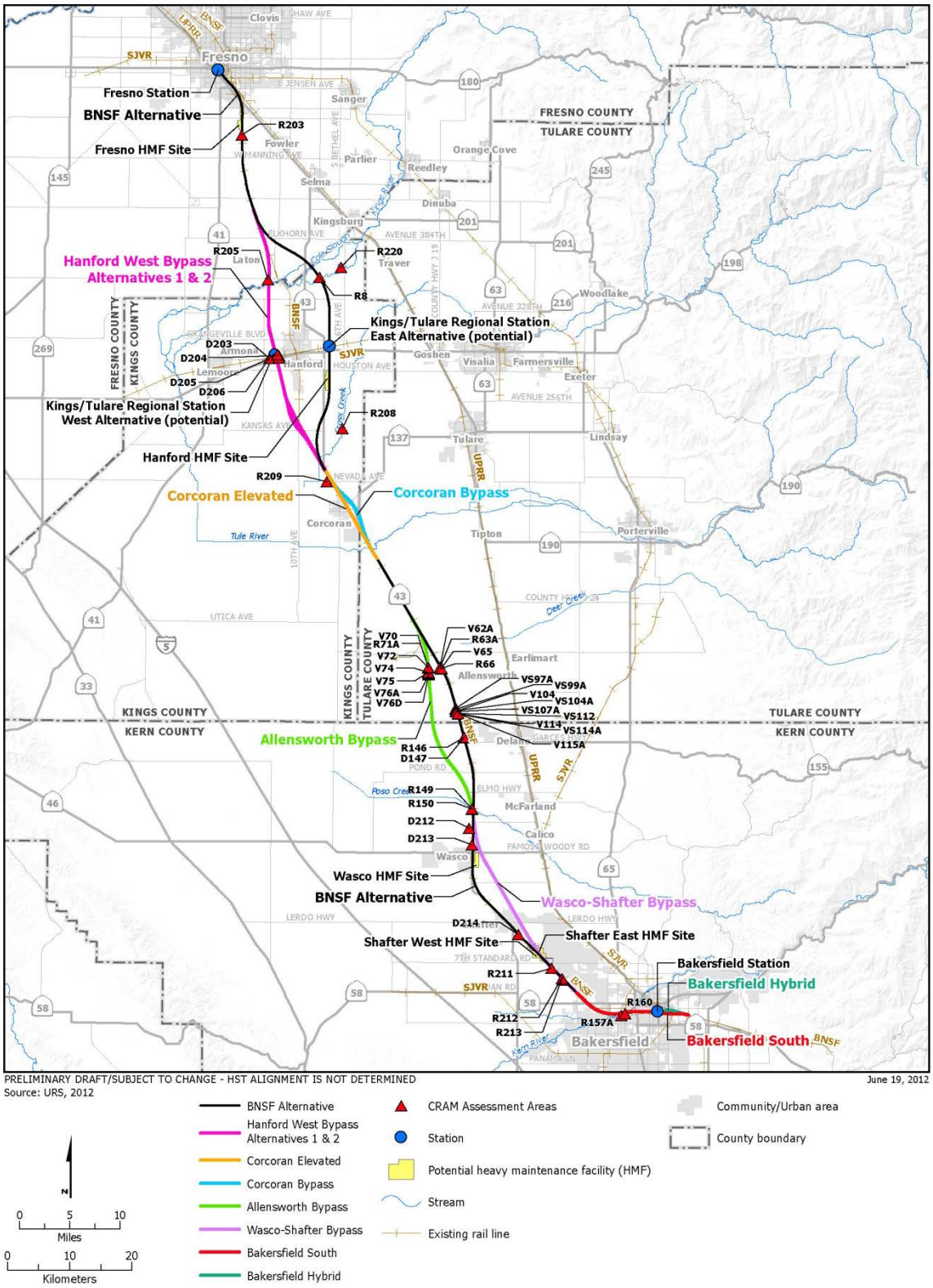
CRAM Type	Number of AAs	Range of Index Score	Range in Attribute Scores			
			Buffer and Landscape Context	Hydrology	Physical Structure	Biotic Structure
Depressional Wetland	8	31.5–66.2	33–66.7	28.8–45.4	25–75	25–77.8
Retention/Detention Basin and Agriculture Reservoirs	6	31.5–51.6	33–58.3	28.8–37.5	25–62.5	25–69.4
Seasonal Wetland	2	55.1–66.2	66.7–66.7	45.4–45.4	50–75	58.3–77.8
Riverine Wetland	17	27.8–72.9	25–83	25–93	25–75	30.6–72.2
Canal/Ditch	10	27.8–68.3	25–83	25–93	25–62.5	30.6–67
Seasonal Riverine	7	60.5–72.9	50–75	59–77.5	50–75	53–72.2
Individual Vernal Pool	11	56.7–80.9	75–100	55.8–93.3	37.5–75	25–83.3
Vernal Pool System	6	76.7–82.7	75–100	77.8–93.3	66.7–83.3	58.3–70.8

AA assessment area
CRAM California Rapid Assessment Method

6.2.1.1 Depressional Sites

Depressional sites identified in the study area were fundamentally of two types. The first type was agricultural irrigation reservoirs (retention/detention basins). These features yielded very low CRAM scores, reflecting that these sites are created features that function in conjunction with canals and ditches in rather unnatural “watersheds.” These reservoirs are largely temporary groundwater storage facilities that function hydrologically as the sources of water (and often as the sources of hydrostatic pressure) for the agricultural irrigation systems of which they are elements. They are highly dynamic, with evidence in some reservoirs of significant fluctuations in water surface elevation over short periods, and have little vegetation. Fundamentally, they are not part of the remnant watersheds in the study area except to the extent that they provide water that may flow in the canal/ditch systems that still retain remnant “watershed” characteristics (e.g., drainage networks that convey rainfall to a watershed low point, generally the Tulare Lake bed) in the study area. Little variation in condition was observed among these features anywhere in the Fresno to Bakersfield Section.

The second type of depressional wetland area identified in the project region was detention/retention basins that function as part of local storm-water management systems. Such features were largely restricted to developed parts of the project alignment. These depressions are typically better vegetated but less hydrologically connected than are the agricultural reservoirs (that is, the primary goal of such features is *not* to release water to regional drainage systems), but they also had low CRAM scores that reflect their low importance to study area watersheds.



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Source: URS, 2012

June 19, 2012

BNSF Alternative
Hanford West Bypass Alternatives 1 & 2
Corcoran Elevated
Corcoran Bypass
Allensworth Bypass
Wasco-Shafter Bypass
Bakersfield South
Bakersfield Hybrid

CRAM Assessment Areas
Station
Potential heavy maintenance facility (HMF)
Stream
Existing rail line

Community/Urban area
County boundary

0 5 10 Miles
0 10 20 Kilometers

Figure 6-1
CRAM Evaluation along the Fresno to Bakersfield alternatives

CALIFORNIA High-Speed Rail Authority
U.S. Department of Transportation Federal Railroad Administration

These two types of depressional wetlands are indicative of study area watersheds that have substantially altered land uses and hydrology. The low CRAM scores indicate that these watershed elements do not have a high condition status and provide few of the functions that would be expected from depressional wetlands in less-altered watersheds.

Natural depressional wetlands in the Fresno to Bakersfield Section are rare, apparently occurring primarily as a consequence of past fragmentation and the isolation of more natural aquatic features, though some of the shallow natural wetlands in the Allensworth region may be depressional wetlands and are not uncommon in that context. As indicated by the CRAM scores of two "natural" depressional wetlands near Hanford (apparently relicts of a former riverine feature, probably a distributary of the Kings River), such remnants tend to provide better condition indicators, as exhibited by CRAM scores that are significantly higher than those of the created features.

6.2.1.2 Riverine Sites

The conditions presented by canals and ditches are assessed in CRAM using the riverine module, which allows a comparison of the conditions in such features with respect to remnant natural riverine features in the study area. The canals and ditches assessed throughout the Fresno to Bakersfield Section (with two exceptions; see below) yielded scores that were substantially (approximately 20 CRAM points) lower than the scores for remnant natural riverine systems in the project vicinity (the channels of the Kern River, Poso Creek, Cross Creek, and the Kings River). The CRAM scores for the canals and ditches assessed in the study area indicate that these surface water features also do not provide many of the desired conditions found in natural riverine systems for the study area watersheds.

Functionally, the canals and ditches form an alternative hydrological network in lieu of the more natural drainage system that existed before the commitment of virtually all of the study area to agriculture. In a large sense, the conversion has included even the remnant natural water features. All of the natural channels assessed in this study were clearly used as conveyances for artificial (mostly irrigation) water flow in addition to their more natural functions, such as conveying runoff. At the same time, many of the larger canals in the study area showed indications that they function to convey storm water and to deliver irrigation flows.

The low condition scores for canals and ditches arise largely because of the artificiality of the constructed features in a context of highly modified watersheds. Two canals/ditches in Colonel Allensworth State Historic Park exhibited substantially higher CRAM scores than did the majority of artificial features in the Fresno to Bakersfield Section because of the less-altered hydrological conditions in the state historic park. These sites indicate that canals/ditches elsewhere in the study area provide low condition scores because of the regional alteration of watershed patterns, not simply because they are canals and ditches.

Although the condition scores for the remnant natural features in the project alignment are higher than those of most canals and ditches, even the scores of the natural riverine features are not high in comparison with scores from riverine features in less-altered parts of California (based on CRAM scores reviewed at www.cramwetlands.org; see Section 6.4 of Appendix A for a description of the internal standard in CRAM modules that enables inter-regional comparisons among wetlands in each type). The scores indicate that even the least-altered riverine features in the study area provide fewer benefits to aquatic systems than do riverine features in less-disturbed parts of California.

6.2.1.3 Vernal Pool Sites

The CRAM scores for vernal pool wetlands are the highest scores for aquatic features within the Fresno to Bakersfield Section. This result is fully consistent with the occurrence of these wetlands

in the least-fragmented remnant watersheds in the study area. The scores suggest that the watersheds in the Allensworth region continue to provide higher levels of various functions than do most of the altered watersheds elsewhere in the study area. The CRAM assessment did not locate aquatic features identifiable as vernal pools in parts of the project alignments that were not in the Allensworth region (nevertheless, vernal pool features that were not identified as vernal pools may exist elsewhere). The CRAM assessment generally concluded that it is unreasonable to assume that vernal pools were not historically widespread in the Tulare Lake Basin and that the scarcity of such features today is a consequence of their elimination as part of the conversion of the regional landscape to agriculture.

The identified condition scores for vernal pool systems are uniformly higher than comparable scores for individual vernal pools. Those who conducted the CRAM assessment are uncertain why this pattern exists, given that individual pools were intermixed with vernal pool systems where vernal pools occurred.

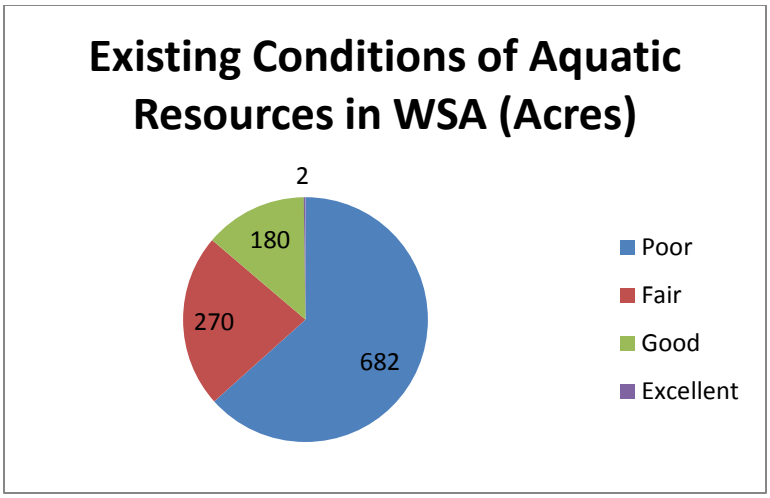
The vernal pools in the Fresno to Bakersfield Section study area are largely lacking in structural patch richness and vernal pool endemic plant species, two metrics that play large roles in calculating the attribute scores for physical structure and biotic structure. Although these metrics capture the conditions of vernal pools in California, they do not seem to account for the unique functions of vernal pools in the study area, which are representative of vernal pools in this region of the Central Valley. Low scores for physical and biotic structure may be indicative of the limitations of CRAM for assessing unique wetland communities.

6.2.2 Relative Condition Impact Assessment

To provide a side-by-side comparison of the direct and indirect impacts on aquatic resources, the relative condition assessment was used to estimate the condition of the aquatic resources that may be affected by the proposed project.

Through the CRAM results and the methods described in Section 3.2, Methodology: Existing Conditions, a relative condition was assigned to all aquatic resources in the study area. The condition of aquatic resources was established using a two-step process. First, the conditions of a representative sample of aquatic features were assessed using the CRAM. Second, the results from the CRAM assessment were extrapolated to provide relative condition values for all aquatic resources in the study area. Aerial photographic interpretation and other factors, including feature type, watershed, and proximity to stressors, were also considered in extrapolating condition scores.

Relative conditions are largely determined by CRAM score, landscape position, and whether the feature has been manipulated (man-made) or occurs in a remnant, un-fragmented landscape. The relative condition of all aquatic resources in the study area (250-foot buffer from footprint) indicated that nearly two-thirds of the aquatic resources in the study are in poor condition, with the remaining third largely split between fair and good conditions, and less than <1% of the aquatic features in excellent condition.



The extrapolation of aquatic resource conditions indicated that wetland feature types do not directly correspond to a single relative condition. As one would expect, based on CRAM results, wetland types exhibit a range of conditions. However, in general, the relative conditions of aquatic resources largely match the anticipated relative condition scores. More clearly, the manipulated or constructed aquatic features are typically in poor condition, with a few features that score higher as fair (or in some rare instances, good). Similarly, the majority of the vernal pool features are in good condition, with relatively few features in fair or excellent condition. Table 6-7 provides a summary of the aquatic resource types, without consideration of watershed or alternative, and the number of features associated with a given relative condition.

Table 6-7
Summary of Aquatic Resource Impacts by Aquatic Type and Relative Condition in the Study Area

Aquatic Resource Type	Relative Condition	Number of Aquatic Features	Notes
Emergent wetland	Poor	1	-—
	Fair	1	Located in Hanford, flow from Guernsey Slough.
	Good	1	Located in Hanford, surrounded by riparian vegetation, supports waterfowl.
Seasonal wetland	Poor	11	Linear features BNSF right-of-way
	Fair	61	—
Vernal pools and swales	Poor	2	1 feature in BNSF right-of-way, 1 feature filled with dumped refuse west of Allensworth
	Fair	97	—
	Good	131	—
	Excellent	5	—

Table 6-7
Summary of Aquatic Resource Impacts by Aquatic Type and Relative Condition in the Study Area

Aquatic Resource Type	Relative Condition	Number of Aquatic Features	Notes
Canals/ditches	Poor	235	—
	Fair	3	Two ditches surrounded by seasonal wetland, one ditch adjacent to vernal pool
	Good	1	Located in Colonel Allensworth State Historic Park, not agricultural ditch
Lacustrine	Poor	179	—
	Fair	5	Four reservoirs, one retention/detention basin surrounded by riparian vegetation
Seasonal riverine[A]	Poor	2	Two sections of Cross Creek
	Fair	11	—
	Good	6	—

Notes:
— = No special note.
[A] The CRAM assessment of seasonal riverine included adjacent riparian areas as part of the AA. Riparian areas are not waters of the U.S. The condition of the riparian areas was assigned based on the condition assigned within the CRAM AA and is the same as the associated seasonal riverine area.

