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

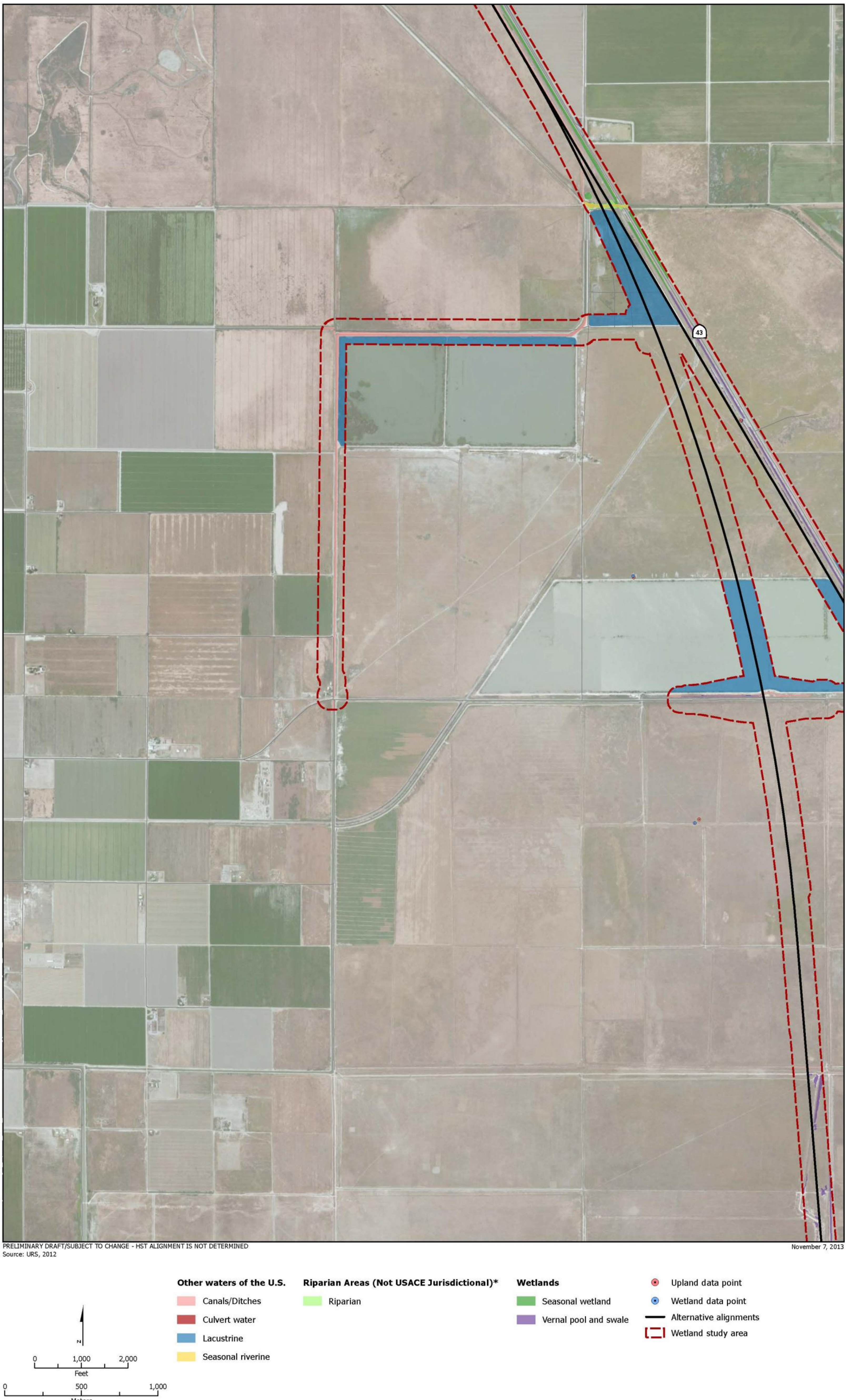

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 18)