6.2.2.1 Watershed Evaluation

Because the HST alternatives occur in more than one watershed, a comparison of relative condition impacts across multiple watersheds and alternatives is not productive in analysis of the least environmentally damaging practicable alternative. However, a watershed-level evaluation can help identify which watersheds have good and excellent quality habitats that may be affected by the project (as discussed in Section 6.1.1, above). For the purpose of understanding the conditions of the aquatic resources that may be affected by watershed, the range of impacts to aquatic resources in poor, fair, good, and excellent condition are provided to aid in this evaluation (Table 6-8). As described in Section 5.3, Watershed Profile Discussion, watershed conditions across the Tulare Lake Basin and especially the conditions present in the Great Valley are largely similar. Table 6-8 provides the range of potential impacts to the conditions of aquatic resources in each watershed.

Implementation of the Fresno to Bakersfield Section would have no direct or indirect impacts on good quality aquatic resources in the Upper Kaweah, Upper Poso, and, for all practical purposes, the Upper Tule watersheds. Regardless of the alternative ultimately selected, few (to no) direct or indirect impacts to good quality aquatic resources in the Upper Dry Watershed would occur. Impacts to good quality aquatic features would occur in the Tulare–Buena Vista Lakes, Upper Deer–Upper White, and Middle Kern–Upper Tehachapi–Grapevine watersheds. The direct impacts in these watersheds range from a small (the Tulare–Buena Vista Lakes and the Middle Kern–Upper Tehachapi–Grapevine watersheds) to a large (the Upper Deer–Upper White Watershed) loss of good quality aquatic features.

The range of impacts to watersheds arises based on the difference in impacts associated with the HST alternatives. The biggest difference in potential direct impact occurs in the Upper Deer–Upper White Watershed: the difference is approximately 10.89 acres. The range of potential direct impacts associated with the Middle Kern–Upper Tehachapi–Grapevine Watershed is small: less than 0.18 acres difference. The range of potential impacts associated with Tulare–Buena Vista Lakes Watershed is less dramatic than that of the Upper Deer–Upper White Watershed and, depending on HST alternative, may result in a 2.78-acre difference.

The range of potential indirect impacts to good quality aquatic features is greater than 10 acres depending on HST alternative; however, the potential indirect impacts under one alternative may increase potential direct impacts for the same alternative.

More detailed condition impact analyses are provided in Section 7.1, Net Watershed Condition. By removing the watershed layer, a more meaningful comparison of the relative condition impacts by alternative is possible; the removal of this layer allows for both a quantitative comparison (see Section 6.1, Impacts on Aquatic Resources) and a qualitative comparison (Section 6.2.2.2, Alternative Evaluation, below).

Table 6-8
Range of Direct and Indirect Impacts to Relative Condition of Aquatic Resources by Watershed

Watershed	Impact Type	Aquatic Resource Relative Condition			
		Poor	Fair	Good	Excellent
		Range of Impact Acreage (Acres)			
Upper Dry	Direct	5.20–5.28	0.67–1.85	0.00–0.16	—
	Indirect	16.00–16.35	1.12–3.40	0.00–1.15	—
Tulare–Buena Vista Lakes	Direct	31.79–39.29	1.90–2.04	0.53–3.31	—
	Indirect	60.05–72.56	12.34–20.49	8.16–26.50	—
Upper Kaweah	Direct	6.31–14.45	0.00–1.09	—	—
	Indirect	10.38–20.25	1.67–10.5	—	—
Upper Tule	Direct	1.92–4.71	0.67–2.61	—	—
	Indirect	0.44–2.78	3.42–4.56	0.01–0.01	—
Upper Deer–Upper White	Direct	12.84–17.10	9.83–11.75	0.17–11.08	0.00–0.03
	Indirect	70.71–75.18	57.55–82.07	8.66–23.59	0.00–1.50
Upper Poso	Direct	1.42–5.66	0.43–0.99	—	—
	Indirect	3.25–9.47	2.36–4.19	—	—
Middle Kern–Upper Tehachapi–Grapevine	Direct	4.17–4.82	0.00–0.02	2.28–2.46	—
	Indirect	15.39–17.72	0.00–0.84	16.06–27.30	—

6.2.2.2 Alternative Evaluation

The relative condition assessment allows for a comparison between the direct and indirect effects anticipated (as presented in Section 6.1, Impacts on Aquatic Resources) and the potential impacts based on relative condition by alternative. Table 6-9 only includes the potential impact on aquatic resources by a given alternative and does not include or consider the associated

watershed or separation by jurisdictional status (waters of the U.S. or CDFG Code 1600 et. seq.). Because the analysis includes riparian area, the actual impact to waters of the U.S, when considering condition alone, is in most cases less than what is presented in Table 6-9. The impacts by condition solely to riparian areas will be presented and evaluated in the *Fresno to Bakersfield Section: Checkpoint C Summary Report* (Authority and FRA 2012e).

This alternative evaluation is important to understand where a quantitatively small impact would affect an excellent or good quality resource versus an alternative that may have slightly higher quantitative impacts but affect a poor quality aquatic resource. Table 6-9 summarizes the direct and indirect impacts associated with each of the Fresno to Bakersfield Section alternatives by condition. In contrast with Table 6-3, this assessment does not include aquatic resource types or jurisdictional status; both Tables 6-8 and 6-9 (and Charts 6-1 through 6-8) only evaluate relative condition (regardless of aquatic resource type).

In general, the focus on impacts is placed on the impacts to aquatic resources that are in excellent or good condition, secondarily on features in fair condition, and lastly on features in poor condition. Similarly, impacts that are direct-permanent are more severe than those that are direct-temporary and those that are indirect-bisected or indirect.

Like Table 6-3, Table 6-9 also uses delta comparison to allow for a quick comparison of the HST alternative alignments. The delta comparison uses the BNSF Alternative, in which the acreage reflects the total impact that would occur along the only end-to-end alternative. To compare the other project alternatives and design options, the table contains two numbers for each of the subsequent alternatives: the first number is the amount of impact anticipated for the given alternative, and the second number is the change (or delta) when compared against the corresponding segment of the BNSF Alternative. Comparison tables differentiate impact acreages between an alternative alignment and its corresponding segment of the BNSF Alternative: positive (+) differences indicate that the alternative alignment results in a larger number of impact acres than its corresponding segment of the BNSF Alternative; negative (-) differences indicate that the alternative alignment results in a smaller number of impact acres than its corresponding segment of the BNSF Alternative.

For example, under the BNSF Alternative, 15.77 acres of good condition aquatic features (waters of the U.S. and riparian areas) would be affected by direct-permanent impacts. Use of the Allensworth Bypass would result in 0.17 acres of direct-permanent impacts, a net decrease of 10.92 acres (i.e., -10.92 acres) when compared with the corresponding area of the BNSF Alternative (BNSF–Through Allensworth).

Table 6-9
Summary of Aquatic Resource Impacts by Aquatic Feature and Relative Condition

Relative Condition	Type of Aquatic Features [a]	BNSF Impact Acreage	Impact Acreage / Difference Compared with Corresponding BNSF Area [b]									
			Hanford West Bypass 1—At-Grade Option	Hanford West Bypass 1—Below-Grade Option	Hanford West Bypass 2—At-Grade Option	Hanford West Bypass 2—Below-Grade Option	Corcoran Elevated	Corcoran Bypass	Allensworth Bypass	Wasco-Shafter Bypass	Bakersfield South	Bakersfield Hybrid
Direct-Permanent Impacts												
Poor	Seasonal wetland, Vernal Pools and Swales, Canals/Ditches, Lacustrine, Seasonal riverine	70.38	15.11 / +4.80	13.78 / +3.47	11.68 / +1.37	10.35 / +0.04	13.29 / -5.70	12.01 / -6.99	11.64 / -5.34	4.78 / -3.28	4.10 / -0.01	4.79 / +0.68
Fair	Seasonal wetland, Vernal Pools and Swales, Lacustrine, Seasonal riverine, Riparian	14.77	0.96 / +0.23	0.83 / +0.11	0.94 / +0.22	0.81 / +0.09	1.76 / -0.43	2.00 / -0.19	11.89 / +1.27	—	—	—
Good	Vernal Pools and Swales, Canals/Ditches, Seasonal riverine, Riparian	15.77	0.41 / -2.83	0.41 / -2.83	0.41 / -2.83	0.41 / -2.83	—	—	0.17 / -10.92	—	1.29 / -0.17	1.29 / -0.17
Excellent	Vernal Pools and Swales	0.03	—	—	—	—	—	—	— / -0.03	—	—	—
Direct-Temporary Impacts												
Poor	Seasonal wetland, Canals/Ditches, Lacustrine	11.05	0.11 / -0.39	0.11 / -0.39	0.21 / -0.29	0.21 / -0.29	0.90 / +0.02	4.57 / +3.69	2.45 / +1.11	1.16 / -1.46	2.93 / -0.18	2.89 / -0.23
Fair	Seasonal wetland, Seasonal riverine, Riparian	0.87	1.05 / +1.05	1.05 / +1.05	1.05 / +1.05	1.05 / +1.05	—	0.61 / +0.61	0.27 / +0.08	—	— / -0.02	— / -0.02
Good	Seasonal riverine, Riparian	1.09	0.28 / +0.20	0.28 / +0.20	0.28 / +0.20	0.28 / +0.20	—	—	—	—	0.99 / -0.02	1.01 / -<0.01
Excellent	N/A	—	—	—	—	—	—	—	—	—	—	—
Indirect-Bisected Impacts												
Poor	N/A	—	—	—	—	—	—	—	—	—	—	—
Fair	Vernal Pools and Swales	11.24	—	—	—	—	4.76 / -0.73	— / -5.49	0.32 / -4.29	—	—	—
Good	Vernal Pools and Swales	12.35	—	—	—	—	—	—	1.41 / -10.93	—	—	—
Excellent	Vernal Pools and Swales	0.30	—	—	—	—	—	—	— / -0.30	—	—	—
Indirect Impacts [c]												
Poor	Emergent wetland, Seasonal wetland, Vernal Pools and Swales, Canals/Ditches, Lacustrine, Seasonal riverine, Riparian	193.41	28.93 / +10.36	22.81 / +4.25	29.50 / +10.93	23.38 / +4.82	30.38 / +8.22	22.07 / -0.09	88.39 / -4.52	12.34 / -7.21	16.79 / -1.98	16.22 / -2.56
Fair	Emergent wetland, Seasonal wetland, Vernal Pools and Swales, Canals/Ditches, Lacustrine, Seasonal riverine, Riparian	101.49	5.17 / +1.17	4.34 / +0.34	16.19 / +12.19	15.37 / +11.36	5.88 / +0.99	6.38 / +1.50	59.04 / -22.07	—	<0.01 / -0.84	<0.01 / -0.84

Table 6-9
Summary of Aquatic Resource Impacts by Aquatic Feature and Relative Condition

Relative Condition	Type of Aquatic Features [a]	BNSF Impact Acreage	Impact Acreage / Difference Compared with Corresponding BNSF Area [b]									
			Hanford West Bypass 1—At-Grade Option	Hanford West Bypass 1—Below-Grade Option	Hanford West Bypass 2—At-Grade Option	Hanford West Bypass 2—Below-Grade Option	Corcoran Elevated	Corcoran Bypass	Allensworth Bypass	Wasco-Shafter Bypass	Bakersfield South	Bakersfield Hybrid
Good	Emergent wetland, Vernal Pools and Swales, Canals/Ditches, Seasonal riverine, Riparian	65.06	9.31 / -17.19	9.31 / -17.19	9.31 / -17.19	9.31 / -17.19	0.01 / 0.00	0.01 / 0.00	7.25 / -3.99	—	16.07 / -11.23	16.06 / -11.24
Excellent	Vernal Pools and Swales	1.20	—	—	—	—	—	—	— / -1.20	—	—	—
Totals												
Total poor		274.84	44.15 / +14.77	36.71 / +7.32	41.40 / +12.01	33.95 / +4.57	44.56 / +2.54	38.64 / -3.38	102.47 / -8.74	18.28 / -11.94	23.83 / -2.18	23.90 / -2.11
Total fair		128.37	7.17 / +2.45	6.22 / +1.49	18.18 / +13.46	17.23 / +12.50	12.39 / -0.17	8.99 / -3.57	71.53 / -25.01	—	— / -0.86	— / -0.86
Total good		94.26	10.00 / -19.82	10.00 / -19.82	10.00 / -19.82	10.00 / -19.82	0.01 / 0.00	0.01 / 0.00	8.83 / -25.84	—	18.35 / -11.41	18.35 / -11.41
Total excellent		1.53	—	—	—	—	—	—	— / -1.53	—	—	—

Notes:

— = No impact or not applicable

[a] Impacts include both waters of the U.S. and Riparian Areas. This leads to an overestimation of the total impacts by condition to waters of the U.S. (wetlands and other waters of the U.S).

[b] The "Difference Compared with Corresponding BNSF Area" represents the difference in impact acreages between an alternative alignment and its corresponding segment in the BNSF Alternative: positive (+) differences indicate that the alternative alignment results in a larger number of impact acres than its corresponding segment in the BNSF Alternative; negative (-) differences indicate that the alternative alignment results in a smaller number of impact acres than its corresponding segment in the BNSF Alternative.

[c] Indirect impacts are calculated within a 250-foot buffer of the project footprint, which includes areas of permanent and temporary impacts. Impact calculations in this table include alignment alternatives and station alternatives, but do not include the HMF site alternatives.

All impacts were calculated based on the 15% engineering design construction footprint.

Another way to look at the differences in impacts between existing conditions by alternative is in graph form. Chart 6-1 shows the total acreage of direct and indirect impacts for each alternative, including the corresponding segment of the BNSF Alternative, color-coded by existing condition. The chart includes HST segments that are common to all alternatives (Fresno, Pixley, and Monmouth). The BNSF Alternative is presented through the use of segments that compose the BNSF (Fresno, Hanford, Through Corcoran, Pixley, Through Allensworth, Through Wasco-Shafter, Monmouth, and Bakersfield North).

Total impacts (including direct and indirect impacts) by acreage and existing conditions are largely similar for the alternative alignments within the same geographic area; however, differences in impact acreage and existing conditions are present. Excellent condition features only exist in small quantities, in the Allensworth area (in the Upper Deer–Upper White Watershed). The Allensworth area also has more acreage of aquatic features, including those in good condition (vernal pools and swales, Deer Creek, and Poso Creek), than any of the other geographic areas. The Bakersfield and Hanford areas also contain aquatic resources in good condition—primarily those associated with King River Complex, seasonal wetlands, and the Kern River. All of the impacted features in the Wasco-Shafter area are in poor existing condition.