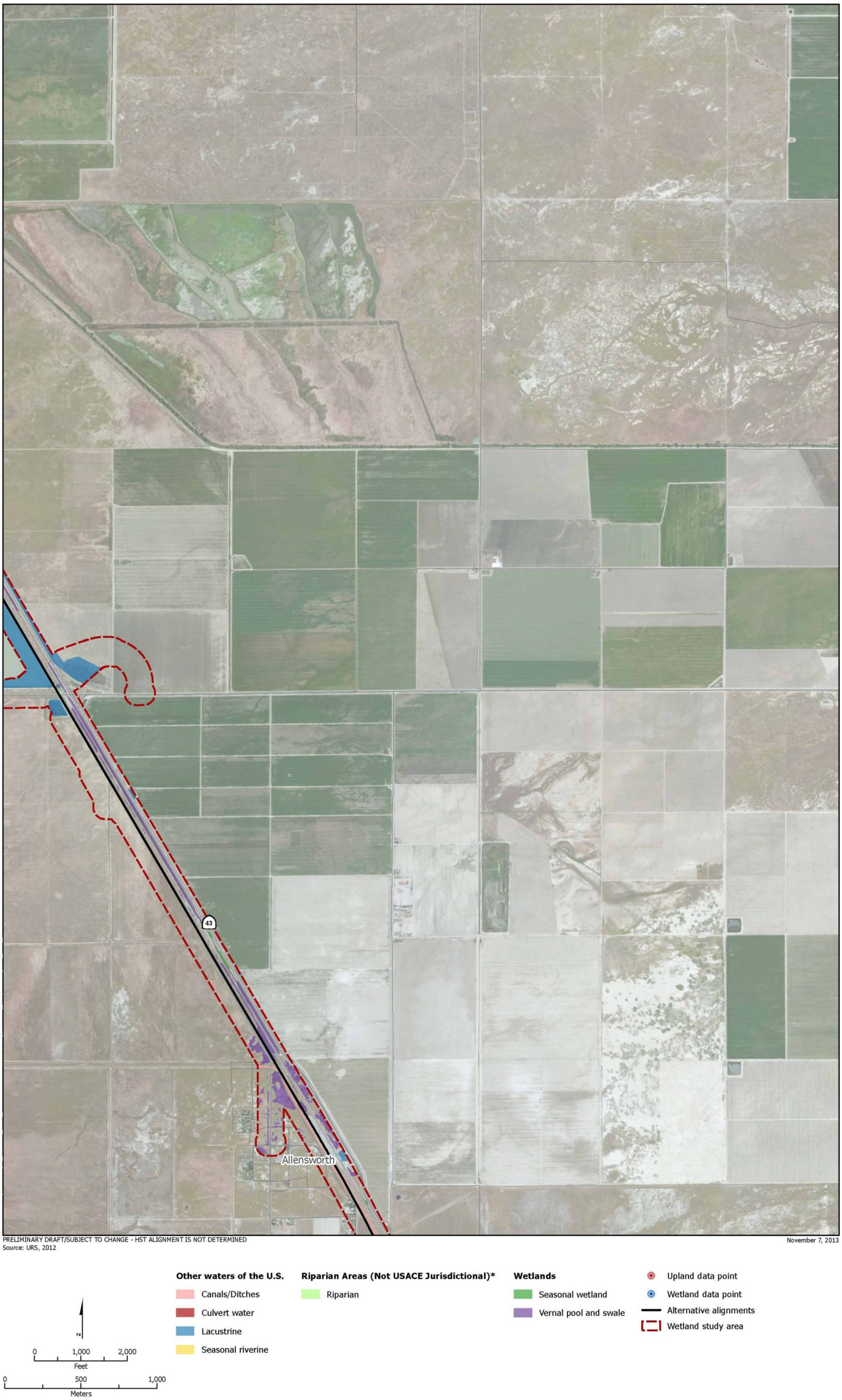

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 19)

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)

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

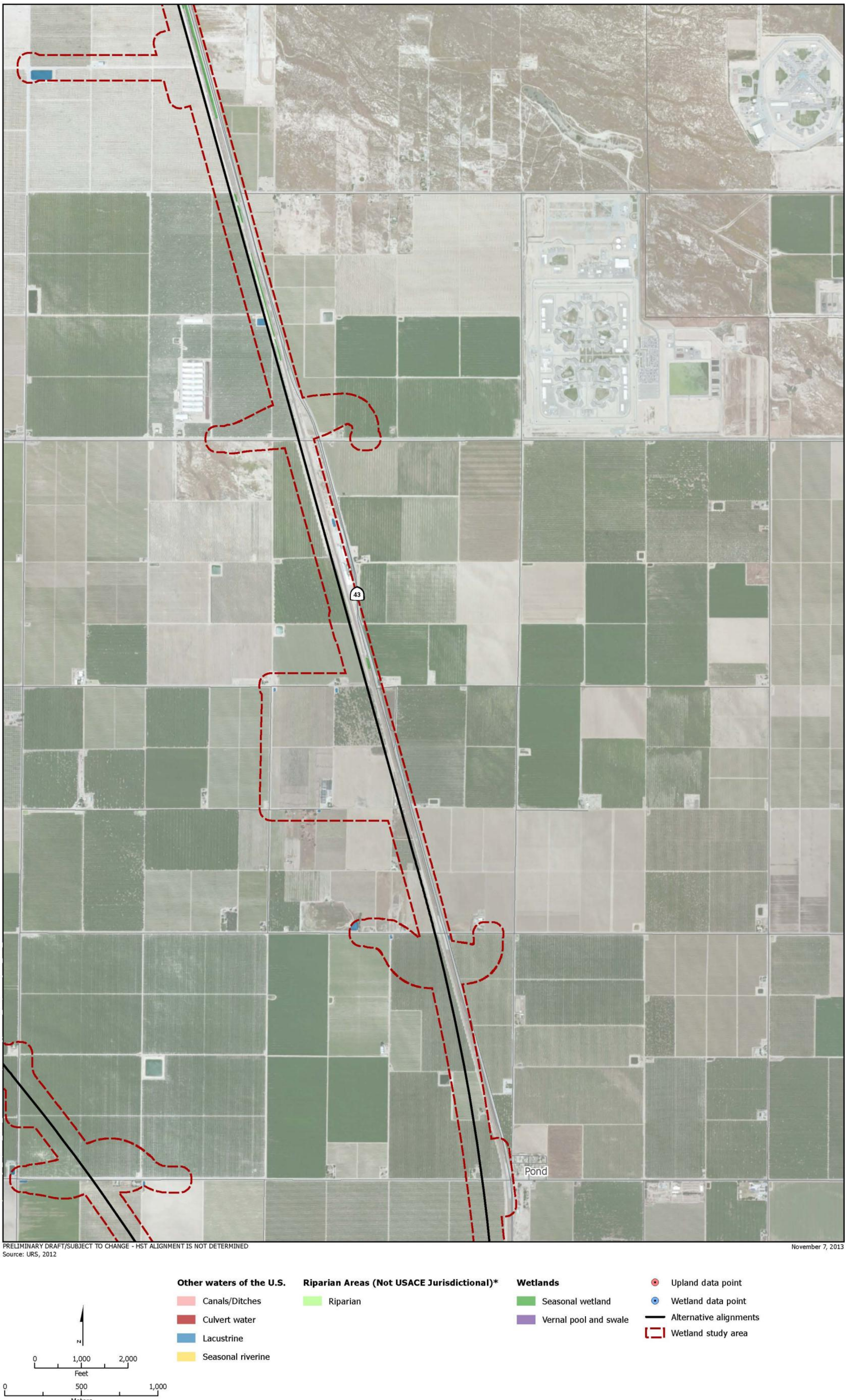

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 23)