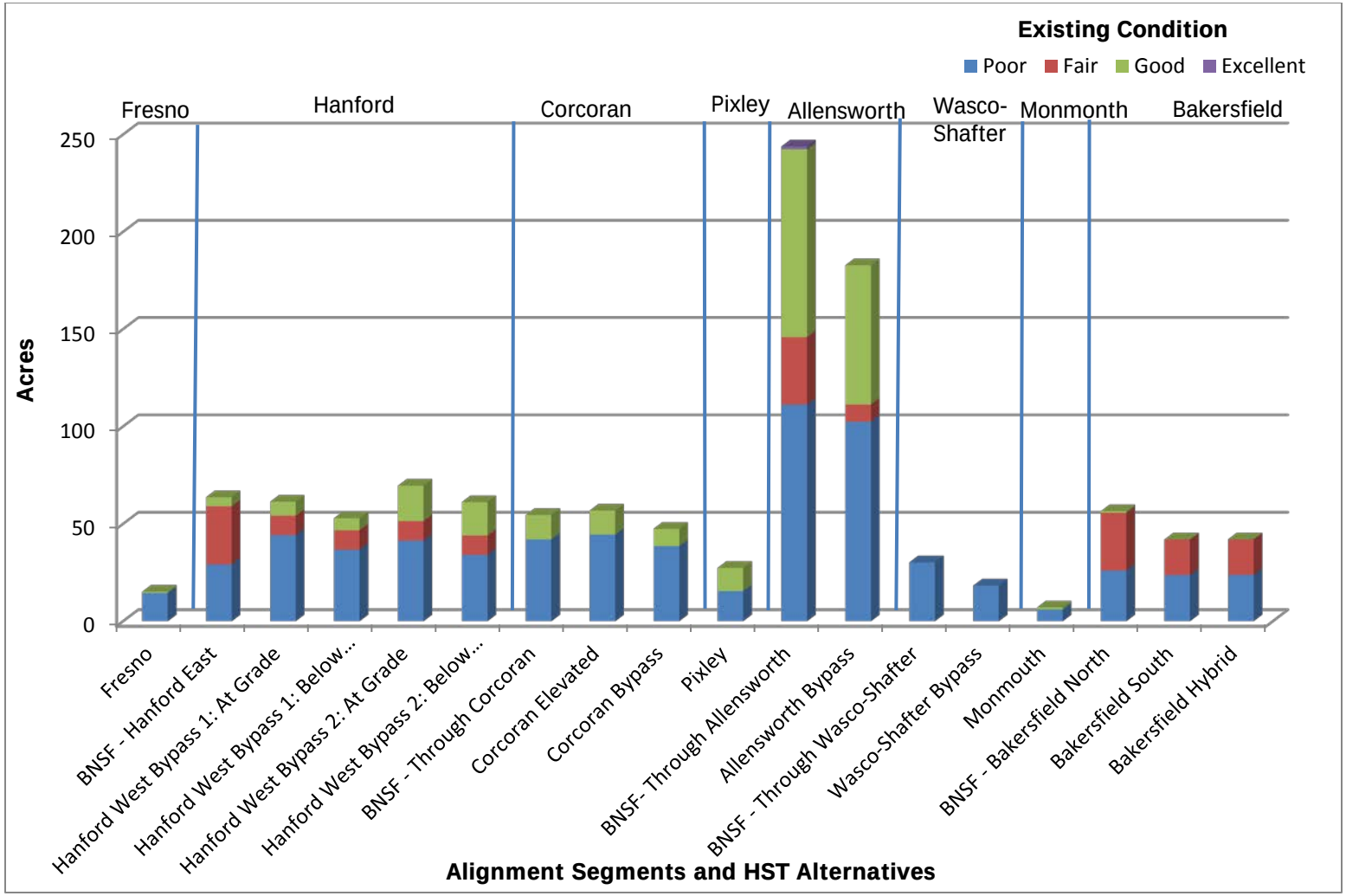


Chart 6-1
Existing Condition of Aquatic Features by Alternative

6.2.3 Stressors

In addition to calculating an overall condition score and attribute scores, CRAM includes a stressor checklist. A stressor is defined in the CRAM User's Manual as "an anthropogenic perturbation within a wetland or its setting that is likely to negatively impact the functional capacity of a CRAM Assessment Area" (CWMW 2012). The stressor checklist is used to account for low CRAM scores by identifying specific impacts on the landscape, hydrology, physical, or biotic structure of an aquatic feature. 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 (EPA 2002). The same stressors also influence and affect relative condition classification.

A number of stressors were identified during CRAM field work. Table 6-10 summarizes the stressors identified by each CRAM wetland type. No strong correlation of CRAM scores and the number of stressors was found among the aquatic features assessed in the Fresno to Bakersfield Section. A weak correlation (-0.15) supports the assumption that features with lower CRAM scores are subjected to more stressors, though many low-scoring features had few stressors.

The CRAM assessment concluded that the low-scoring man-made and manipulated features (canals/ditches, lacustrine) are a direct result of anthropogenic influences (i.e., these features are the stressors for natural watershed conditions in the project area). However, when CRAM scores and the numbers of stressors are compared for "natural" features only, the correlation remains weak. The CRAM assessment concluded that the effects of stressors throughout the project area have overwhelmed the potential relationships among stressors and natural aquatic systems, as a consequence of the regional conversion of the land use pattern to one completely dominated by agriculture, urban development, and transportation corridors with few remnants of natural hydrological/wetland systems. The most common stressors (presence of dike/levee, transportation corridor, adjacent to an orchard/nursery) are present throughout the Fresno to Bakersfield Section and affect all types of aquatic features to the extent that statistical relationships among stressors and condition scores are not observable.

Table 6-10
Most Common Stressors Affecting CRAM Wetland Types

CRAM Wetland Type	Attribute	Stressor
Depressional	Buffer and landscape context	Orchards/nurseries, row crop agriculture, industrial and commercial, and transportation corridor
	Hydrology	Actively managed hydrology
	Physical structure	Trash/refuse
	Biotic structure	Pesticide application/vector control, and human visitation
Riverine	Buffer and landscape context	Orchards/nurseries, Transportation corridor, dryland farming and row crop agriculture
	Hydrology	Dikes/levees, actively managed hydrology, and non-point source discharges
	Physical structure	Vegetation management, trash, refuse, excessive sediment from watershed, plowing discing, and grading and compaction.
	Biotic structure	Pesticide application/vector control, excessive human visitation, and treatment of non-native vegetation

Table 6-10
Most Common Stressors Affecting CRAM Wetland Types

CRAM Wetland Type	Attribute	Stressor
Vernal pools	Buffer and landscape context	Transportation corridor, dryland farming, and orchards/nurseries
	Hydrology	Dikes/levees, and flow obstructions
	Physical structure	Grading/compaction, and trash/refuse
	Biotic structure	Few stressors identified
CRAM = California Rapid Assessment Method		

6.3 Post-Project Condition

A post-project condition assessment for the various aquatic features in the Fresno to Bakersfield alternatives was conducted using construction and project footprint information coupled with a set of projections made for each design feature, as described in Section 3.4, Methodology: Post-Project Conditions. This section provides a comparison of the post-project conditions by alternative. This analysis is useful to understand the potential changes that would result from the construction and operation of the Fresno to Bakersfield Section.

The post-project condition includes five potential condition categories: does not exist, fair, poor, good and excellent. The acreages associated with each classification are based on the total acreage affected by the four types of the potential project impacts: direct-permanent, direct-temporary, indirect-bisected, and indirect.

Aquatic resources assigned a post-project condition of “does not exist” are expected to experience fill and would be lost through construction and implementation of the project. These adverse and significant impacts would occur as a result of direct-permanent impacts and as a result of direct-temporary impacts associated with the loss of sensitive features, such as vernal pools and swales (as described in Section 3.3, Methodology: Impact Calculations, all direct-temporary impacts to vernal pools and swales are considered direct-permanent impacts). Some features that are associated with direct-permanent impacts would experience a reduction in relative condition as a result of construction elements that would allow the resource or feature to remain. For example, the construction of an elevated structure or bridge structure over seasonal riverine features (as is the case throughout the project area) would only cause a reduced condition.

The other post-project condition classifications (poor, fair, good, and excellent) would result from a combination of potential construction and operations impacts, including direct-temporary, indirect-bisected, and indirect. Aquatic features in areas of direct-temporary impacts would be temporarily lost during construction and may experience fill. However, following the completion of construction, these features would be restored. In some instances (i.e., for man-made and manipulated features), aquatic features would be restored to the pre-project or existing condition. In other situations (i.e., for natural features), these features would be restored but their overall condition would be reduced. Because vernal pools and swales that experience indirect-bisected impacts are expected to experience significant impacts, these features are expected to be in poor condition after construction. The post-project condition of features in areas of indirect impact would vary depending on the resource considered: for man-made or

manipulated features, indirect impacts are not expected to result in a change in condition, whereas for natural features, indirect impacts may result in a reduction in condition.

The focus of the post-project evaluation in this section is the conversion of features from good or excellent condition class to lesser condition classes. In this sense, the evaluation is weighted, with the most important part of the post-project condition assessment being those features that converted to the "does not exist" condition. Secondary focus and analysis are placed on the conversion of good or excellent aquatic features to a lesser condition class.

6.3.1 Comparison by HST Alternative

This section discusses the post-project condition of aquatic resources associated with each of the potential alternatives within a given geographic area. The post-project condition is presented first for the common components and then for potential alternatives within distinct geographic areas. In each section, a chart is provided to show the acreage of aquatic features within each post-project condition category for the various alternatives. The charts also use coloring to show the existing condition, which allows one to determine whether the condition of the aquatic features has changed as a result of the project. Table 6-2 lists the various BNSF Alternative segments, the corresponding alternatives, and the common components.

6.3.1.1 BNSF Alternative

As the only end-to-end alternative from Fresno to Bakersfield, the existing relative condition scores of aquatic features within the BNSF Alternative range from poor to excellent, with most features being in poor condition and few features in good or excellent condition. As depicted in Chart 6-2, after project construction, some of the features in good condition would be lost and their post-project condition would be "does not exist." The majority of the good and excellent features would be reduced to fair or poor condition under this alternative. This chart does not provide a comparison with other HST alternatives; instead, it shows the amplitude of potential project impacts with which the least environmentally damaging practicable alternative may subsequently be compared.

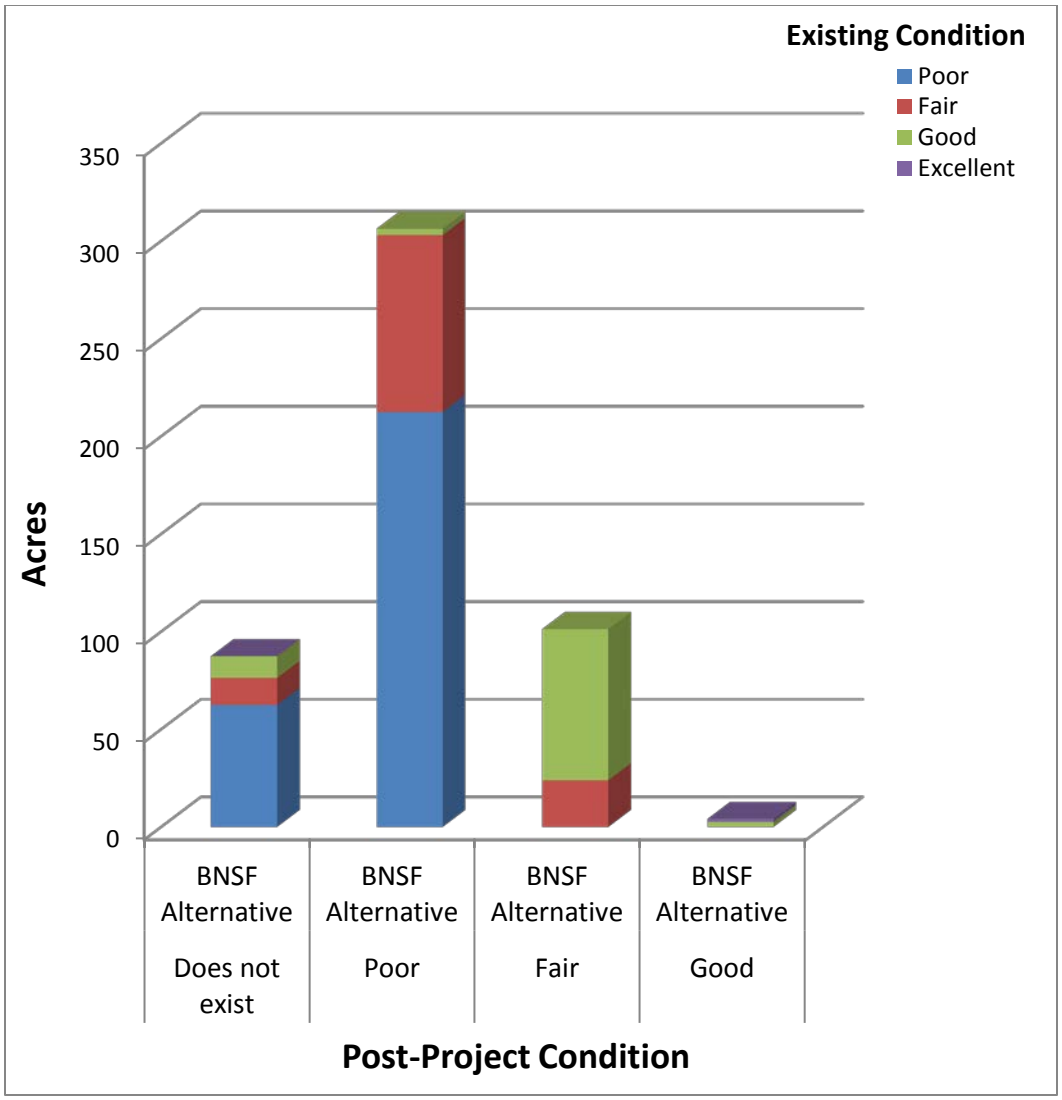


Chart 6-2
Post-Project Condition of BNSF Alternative

All aquatic resource types are represented in the BNSF Alternative; those features that are in good and excellent condition associated with the BNSF Alternative include riparian areas (not USACE jurisdictional), seasonal riverine, canals/ditches, and vernal pool and swale resources.

6.3.1.2 Common Components

Because the common components have no alternatives, the impacts associated with the construction and operation of these components will be a part of the project regardless of the alternatives ultimately selected. As depicted in Chart 6-3, all aquatic features within the common components have an existing condition of poor or fair. In the Fresno segment, features in fair condition will be reduced to poor condition. In the Pixley segment, these features will be reduced to poor condition or will no longer exist. All of the features in fair condition in the Monmouth segment are expected to remain in fair condition. In all three of these segments, most features with an existing condition of poor will remain in poor condition, but some features will no longer exist.