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

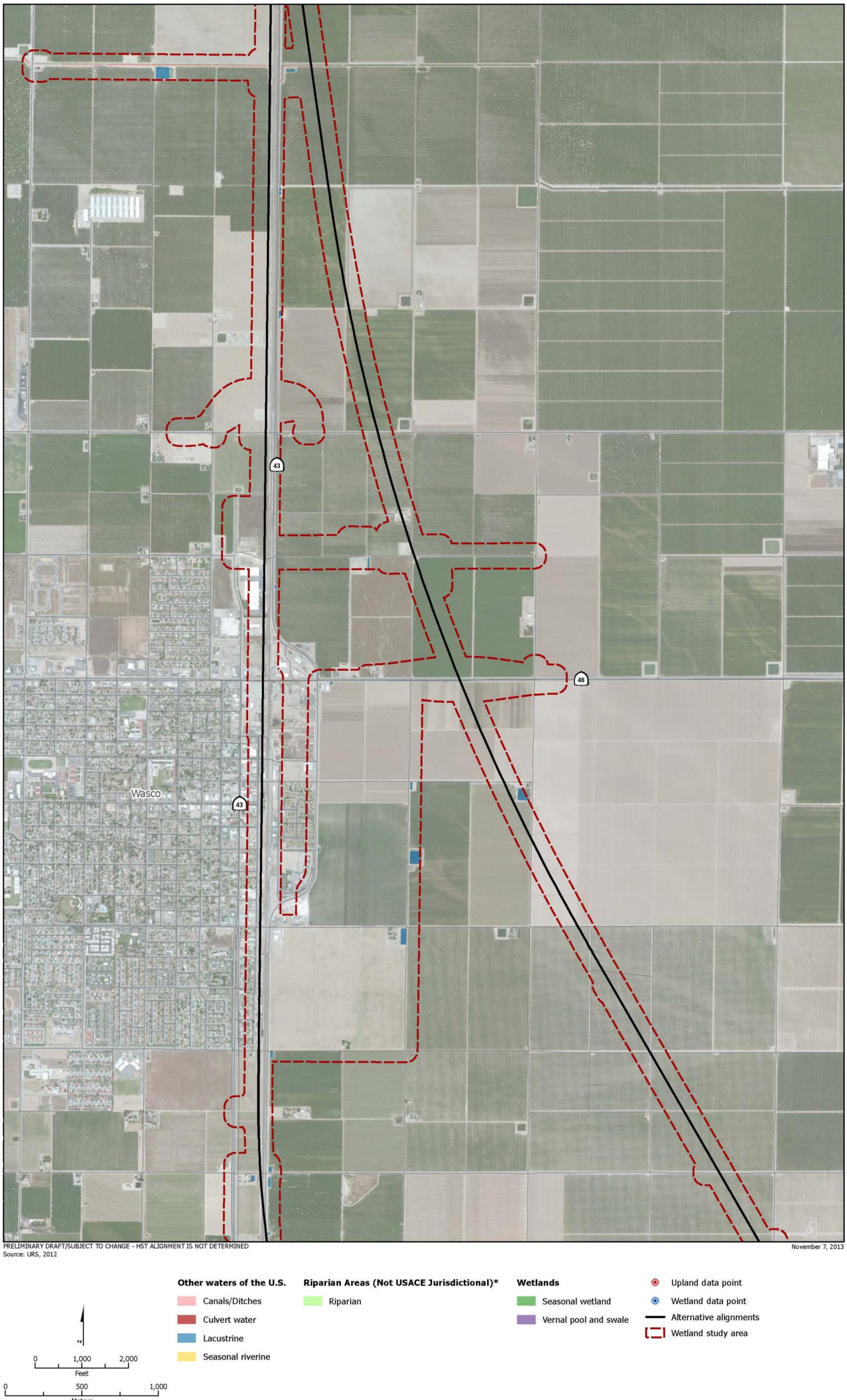

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 25)