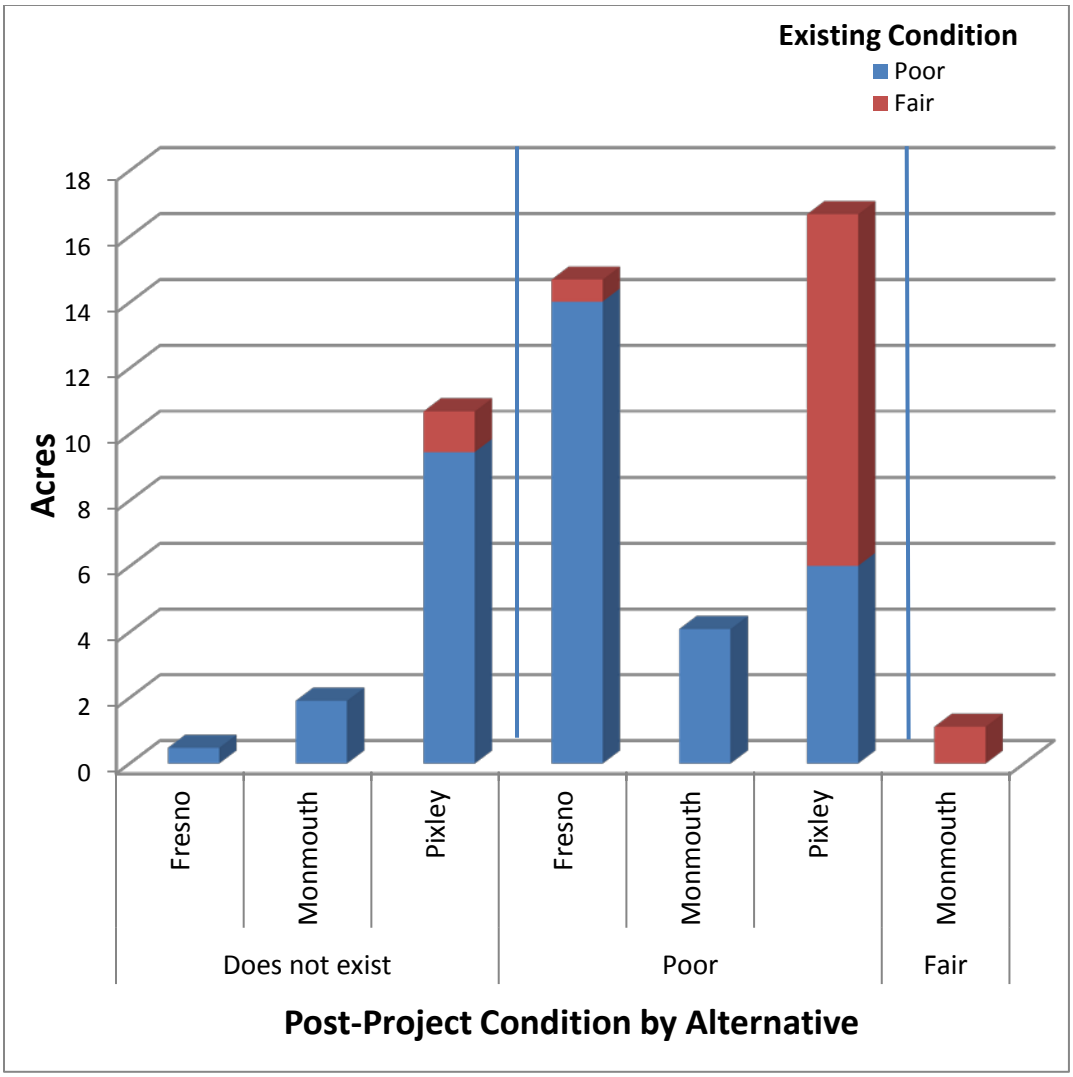


Chart 6-3
Post-Project Condition of Common Components

6.3.1.3 Hanford Alternatives

The Hanford alternatives (the Hanford West Bypass 1 and 2 alternatives) would collectively affect canals/ditches, emergent wetland, lacustrine, riparian (not USACE jurisdictional), seasonal riverine, and seasonal wetland aquatic resources (Section 6.1, Impacts on Aquatic Resources). The existing condition scores of aquatic resource features within these alternatives range from poor to good, with most features in poor condition. After the completion of project construction, riparian and seasonal riverine features in good condition would be reduced to fair condition.

Chart 6-4 provides a comparison of the post-project condition for aquatic features in the five Hanford alternatives (BNSF–Hanford East segment, Hanford West Bypass 1 Alternative at-grade option, Hanford West Bypass 1 Alternative below-grade option, Hanford West Bypass 2 Alternative at-grade option, and Hanford West Bypass 2 Alternative below-grade option). Chart 6-4 illustrates the changes from the existing conditions. The BNSF–Hanford East segment has the largest acreage of aquatic features with an existing condition of good; all of these features would be reduced to a post-project condition of either fair or poor. The reduction in condition from good to a lesser condition class would occur due to direct-permanent impacts on the various seasonal

riverine features (primarily those belonging to the Kings River complex). These features would be reduced but not removed because they would be spanned by a bridge structure. In the Hanford West Bypass alternatives, some features in good condition would remain in good condition because of buffered indirect impacts to emergent wetlands, whereas others would be reduced to fair or poor condition because, as described in Table 6-5 (see Section 6.1.2, Alternative Evaluation), the Kings River complex would be crossed on an elevated structure. The acreage of features reduced from fair to poor is similar across all of the Hanford alternatives except the Hanford West Bypass 2 Alternative, where more features with an existing condition of fair remain in fair condition in the post-project condition.

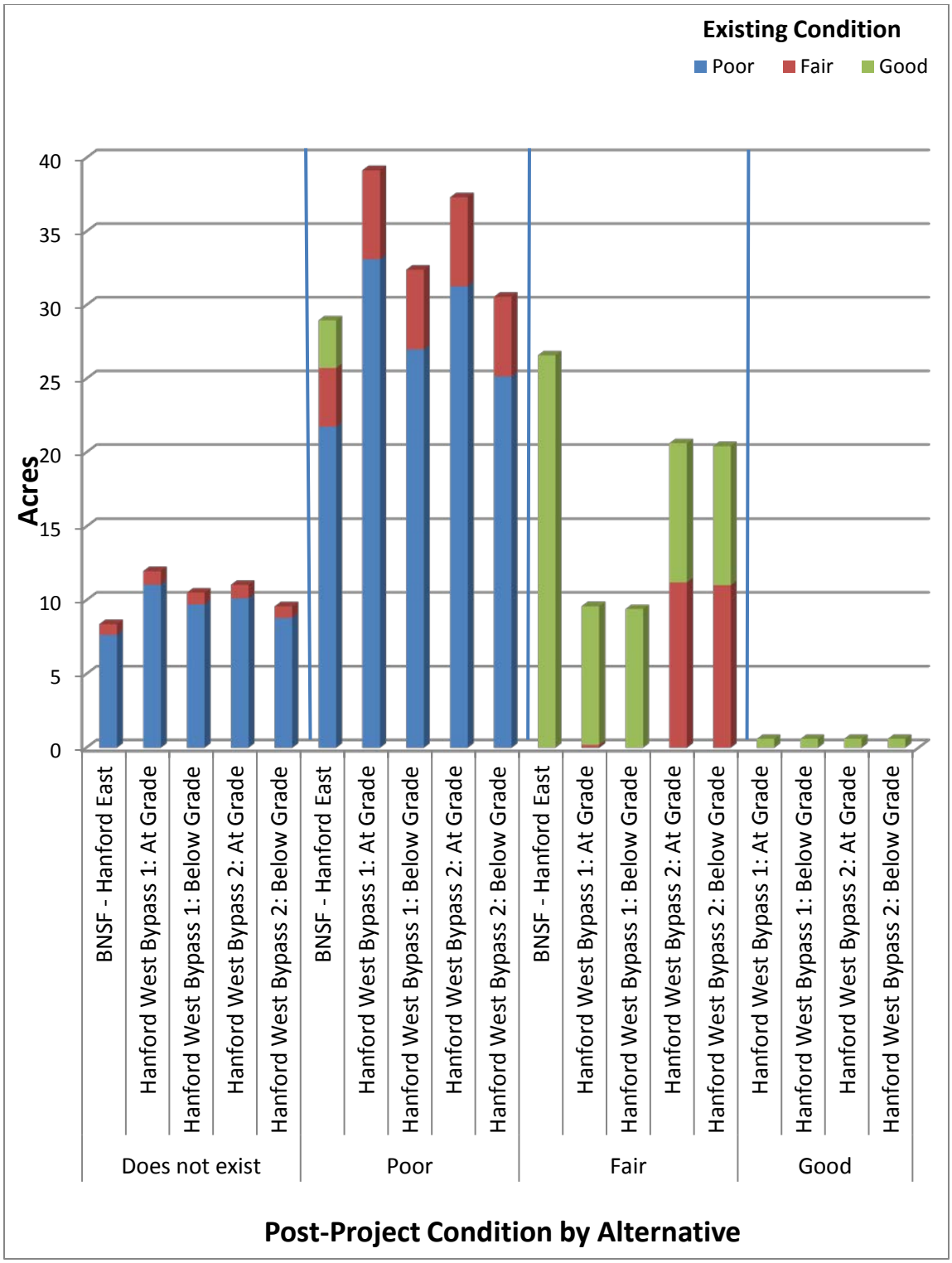


Chart 6-4.
Post-Project Condition of Hanford Alternatives

6.3.1.4 Corcoran Alternatives

The three Corcoran alternatives (BNSF–Through Corcoran segment, Corcoran Elevated Alternative, and Corcoran Bypass Alternative) collectively affect canals/ditches, lacustrine, riparian, seasonal riverine, seasonal wetland, and vernal pools and swales (Table 6-3). The existing condition of aquatic features in the Corcoran area ranges from poor to good, though the majority of aquatic features are in poor condition, and only 0.01 acres are in good condition.

The post-project conditions and the changes in condition for aquatic features are similar for all of the Corcoran alternatives (Chart 6-5). After the completion of project construction, features in good condition (totaling 0.01 acres) would be the reduced to fair condition in all Corcoran alternatives because these impacts would occur in an area where all three alternatives are in close proximity and are essentially the same. Nearly all aquatic features in fair condition, including vernal pools and swales, would be reduced to poor condition or would be removed through the placement of fill and would no longer exist (i.e., post-project condition would be "does not exist").

Although the impacts are generally similar for the Corcoran alternatives, the BNSF-Through Corcoran segment and the Corcoran Elevated Alternative have more acreage that would be lost and more features converted from fair to "does not exist" than the Corcoran Bypass Alternative. The Corcoran Bypass Alternative has the smallest amount of loss (conversion to "does not exist") of fair condition aquatic features.

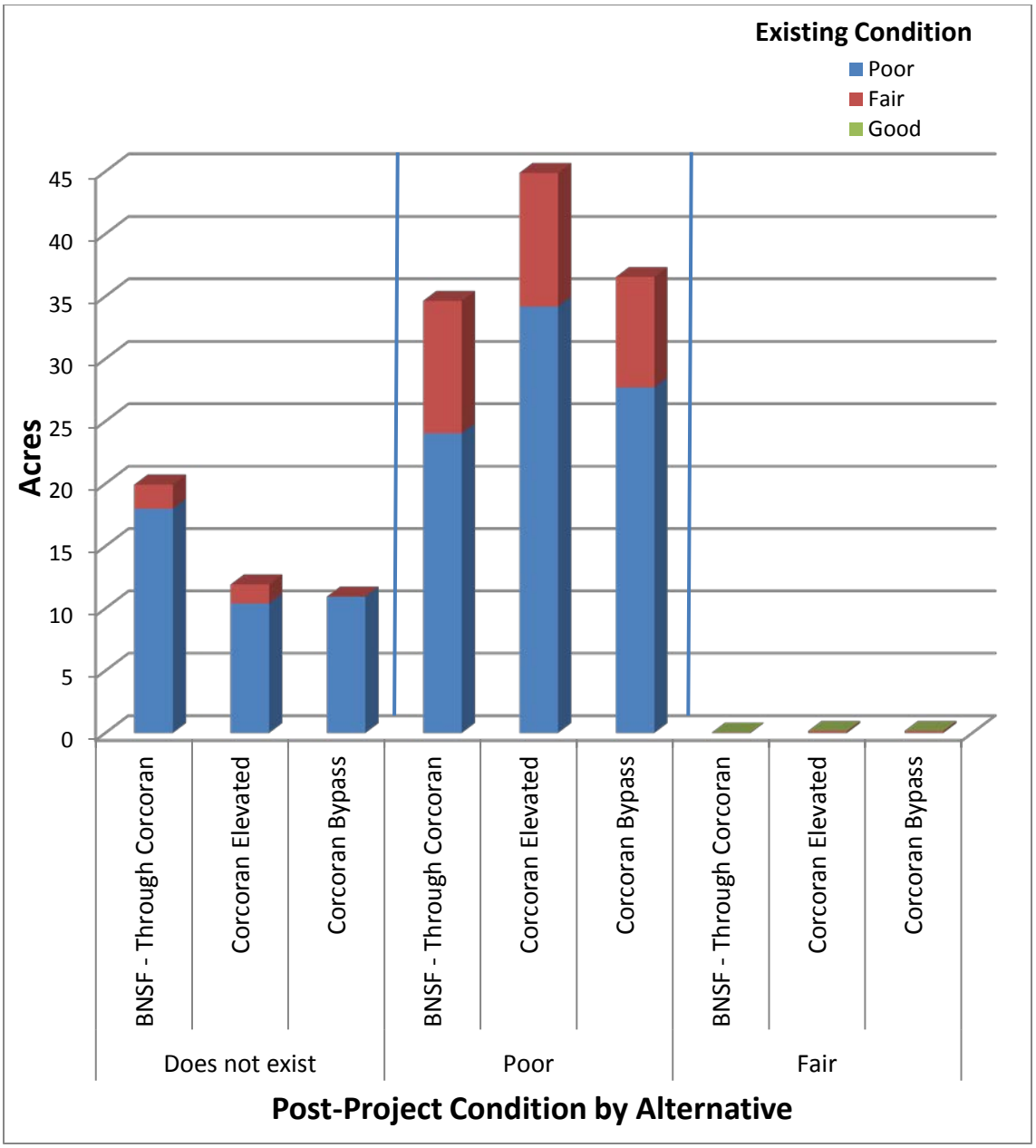


Chart 6-5.
Post-Project Condition of Corcoran Alternatives

6.3.1.5 Allensworth Alternatives

The Allensworth alternatives affect canals/ditches, lacustrine, riparian, seasonal riverine, seasonal wetland, and vernal pools and swales (Table 6-3). The existing condition of these aquatic features ranges from poor to excellent. Both the BNSF–Through Allensworth segment and the Allensworth Bypass Alternative contain more good quality features than any other groups of alternatives (Hanford, Corcoran, Wasco-Shafter, and Bakersfield). A small acreage of excellent features and a significant acreage of good features are associated with the BNSF–Through Allensworth segment. These features are associated with areas of alkali desert scrub that have not been recently disturbed and in many cases are protected as part of the Allensworth Ecological Reserve. The aquatic resources associated with these good and excellent conditions

are vernal pools and swales. Although vernal pools and swales are present in the Allensworth Bypass Alternative and some of these features are in good condition, many are in fair condition—likely as a result of the stressors associated with the adjacent land uses (e.g., orchards, dry land farming).

After the completion of project construction, aquatic features in excellent and good condition would be lost (post-project condition would be "does not exist") or reduced in quality to poor or fair condition (Chart 6-6). The Allensworth Bypass Alternative would have fewer aquatic features in good condition removed or lost and consequently converted to a post-project condition of "does not exist." Therefore, fewer features in good condition would be reduced to poor condition than in the BNSF–Through Allensworth segment.

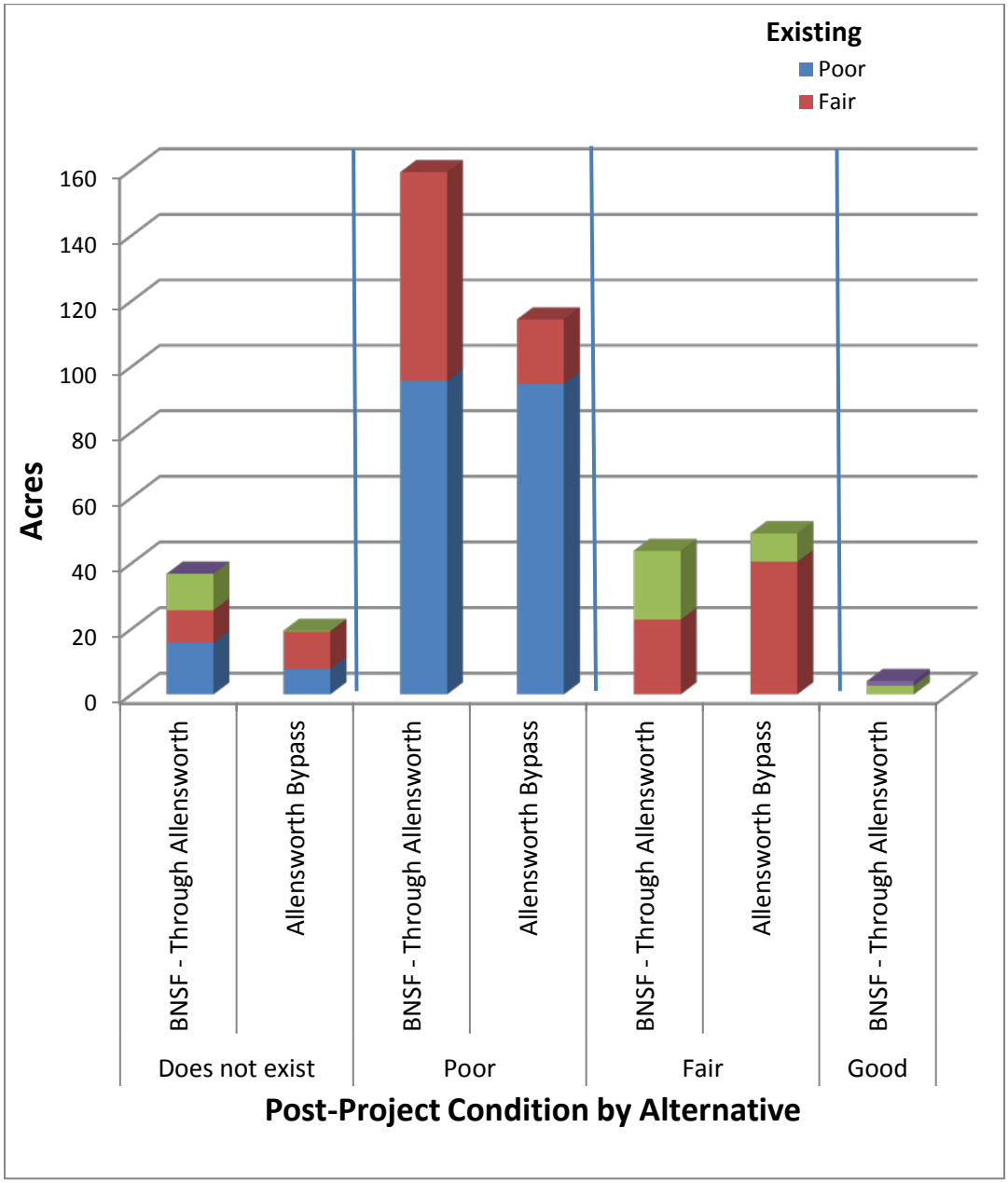


Chart 6-6
Post-Project Condition of Allensworth Alternatives

6.3.1.6 Wasco-Shafter Alternatives

A relatively small acreage of two aquatic feature types, canals/ditches and lacustrine, would be affected by the two Wasco-Shafter alternatives (BNSF–Through Wasco-Shafter segment and Wasco-Shafter Bypass Alternative) (Table 6-3). All of the aquatic features in the Wasco-Shafter area are in poor condition.

The BNSF-Through Wasco-Shafter segment would convert more features in poor condition to a "does not exist" condition as a result of construction and project fill activities than the Wasco-Shafter Bypass Alternative (Chart 6-7). Aquatic features in both alternatives would experience direct-temporary and indirect impacts that are not expected to change the existing poor condition of the resources after construction. However, the BNSF–Through Wasco-Shafter segment would subject a greater amount of poor quality aquatic features to direct-temporary and indirect impacts than the Wasco-Shafter Bypass Alternative.

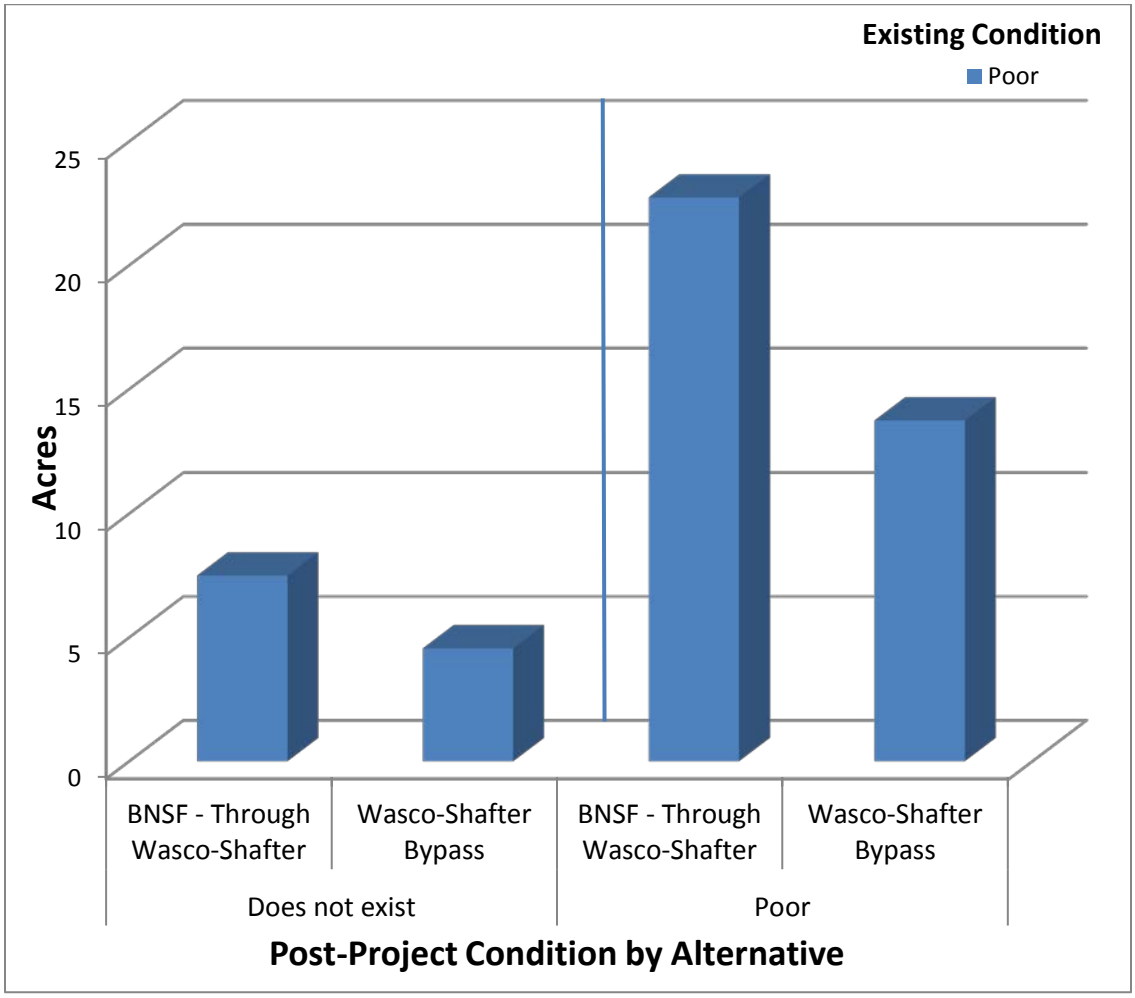


Chart 6-7
Post-Project Condition of Wasco-Shafter Alternatives

6.3.1.7 Bakersfield Alternatives

The three Bakersfield alternatives (BNSF–Bakersfield North segment, Bakersfield South Alternative, and Bakersfield Hybrid Alternative) would collectively affect canals/ditches, emergent wetland, lacustrine, riparian, seasonal riverine, and seasonal wetland features (Table 6-3). The Bakersfield alternatives contain aquatic features in poor, fair, and good condition. The acreages of poor and good features are almost equal; however, few aquatic features are in fair condition (Chart 6-8). For all of the Bakersfield alternatives, the good quality aquatic resources would be reduced to fair condition, but no good quality aquatic features would be lost (i.e., post-p0roject condition of "does not exist") as the result of this project. The aquatic resources that are in good condition include both riparian and seasonal riverine, primarily associated with the Kern River. As described in Table 6-5, an elevated structure would be built to cross the Kern River and the quality or condition of the river may experience some reduction as a result of project direct-temporary or indirect impacts. The reduced conditions associated with the Kern River are the same for the Bakersfield South and Bakersfield Hybrid alternatives. Both the Bakersfield South and the Bakersfield Hybrid alternatives have fewer good condition features that would be converted to fair than the BNSF–Bakersfield North segment.

All Bakersfield area alternatives would convert a small amount of fair quality features to poor condition due direct-temporary and/or indirect impacts. However, the BNSF–Bakersfield North segment would convert slightly more than the other two alternatives (Bakersfield South and Bakersfield Hybrid alternatives). Similarly, all of the Bakersfield area alternatives would change the poor condition features to a condition of "does not exist." Generally, all three Bakersfield area alternatives are similar, but the BNSF–Bakersfield North segment would have higher acreages with a post-project condition of poor and fair due to its overall greater number of impacts (Chart 6-8).

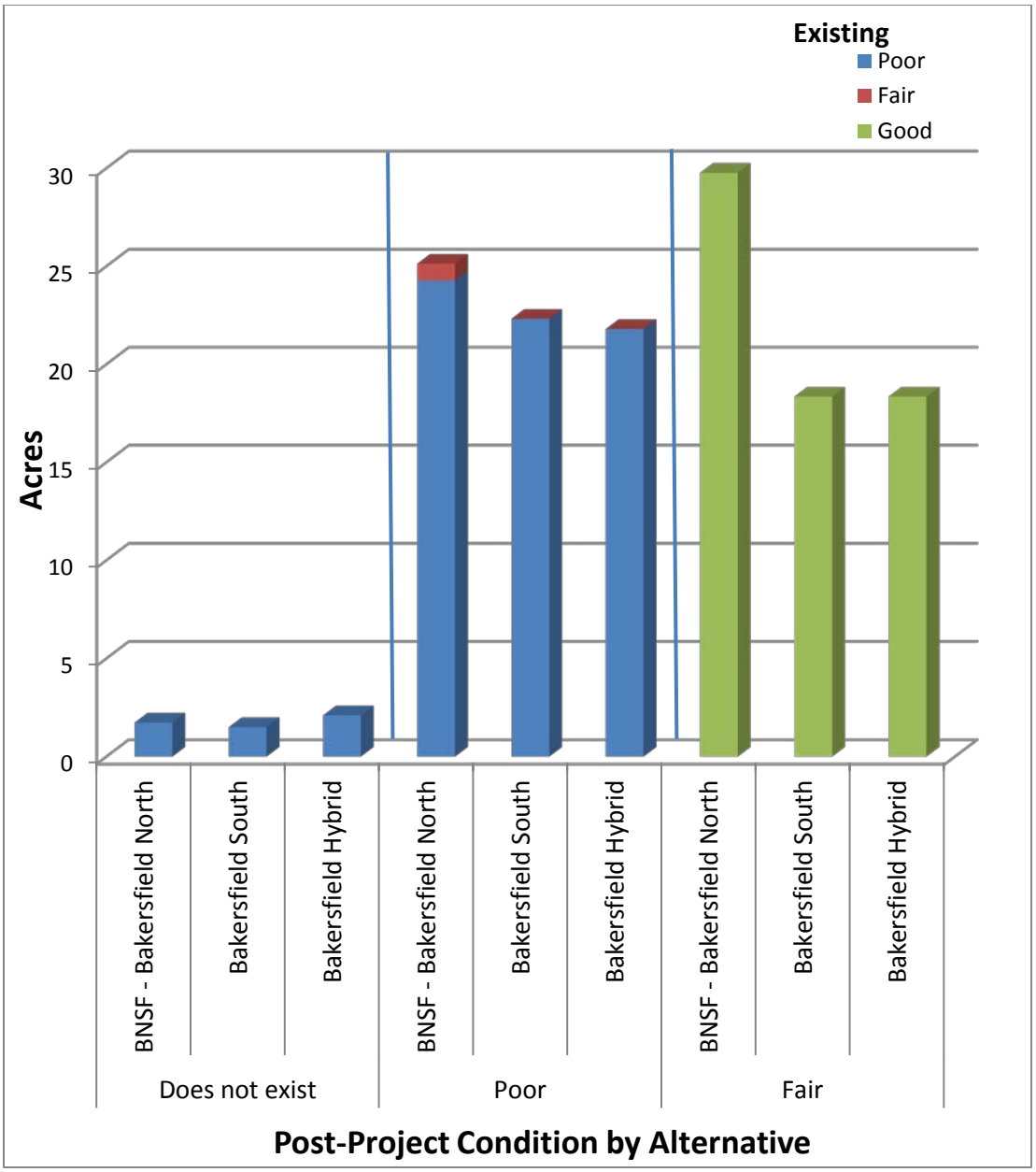


Chart 6-8
Post-Project Condition of Bakersfield Alternatives

6.4 Compensatory Mitigation

Compensatory mitigation for adverse impacts to aquatic resources will be determined in consultation with the USACE and in part through the assessment of the aquatic resource conditions (including functions and values) that would be lost or impaired through construction and operation of the Fresno to Bakersfield Section of the HST System. Compensatory mitigation will preserve, create, and/or enhance aquatic resource conditions, functions, values, and services.