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

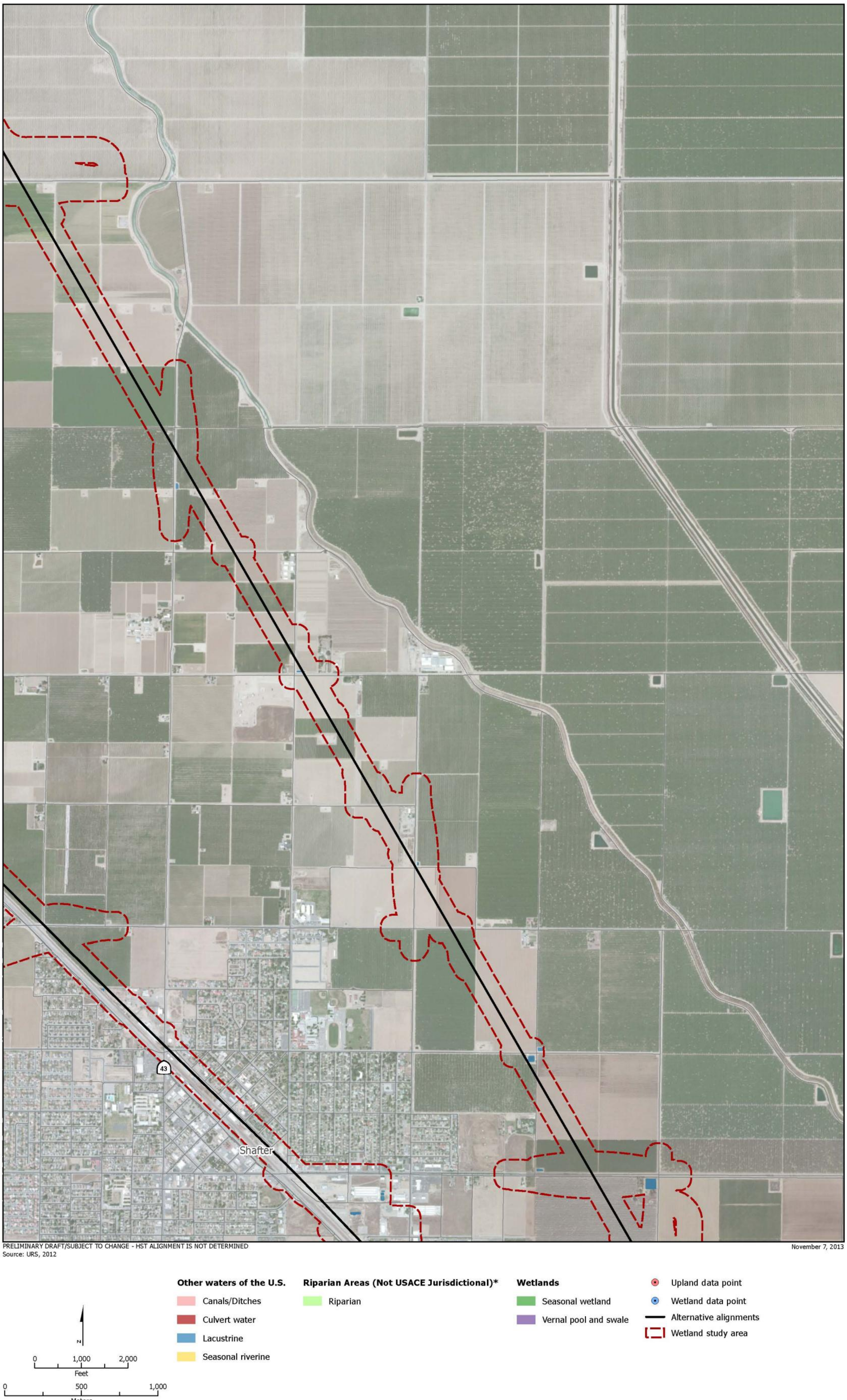

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 27)

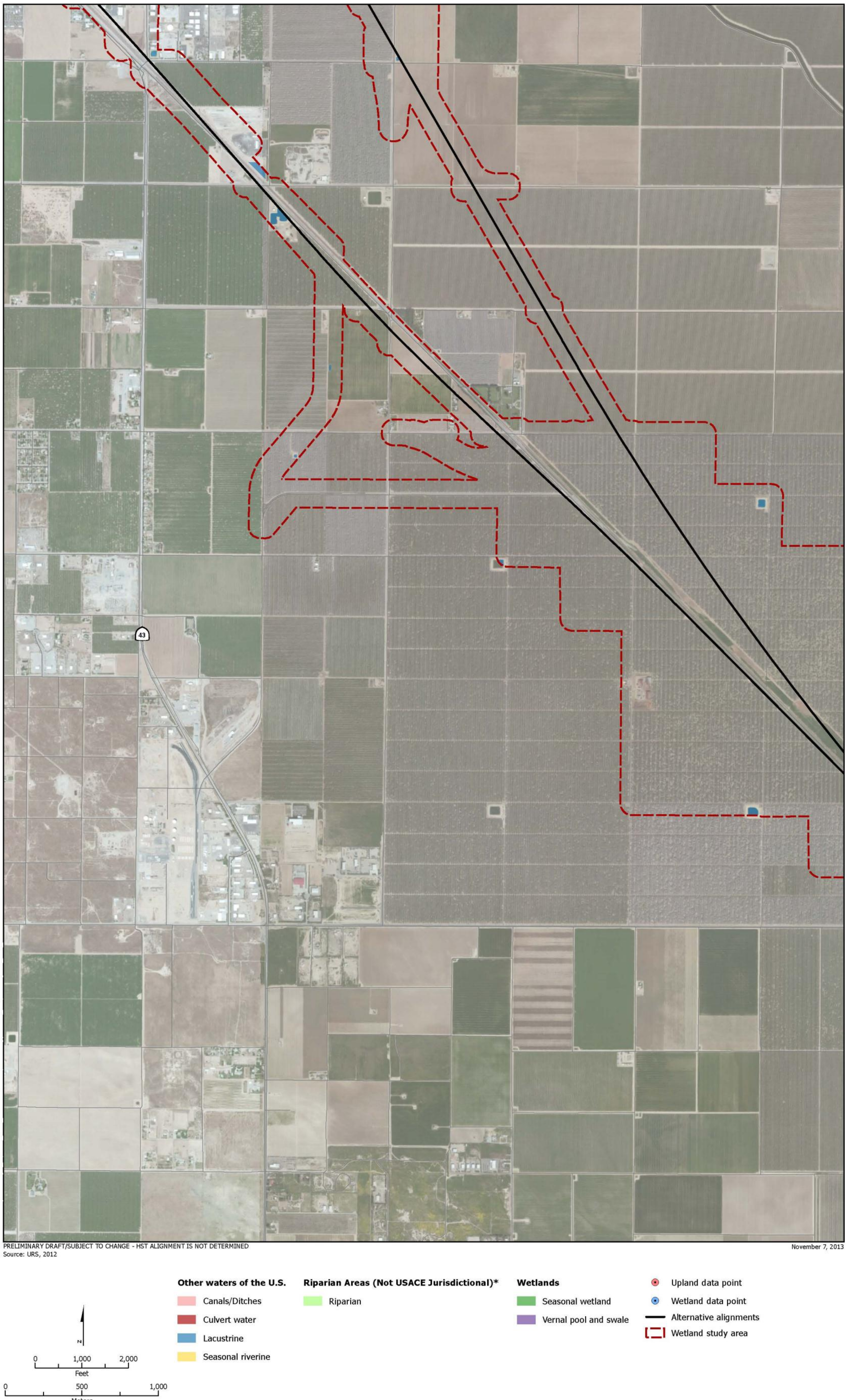

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 28)