The USACE requires compensatory mitigation of impacts to aquatic resources using a watershed approach in accordance with the 2008 Mitigation Rule. Where watersheds have been highly modified and highly fragmented, as many are in the San Joaquin Valley, the function and value of

wetlands may better be restored if sites are chosen on the basis of quality, location, size, and connectivity—even if this site selection means mitigating outside of a given watershed. The preamble to the 2008 Mitigation Rule recognizes the challenges of mitigating impacts in the same watershed for linear projects. District engineers have the flexibility to allow compensation for linear projects to be conducted on one or multiple sites, based on environmentally preferable and practicable compensatory mitigation options. For linear projects, such as the Fresno to Bakersfield Section, district engineers may determine that consolidated compensatory mitigation projects provide appropriate compensation for the authorized impacts and are environmentally preferable to requiring numerous small permittee-responsible compensatory mitigation projects in a number of watersheds along the linear project corridor.

The USACE recently released guidance on the method used to determine mitigation ratios for different mitigation scenarios. This guidance is published in the *Standard Operating Procedure for Determination of Mitigation Ratios* (USACE 2012). Under these guidelines, mitigation ratios are determined through a standardized procedure that compares project impacts to proposed mitigation sites both quantitatively and qualitatively. Under this guidance, impacts to aquatic resources are evaluated based on their size, location, and type (or type conversion). Furthermore, proposed mitigation sites are also evaluated based on their size, location, and type (or type conversion) as well as their certainty of success and any temporal losses. Impact areas and mitigation sites are compared using CRAM evaluations or other more qualitative methods. Numerical or categorical values are assigned to the results of these evaluations and are used to calculate the required mitigation ratio. The guidelines establish a preference for onsite and in-kind mitigation; however, if this is not practicable or compatible with the proposed project, offsite and/or out-of-kind mitigation may be used. District engineers have the flexibility to allow for out-of-kind mitigation based on environmentally preferable and practicable mitigation options (33 C.F.R. Parts 325 and 332 and 40 C.F.R. Part 230).

6.4.1 Watershed Perspective

Based on the results of the Level 1 Watershed Profile and the Level 2 Impact Evaluation, the compensatory mitigation should focus on improving conditions within the watersheds where the linear project has the most significant detriment to the overall watershed and should focus on improving conditions where aquatic resources have been reduced and opportunities for improvement are present.

Because the Level 1 Watershed Profile and Level 2 Impact Evaluation identified significant vernal pools and swales in the Upper Deer–Upper White Watershed, compensatory mitigation should focus on maintaining and/or improving these features and overall watershed conditions in this watershed. Other watersheds that have significant areas of vernal pools and swales in good condition, and therefore provide an opportunity for improvement which should be considered for vernal pool compensatory mitigation, include Upper Dry, Tulare–Buena Vista Lakes, Upper Kaweah, and Upper Tule watersheds. Because of the sensitivity of vernal pool landscapes, a recent increase in their conversion, and the continued threat of loss, vernal pool compensatory mitigation should include a significant amount of preservation. Creation, reestablishment, and enhancement activities of vernal pool and swale features are seldom successful and carry significant risk in terms of not meeting performance standards. As a lower-risk alternative, the creation, enhancement, or re-establishment of out-of-kind aquatic resources (seasonal or emergent wetland features) may be used to achieve an overall improvement in watershed condition.

Compensatory mitigation for impacts to seasonal riverine features could occur in any of the identified watersheds because these features are present in all watersheds. Selection of compensatory mitigation sites should focus on areas where there is connectivity to protected lands, up-stream stressors are absent or reduced, and opportunities for stream and riparian

habitat enhancement or restoration are available. Given the significant degradation of the watershed landscape, creation, re-establishment, and enhancement opportunities are likely limited and would include significant risk that mitigation may be difficult given the linear nature of these features. Therefore, compensatory mitigation sites for riverine and riparian impacts should be carefully selected to increase the likelihood of success.

Additionally, compensatory mitigation focused on restoring historically valuable aquatic resources such as Tulare Lake would greatly benefit overall watershed condition. The restoration of Tulare Lake and associated historical emergent wetlands could provide both in-kind and out-of-kind mitigation opportunities.

6.4.2 Compensatory Mitigation Options

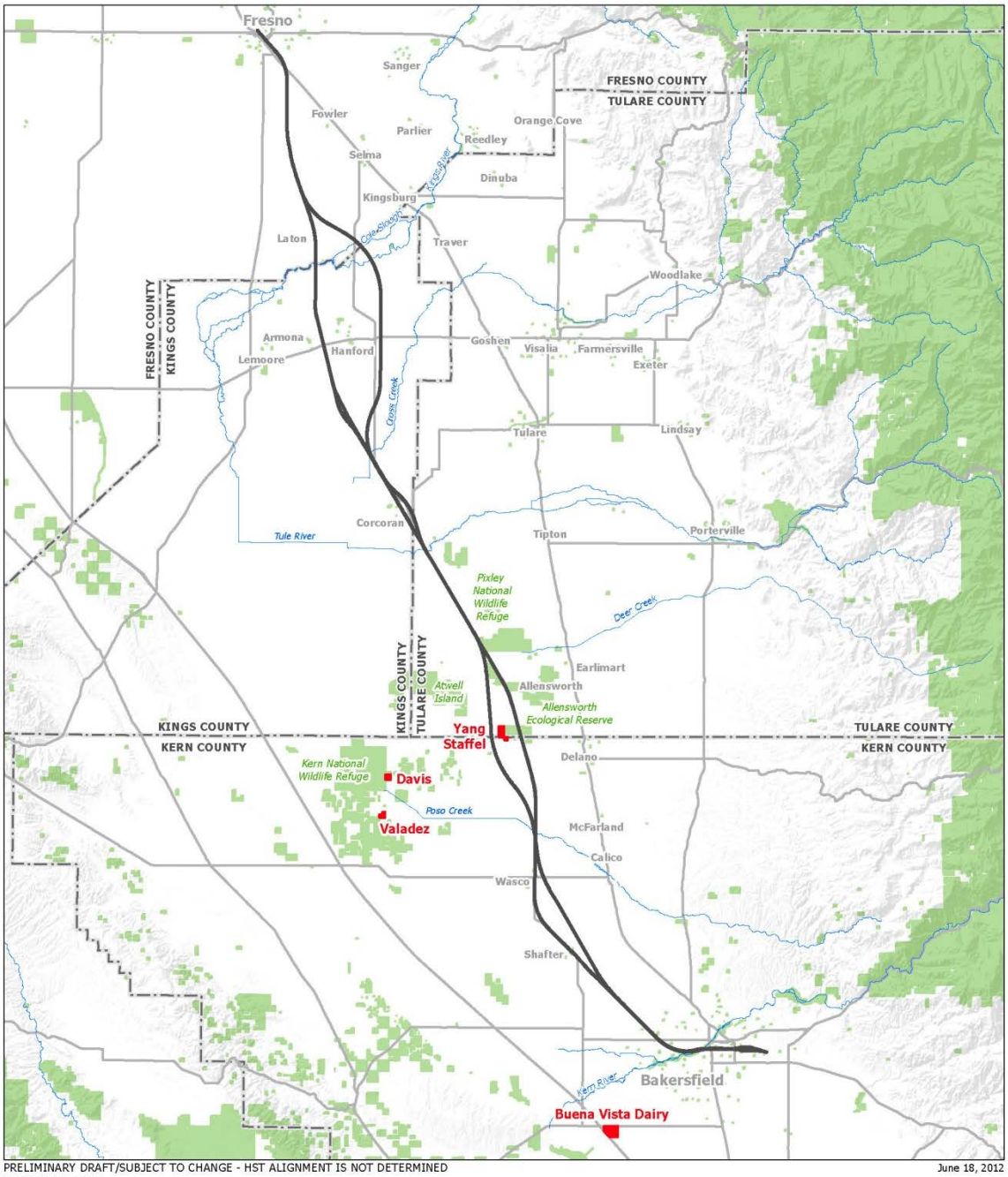
Mitigation banks, in-lieu fee programs, and permittee-responsible mitigation options may be used to satisfy the 2008 Mitigation Rule requirements. However, there are currently no USACE-approved in-lieu fee programs or wetland mitigation banks in the vicinity of the project. Three special-status species conservation banks have been identified that provide mitigation for aquatic special-status species (e.g., vernal pool branchiopods); however, USACE has not approved any of these conservation banks to sell aquatic resource credits. Therefore, the mitigation options for aquatic resources are limited to permittee-responsible activities.

To date, several permittee-responsible mitigation options have been identified that may be suitable to partially or fully mitigate potential impacts to aquatic resources. As described in more detail in the Compensatory Mitigation Plan, five potential mitigation sites containing aquatic features have been identified and are currently under consideration. These five properties include lands adjacent to or in the immediate vicinity of public lands, including the Kern NWR, the Allensworth ER, the Kern Water Bank Authority Conservation Bank, the Semitropic Ecological Reserve, Center for Natural Lands Management lands, vernal pool fairy shrimp critical habitat, Poso Creek, and the Tule River. These properties have been surveyed for the presence of aquatic resources (wetland delineation) and CRAM assessments have been conducted to determine the baseline extent, condition, and suitability for mitigation (preservation, enhancement, re-establishment, or creation) consistent with the 2008 Mitigation Rule. Aquatic resources identified on these properties include vernal pool, depressional wetland, riverine, and riparian resource types.

The CRAM evaluation included evaluating wetland conditions identified on each site based on buffer and landscape context, hydrology, physical structure, and biotic structure using various metrics (and sub-metrics) to address wetland class-specific relationships. CRAM data can be utilized to determine which assessment areas could benefit from restoration or enhancement and which are suitable for preservation. In general, potential mitigation sites with CRAM scores >70 are suitable for preservation, sites with CRAM scores of between 25 and 70 are suitable for enhancement and or re-establishment, and sites with no aquatic resources may be suitable for creation.

CRAM data will also be key in determining the appropriate amounts of compensatory mitigation required to replace or compensate for the loss of wetlands (e.g., an impact to a wetland feature with a high CRAM score would require a higher mitigation ratio to compensate for unavoidable impacts to the wetland feature).

The wetland delineations and CRAM assessments conducted on five properties (i.e., the Buena Vista Dairy, Davis, Staffel Family Trust, Valadez, and Yang properties) identified that these properties, taken together, have a significant area of vernal pools that is suitable for preservation (Figure 6-2). These features are ideal candidates for preservation because they are in good condition. In addition to vernal pools, the Buena Vista Dairy property also has depressional wetlands in good condition that are, therefore, suitable for preservation. Also, the Staffel Family



PRELIMINARY DRAFT/SUBJECT TO CHANGE - HST ALIGNMENT IS NOT DETERMINED
Source: URS, 2012

June 18, 2012

Figure 6-2
Location overview of potential mitigation properties

Trust, Davis, and Valadez properties have depressional wetlands that have potential for enhancement because they have lower CRAM scores.

Re-establishment and creation may be possible on some of the properties identified. Specifically, a historic riverine system is present on the Buena Vista Dairy property that is currently being evaluated to determine its suitability for re-establishment. At several locations, the presence of vegetation (facultative plants) and seasonal wetland depressions suggests that creation of depressional wetlands would provide "ecological lift" to the overall ecosystem of the sites. Both creation and re-establishment would require additional consideration of the potential impacts of land conversion on the special-status wildlife species that are believed to occur on these parcels. Creation and re-establishment may be more appropriate on other properties that are yet to be identified where aquatic resources have been removed through the conversion to agriculture land uses and impacts to special-status wildlife would not occur. Although these resources may be created out-of-kind, they would provide ecological benefits to the landscape and watershed.

The estimated aquatic resource acreage is preliminary and the mitigation proposal will require review and approval by the USACE. Other properties are currently being considered and will be evaluated when the potential for mitigation has been analyzed in more detail. Specifically, further investigations are focusing on properties with potential for riverine and riparian enhancement and properties adjacent to the five properties identified in Table 6-11 that may be suitable for creation or enhancement of aquatic resources The total acreage of compensatory mitigation utilizing preservation, enhancement, and re-establishment has not been finalized. However, suitable opportunities exist in the potential permittee-responsible mitigation properties and in unidentified areas within the project watersheds.

Table 6-11
Potential Mitigation Properties: Acreage, CRAM Scores, and Mitigation Suitability

Mitigation Property	Resource Type	Acres	Average CRAM Score [a]	Mitigation Category
Middle Kern-Upper Tehachapi-Grapevine Watershed				
Buena Vista Dairy properties (715.0 acres)	Vernal pool	243.5	79.2	Preservation
	Depressional wetland	13.3	70.7	Preservation
Upper Deer–Upper White Watershed				
Yang properties (316.4 acres)	Vernal pool	170.0	81.0	Preservation
Staffel Family Trust property (61.2 acres)	Vernal pool	2.8	73.9	Preservation
	Depressional wetland	0.1	N/A	Enhancement
Tulare-Buena Vista Lakes Watershed				
Davis property (158.0 acres)	Vernal pool/swale	28.3	N/A	Enhancement
	Depressional wetland	4.1	69.7	Enhancement
Valadez property (120.0 acres)	Vernal pool	0.2	57.7	Enhancement
	Depressional wetland	0.8	58.5	Enhancement

N/A = not available

[a] Features without a CRAM score are the result of CRAM and wetland protocols classifying features differently. For example, the wetland delineation listed acreage for riverine features, but these features were historical; CRAM classified these same features as depressional wetlands.

CRAM = California Rapid Assessment Method

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Section 7.0

Net Watershed Condition and Recommendations

7.0 Net Watershed Condition and Recommendations

This section provides a high-level discussion regarding the potential post-project condition of the watersheds after implementation of the project, regardless of project alternative, with potential compensatory mitigation (the net watershed condition). At this time, a detailed evaluation is not possible because the project alternatives have not been selected, compensatory mitigation is in the planning phase, and no parcels are currently under contract or approved by the various regulatory agencies.

7.1 Net Watershed Condition

After the implementation of the compensatory mitigation, the HST project is anticipated to result in no net change or in a net increase in condition for the watersheds that would be affected by the project. No change in condition is expected because of the nature of the watersheds and aquatic features in the impact area, as described below, and because the implementation of compensatory mitigation would replace any potential loss through the creation, enhancement, or preservation of aquatic resources.

In general, the Level 1 Watershed Profile identified a number of common themes in each of the affected watersheds, especially in the Great Valley Ecological Section:

1. The conditions of aquatic features in the watersheds are similar, with significant quantities of aquatic features in poor condition and limited numbers of features in good condition.

2. The relative abundance and condition of habitats within watersheds depend on the level of disturbances or stressors on the watersheds.

3. Most of the aquatic features are man-made or manipulated; of the limited natural features that are present, most are affected by some form of disturbance or stressors.