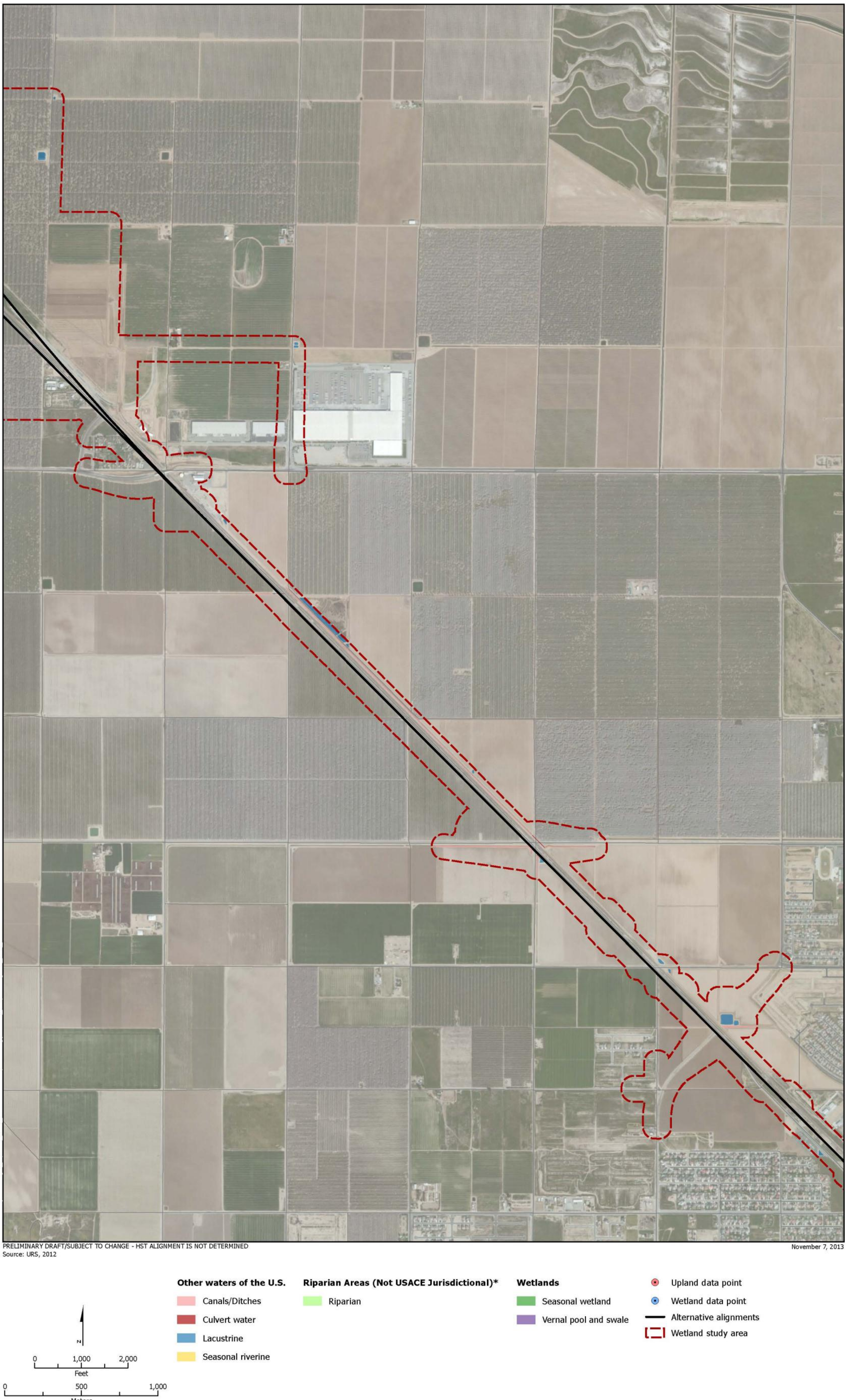

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 29)

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

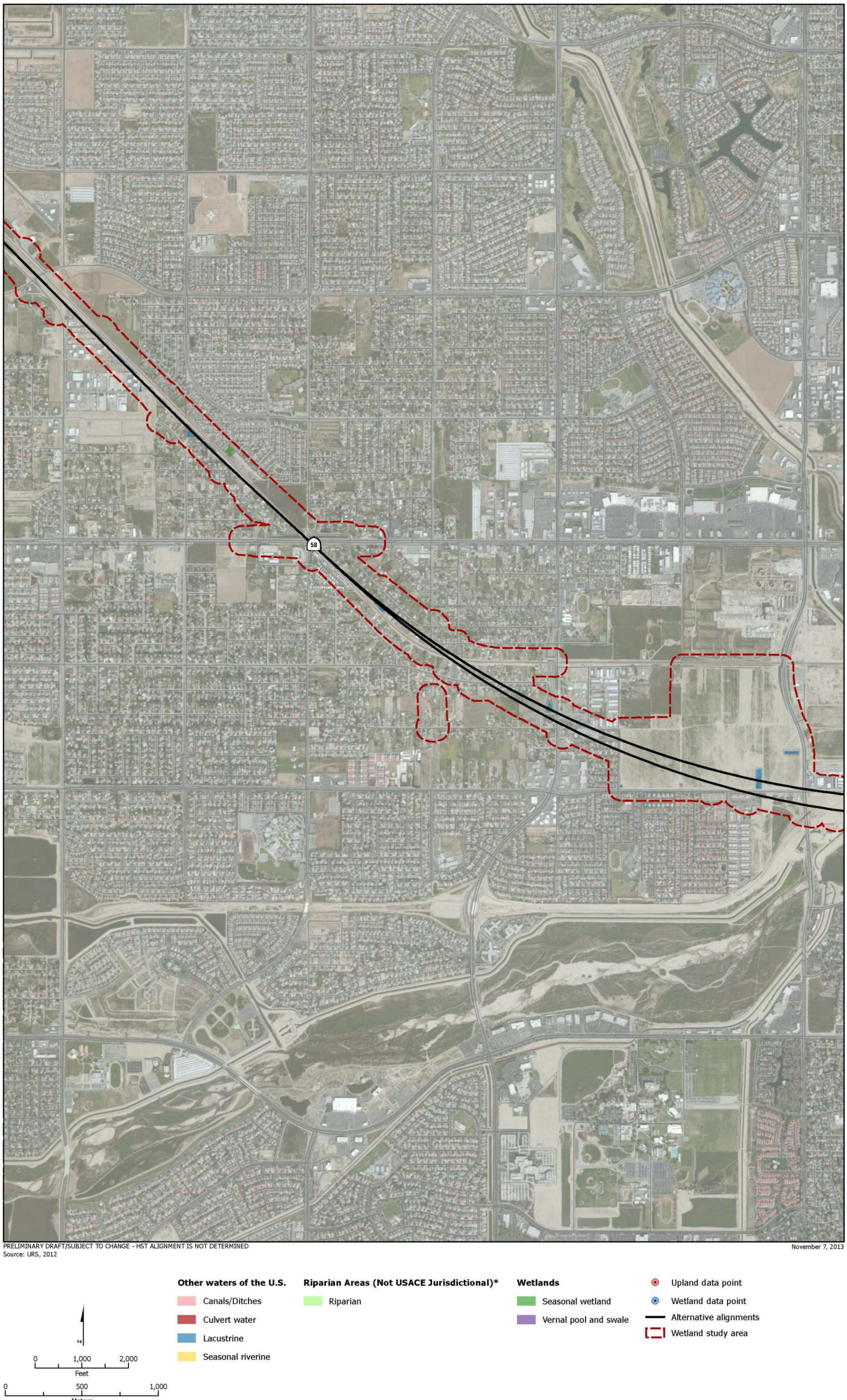

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 30)

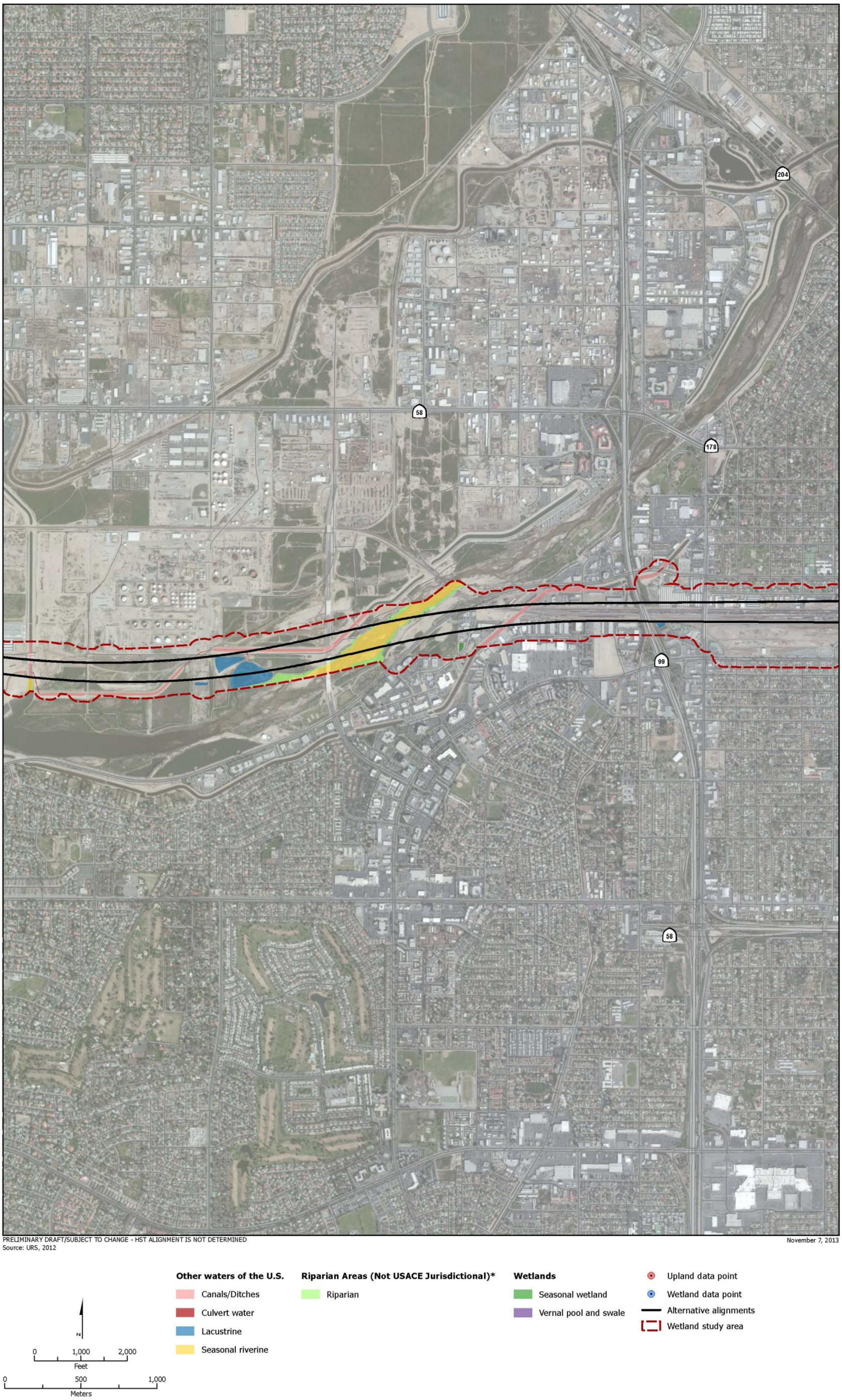

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 31)