4. Similar aquatic features are present in all watersheds (except in the Upper Deer–Upper White Watershed, where a significantly larger area of vernal pool landscape is present than in the other watersheds).

5. Watershed boundaries have been blurred through extensive water diversion.

Both in terms of the conditions in the watershed and the land uses identified in the watersheds, the Level 2 Impact Evaluation for the project affirms the findings of the watershed profile. As described below, the themes identified in the watershed profile are consistent with the conditions observed within the study area:

1. The vast majority of the aquatic resources in the Great Valley have been significantly degraded through extensive conversion to agricultural, urban, and transportation land uses. As a result, aquatic features are generally in poor condition, though some features, including seasonal riverine and vernal pools and swales, are generally in excellent or good condition. The condition of features in the study area is generally tied to the type of feature (i.e., man-made or manipulated features are typically in poor or fair condition and natural features are generally in good or excellent condition). These conditions were anticipated by the watershed profile and supported in the study area by the CRAM results. However, some vernal pools and swales near the Corcoran alternatives are in fair condition because they are near major stressors (SR 43 and the existing BNSF Railway tracks).

2. The relative abundance and condition of aquatic resources in the study area reflect the relative condition of habitats within their watersheds. For example, aquatic resources within the study area identified through CRAM as being in relatively "poor" condition generally correspond to habitats in the greater watershed most impacted by altered hydrology and land conversion. Likewise, aquatic resources within the study area identified through CRAM as being in relatively "good" condition generally correspond to relatively natural habitats in the watershed.

3. As described in Section 6.1, Impacts on Aquatic Resources, and Section 6.2, Existing Conditions, most aquatic features in the study area are man-made or manipulated. Natural aquatic features are present in the study area; however, their acreage and distribution are limited. The natural aquatic features present (vernal pools and swales and seasonal riverine) are generally in better condition, but many of these features have been subject to disturbance associated with conversation of adjacent areas and in the case of seasonal riverine, the reduction of the flood channel and riparian areas.

4. Similar aquatic features (canals/ditches, lacustrine, emergent wetlands, seasonal wetlands, seasonal riverine, riparian, and vernal pools and swales) are present throughout the study area. Many of the aquatic resources have been manipulated or are man-made to support agricultural land use practices, including canals/ditches, lacustrine, and emergent wetlands. However, as seen in the watershed profile, a higher density of vernal pool features is present in the Upper Deer–Upper White Watershed, which is associated with the Allensworth alternatives.

5. Due to extensive networks of canals and water diversions, clear watershed boundaries were not observed.

The above themes, which were observed in both the Level 1 Watershed Profile and the Level 2 Impact Evaluation, reduce the potential for the project to result in a net negative impact on the project watersheds.

Because most aquatic features that would be affected by the project are already in poor condition, it is not likely that project impacts (especially indirect impacts) would further reduce the condition of the features significantly. Many features in poor condition are currently exposed to stressors such as transportation corridors, agricultural land uses, and urban development; therefore, construction of the HST project would not significantly change the existing condition or significantly modify the watershed profile. The features that are in good or excellent condition are much more likely to experience a reduction in condition due to construction of the HST project. The aquatic conditions (including functions and services) of these features that would be lost as a result of project construction would be the focus of the compensatory mitigation efforts.

After the occurrence of direct-permanent impacts on man-made and manipulated features in the study area, these features would be considered to be completely lost. However, through project engineering design and the inclusion of culverts, hydrological connections associated with canals/ditches would be maintained and the services provided would not be lost. After the occurrence of direct-temporary impacts on man-made and manipulated features in the study area, these features would be restored to pre-project condition after construction, where possible, with no reduction in condition (and with no reduction or loss of functions and services). For example, several canals/ditches will be re-routed to accommodate construction of the HST project but this re-routing would not reduce the condition of these features or diminish their functions and services. The limited natural features that would be affected by the project (i.e., would experience direct-permanent or direct-temporary impacts) are much more susceptible to project impacts and would be reduced both in condition and in terms of functions, values, and

services. The loss of the natural features would be mitigated through compensatory mitigation efforts.

Under a strict interpretation of the watershed-based mitigation, a number of small compensatory mitigation projects would need to be implemented in each of the project watersheds. The numerous small projects required under a strict interpretation would have a limited influence on the overall condition of the regional watershed. In many of the project watersheds, the mitigation would only compensate for impacts to features in poor ecological condition, because the conditions of aquatic resources have been significantly degraded across all of the project watersheds through the conversion of natural land to agricultural and urban land uses.

However, because the watershed boundaries are blurred and similar features were observed in all watersheds, the project area is more realistically considered as a single hydrologic unit. Focusing compensatory mitigation efforts in a subset of this larger watershed will result in larger projects that will improve the conditions in those watersheds and which will provide a greater degree of functional lift for the overall condition of the region. With consideration of these factors, compensatory mitigation should be designed to maintain the condition (in terms of both quantity and quality of aquatic resources) of the greater project region rather than mitigating on a watershed-by-watershed basis.

Compensatory mitigation efforts should focus on locations where mitigation efforts are likely to succeed (i.e., in locations where the risk of failure for enhancement, restoration, and preservation projects is low). Examples of such locations include areas where the aquatic features present are in good condition or are adjacent to good condition aquatic resources and/or protected areas.

In summary, watershed profiles and project impacts evaluations (both in terms of quantity and quality) and compensatory mitigation will be conducted in select areas and will focus on select watersheds (consistent with project impacts to sensitive resources). Sufficient opportunities will be available to provide significant enhancements and benefits to one or more watersheds that will, in both the short term and the long term, provide local and regional ecological benefit (or lift) to the watershed and to existing conditions of the associated aquatic features. In the end, the condition of the watersheds will be sustained or enhanced through the long-term preservation of aquatic resources and will experience no net loss of aquatic functions, values, or services (condition).

7.2 Recommendations

This report is designed to provide an analysis to the USACE of the extent and quality of the wetlands and other jurisdictional features present in the watershed in which the Fresno to Bakersfield Section of the HST System occurs. The purpose of this evaluation is to provide the USACE with information with regard to the extent and quality of the aquatic resources present in the study area and the extent to which these features would be affected by construction and operation of the Fresno to Bakersfield Section. The impacts to existing aquatic resources are organized by watershed and by project alternative so that the project proponents (Authority and FRA), along with the USACE and EPA, can use the data in this report to evaluate, identify, and compare the preferred project alternative and ultimately assist in the identification of the preliminary LEDPA.

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Section 8.0
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8.0 References Cited

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Section 9.0
List of Preparers

9.0 List of Preparers

This section lists the URS-HMM-Arup Joint Venture employees that prepared this report, and provides a summary of their qualifications, roles, and responsibilities in the preparation of this Watershed Evaluation Report.

Name Title	Role	Years Experience, Qualifications
REGIONAL CONSULTANT ENVIRONMENTAL TEAM		
Report Text and Preparation		
Justin Whitfield Project Ecologist	Fresno to Bakersfield Biology Task Manager, organized and planned report preparation.	B.S., Biological Sciences, Florida State University. 10 years of experience conducting biological assessments and preparing environmental documents.
Andrea Coleman Wildlife Biologist	Coordinated watershed data analysis, prepared report text.	B.S., Biology, University of California-Los Angeles. 3 years of experience conducting special-status species surveys and preparing environmental documents.
Amy Langston Wetland Scientist	Coordinated impacts analysis, prepared report text.	M.S., Biology, San Francisco State University. 7 years of experience conducting wetland delineations and preparing environmental documents.
Tammy Lim Wildlife Biologist	Prepared report text.	M.A., Ecology and Systematic Biology, San Francisco State University. 12 years of experience conducting special-status species surveys and preparing environmental documents.
Katie Dudney Senior Ecologist	Prepared report graphs.	M.S., Natural Resources, North Carolina State University. 5 years of experience preparing mitigation and restoration plans.
Tracy Bain Wildlife Biologist	Prepared report text.	B.S., Wildlife Biology, Ohio University. 3 years of experience conducting surveys for special-status wildlife species.
Report Figures		
Rose Abbors Senior GIS Analyst	Fresno to Bakersfield GIS Task Manager.	B.S., Geography, Arizona State University. 6 years of experience in GIS task management and cartographic design.
Jessie Parteno Geographic Information Systems (GIS)	Developed GIS models for watershed and impacts analysis.	B.S., Biology and GIS, University of Guelph. 8 years of experience in GIS Geodatabase design.
Report Review / ITR / DCR		
Chad Roberts CRAM Coordinator; Roberts Environmental and Conservation Planning	Provided technical guidance, conducted Internal Technical Review.	Ph.D., Biology, University of California-Davis. CRAM-certified trainer. 32 years of experience in environmental consulting, owner of Roberts Environmental and Conservation Planning.

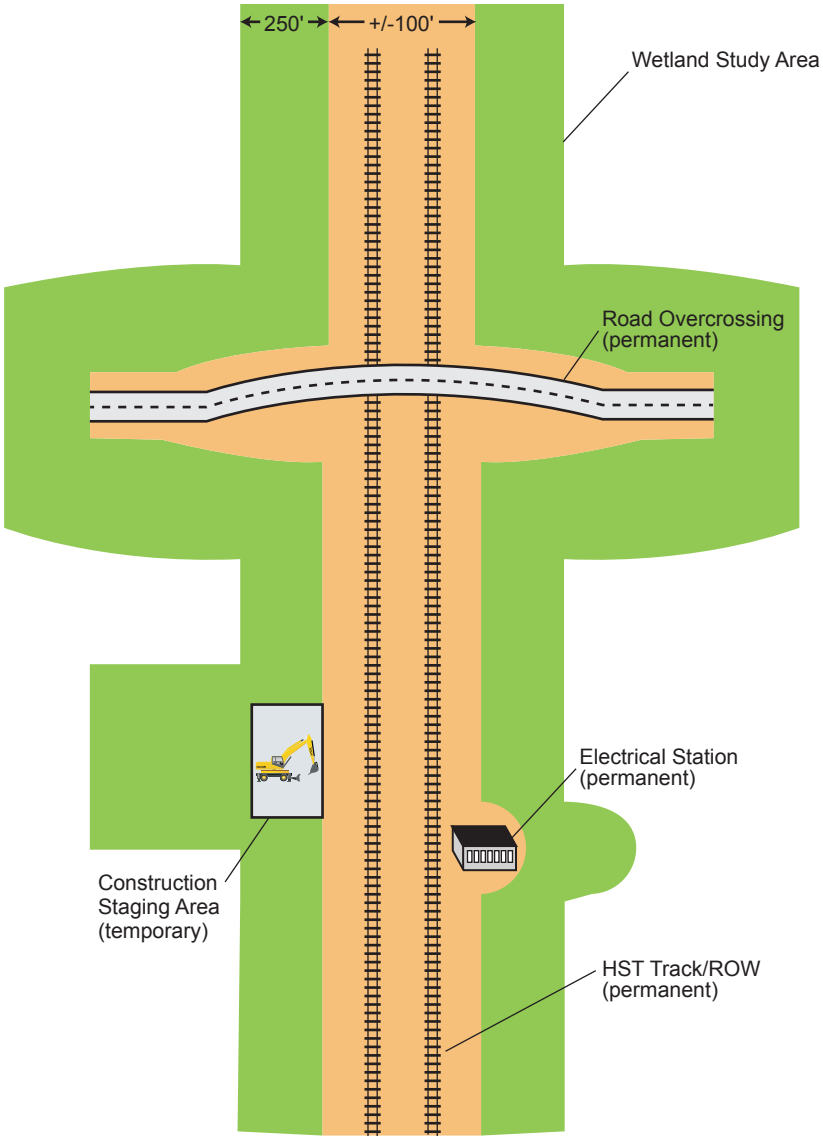
Name Title	Role	Years Experience, Qualifications
Report Editing		
Dennis Rowcliffe Senior Technical Editor	Technical Editor	B.A., American Studies and Journalism, California State University, Los Angeles. 21 years of experience editing technical documents.
Jay Plano Technical Editor	Technical Editor	M.A., Political Science, University of California, Berkeley. 23 years of experience in editing technical, legal and business documents.
Deb Fournier Word Processing and Formatting Specialist	Report formatting	10 years of experience creating and formatting word documents.

Appendix A

Evaluation of Wetland Conditions Using the California Rapid Assessment Method (CRAM) (provided on disk)

Appendix B
Impact Evaluation Schematics

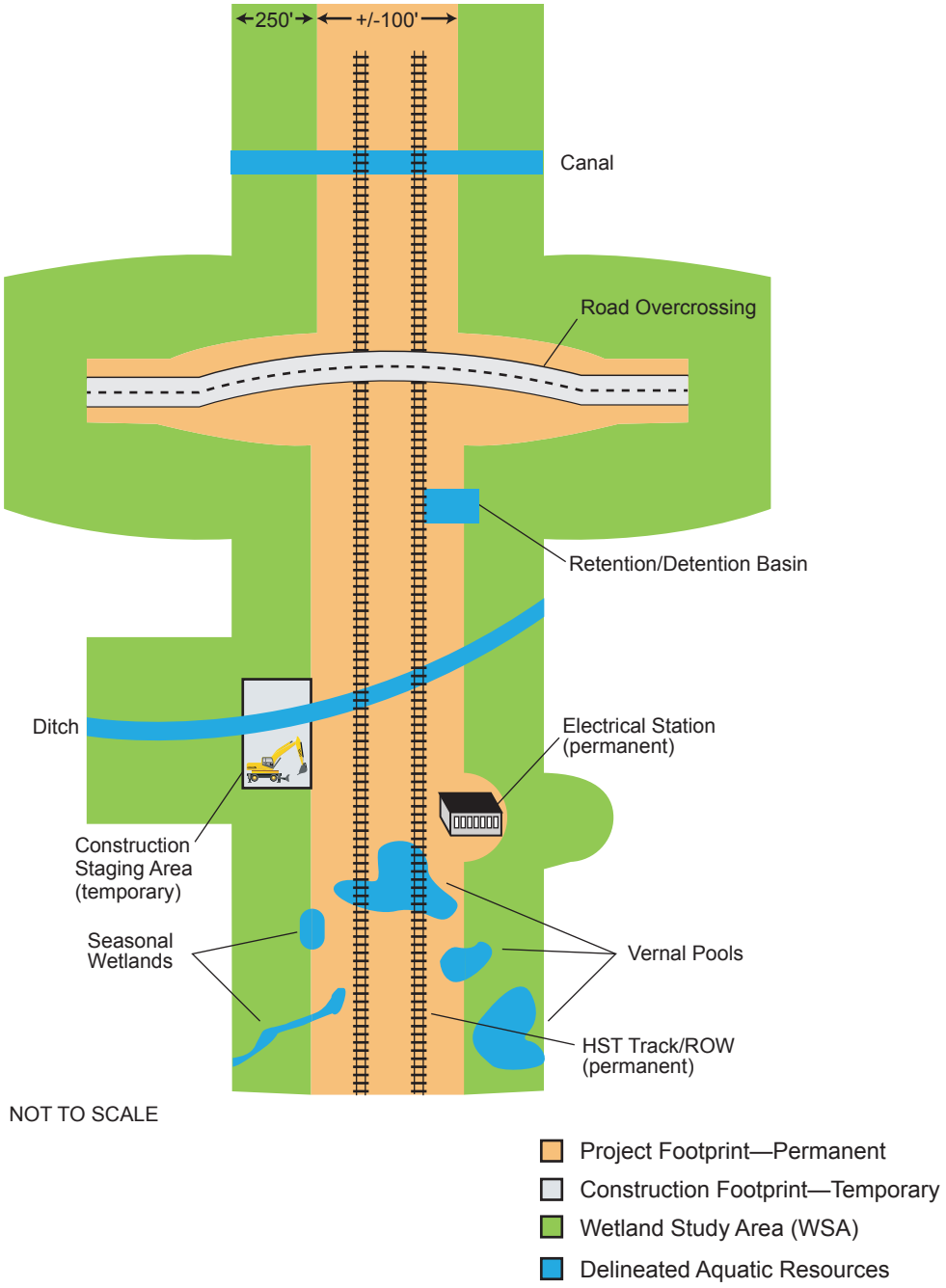
Project and Construction Footprint



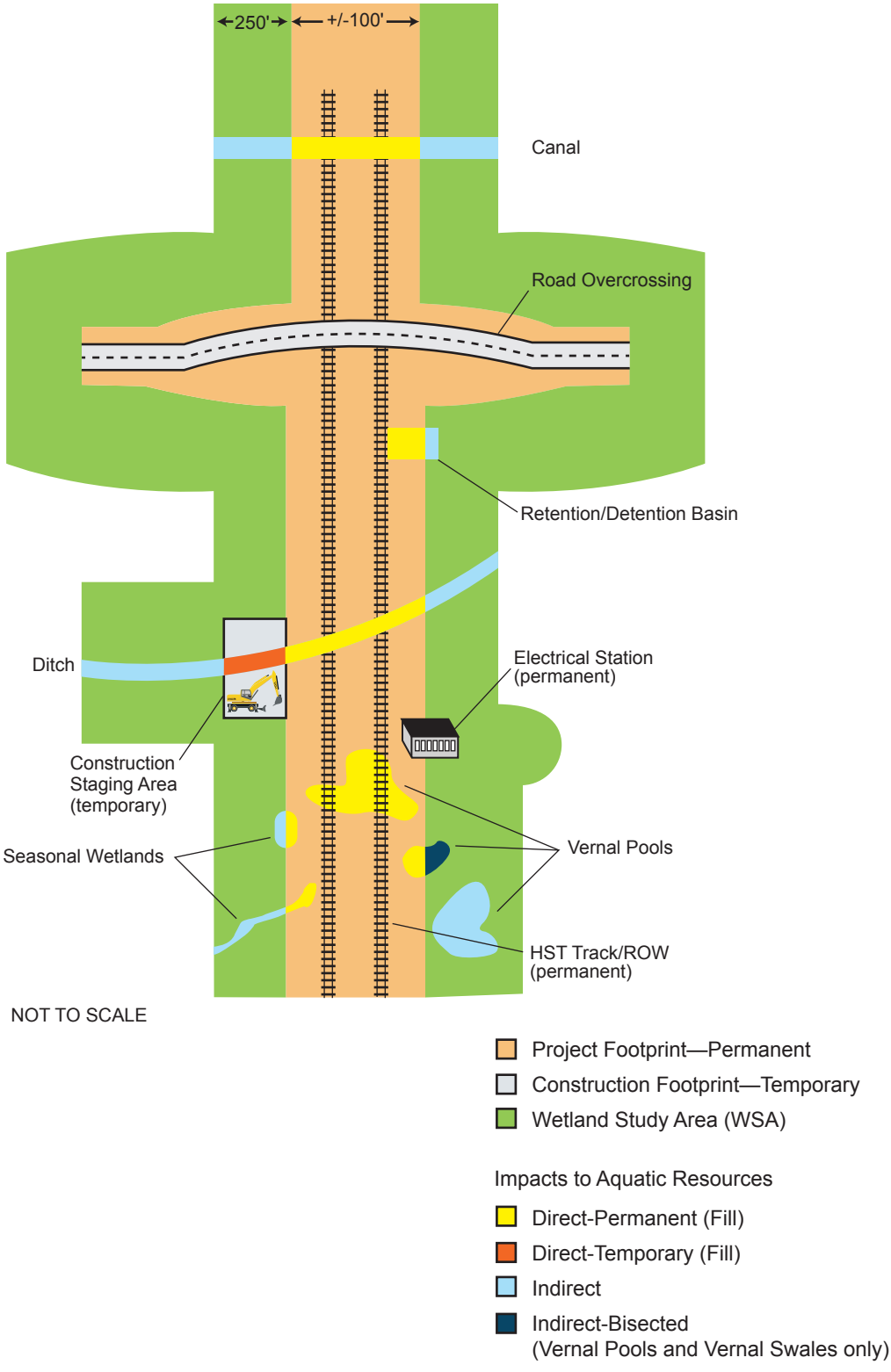
NOT TO SCALE

- Project Footprint—Permanent
- Construction Footprint—Temporary
- Wetland Study Area (WSA)

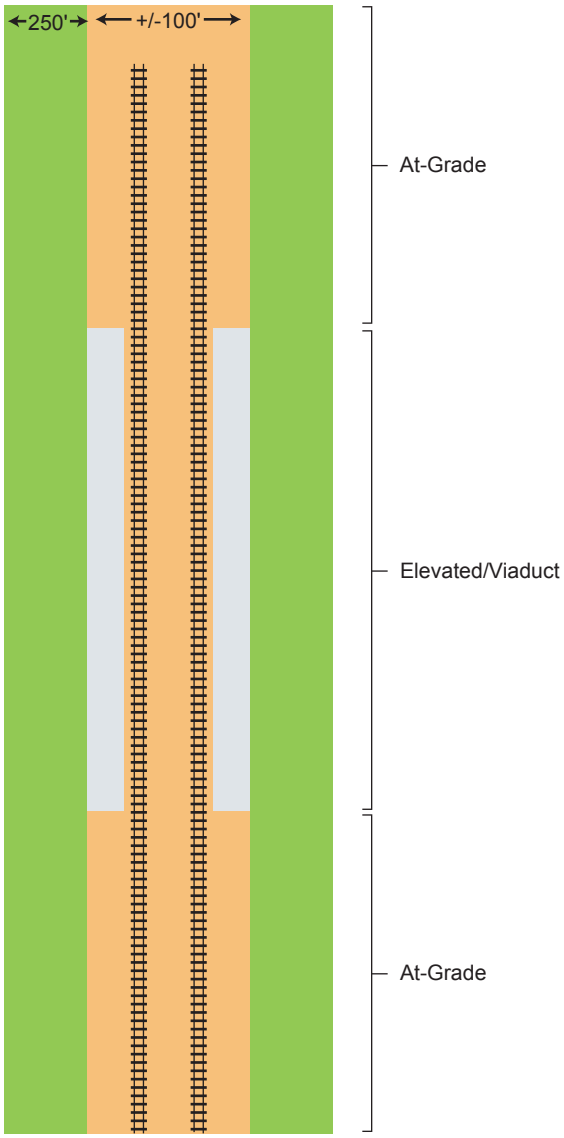
Wetland Delineation



Construction and Project Impacts



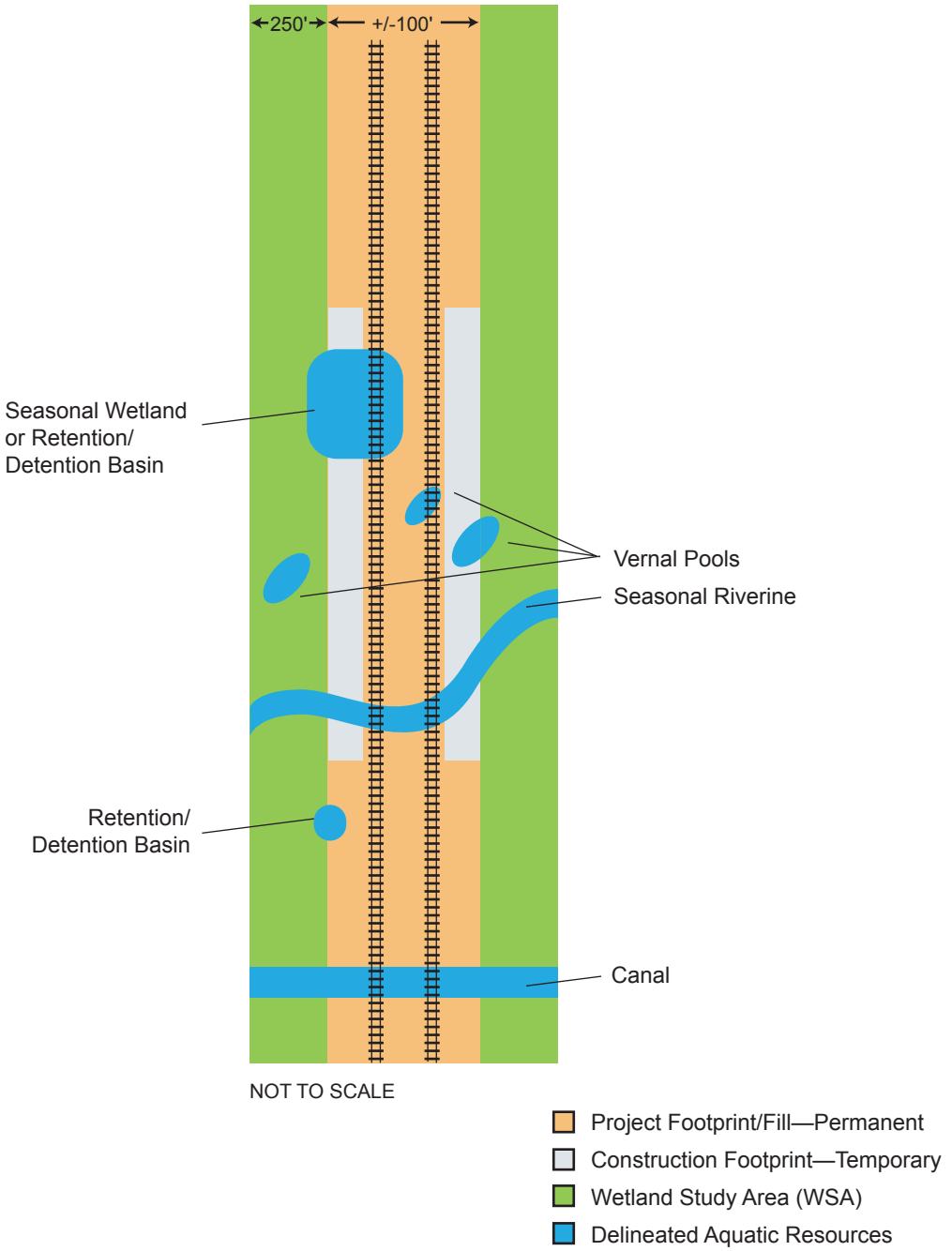
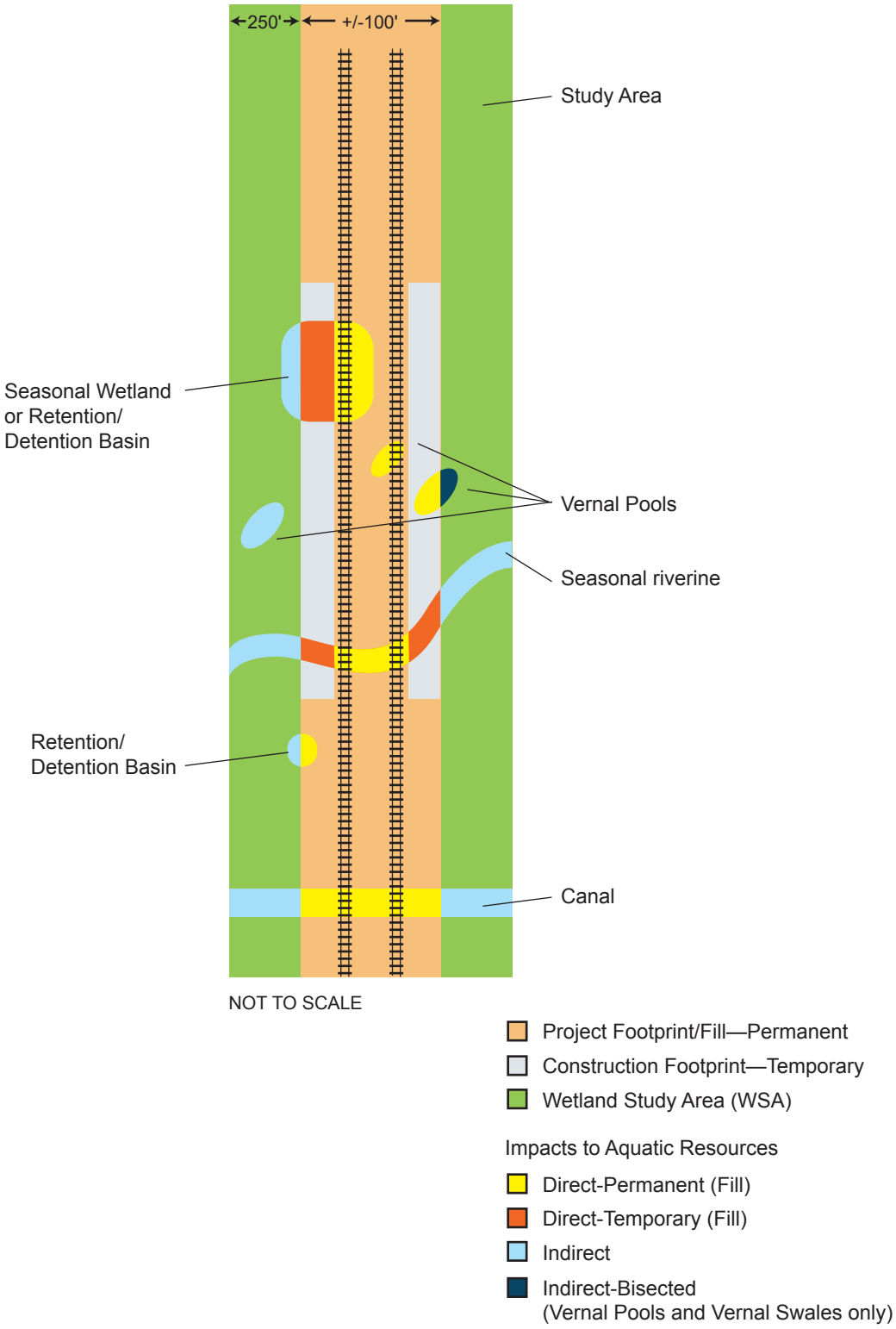
At-grade vs. Elevated



NOT TO SCALE

- Project Footprint/Fill—Permanent
- Construction Footprint—Temporary
- Wetland Study Area (WSA)

Wetland Delineation



Construction and Project Impacts