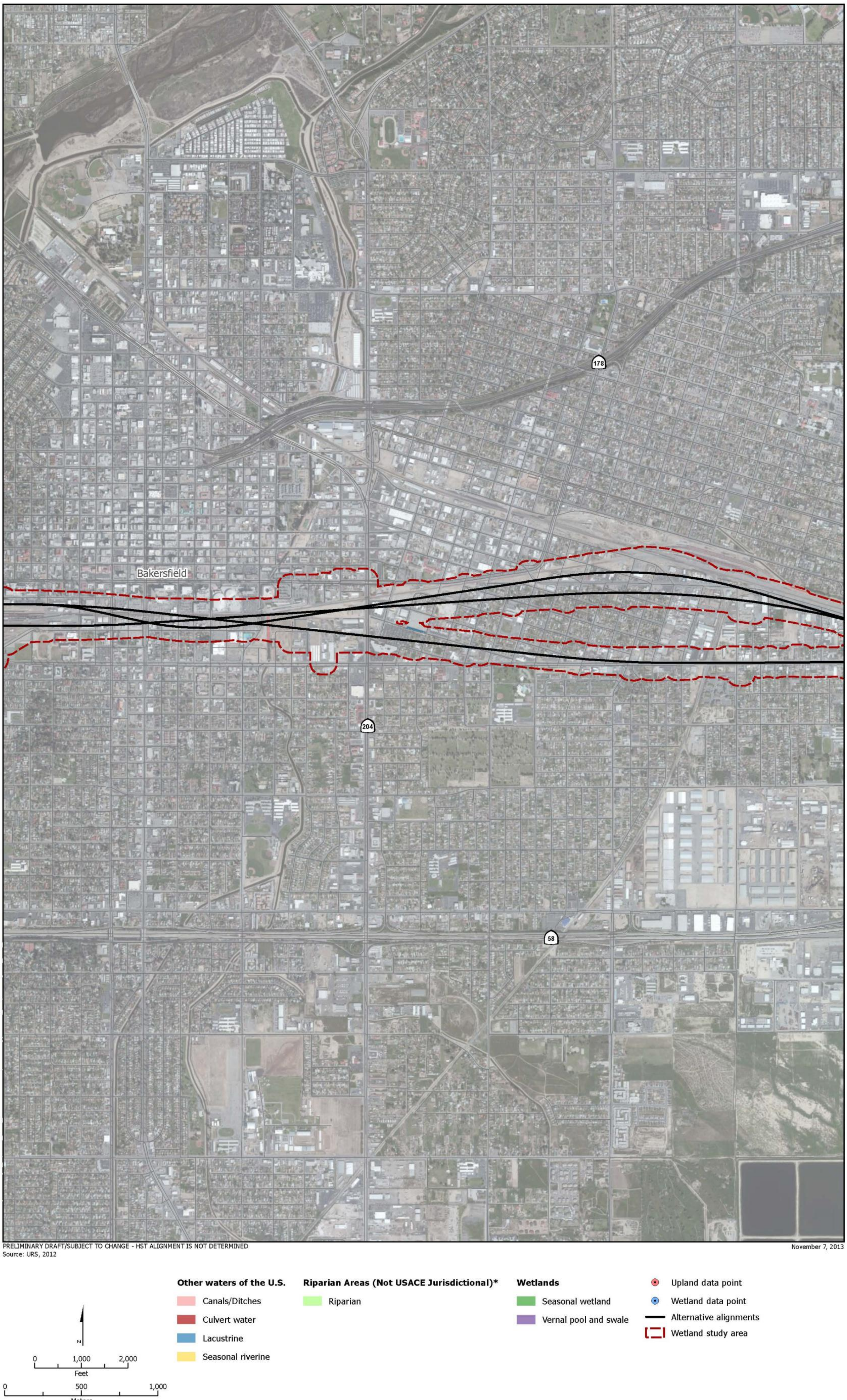

Figure 4-7
Jurisdictional waters delineation and riparian areas (Sheet 32)

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

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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.

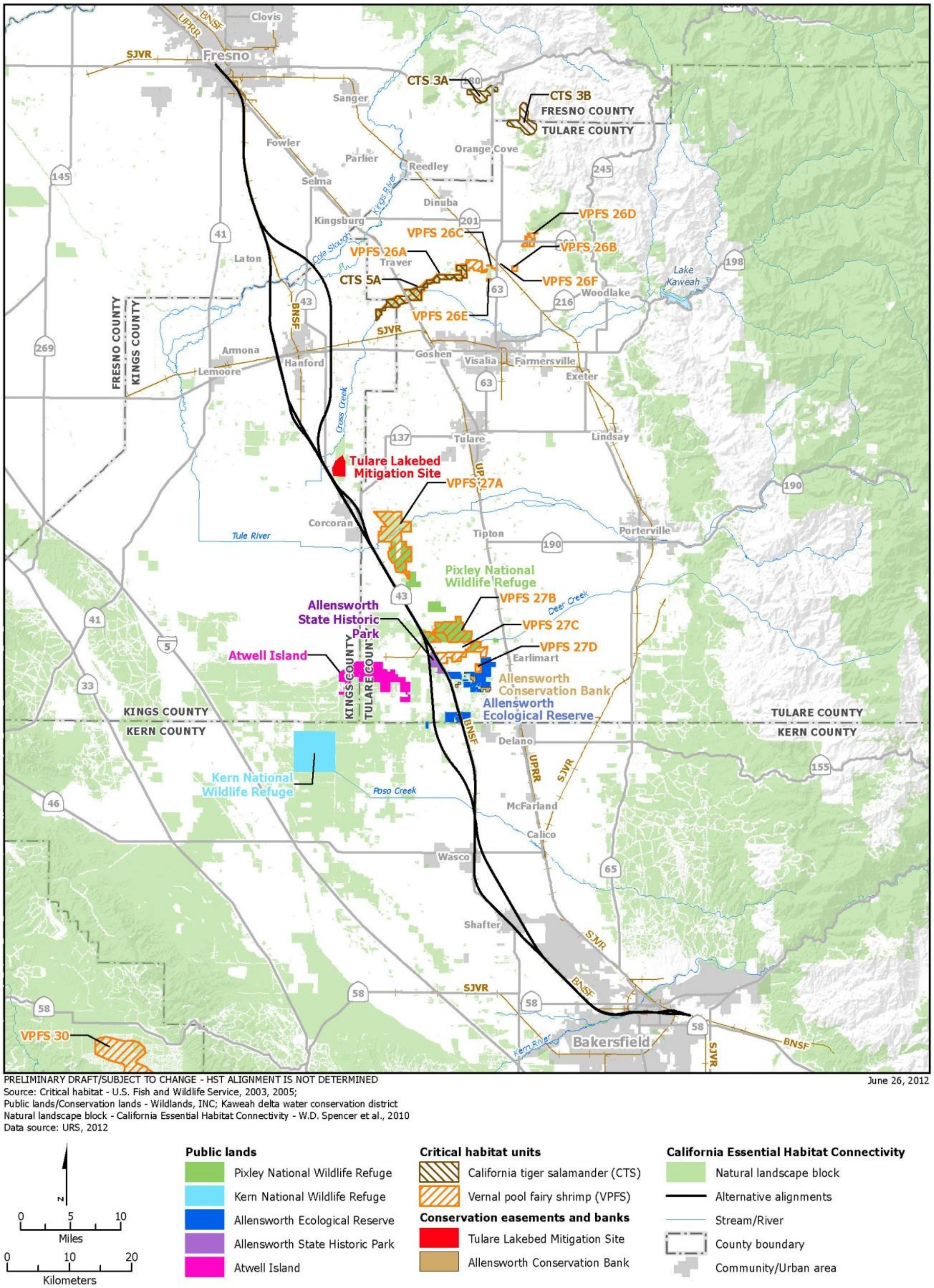

Figure 4-8
Special areas and conservation lands

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.

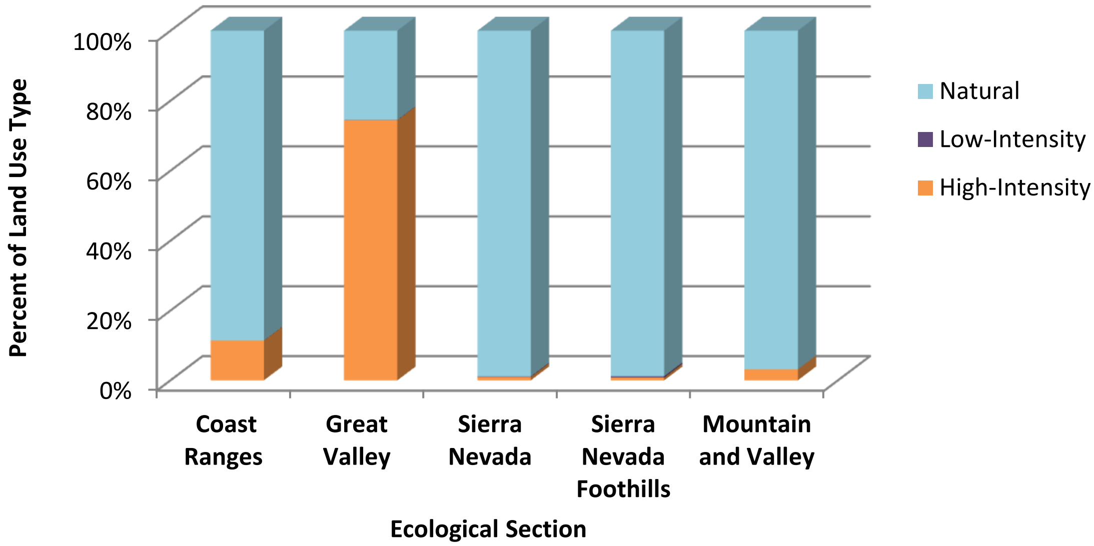

Chart 5-1. Land use types in the Tulare Lake Basin watersheds that intersect the Fresno to Bakersfield Section alternatives, grouped by ecological section.

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.

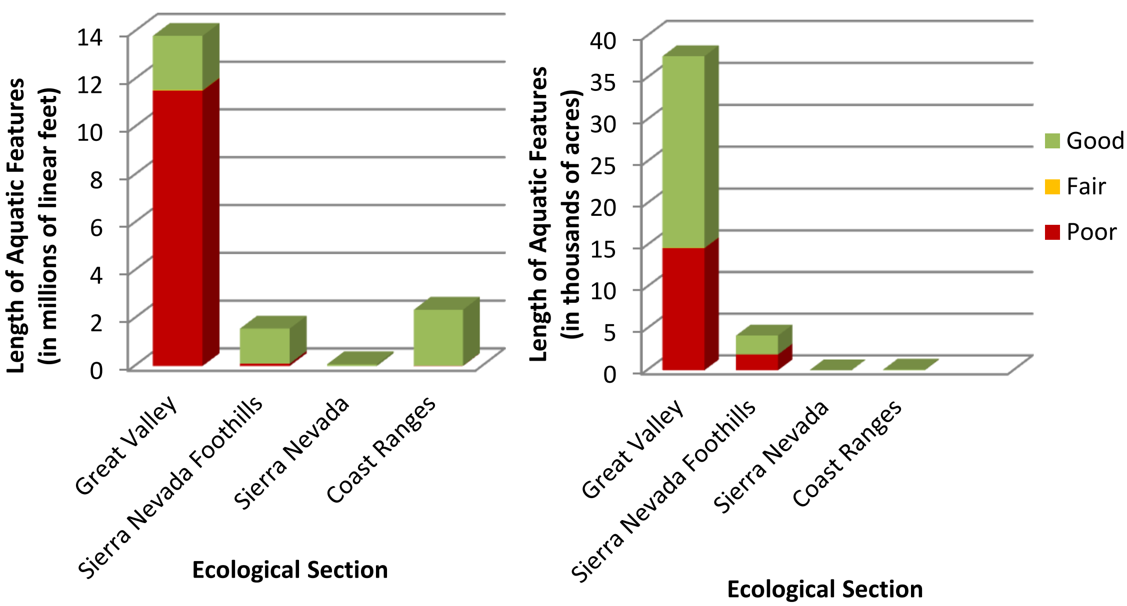

Chart 5-2

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

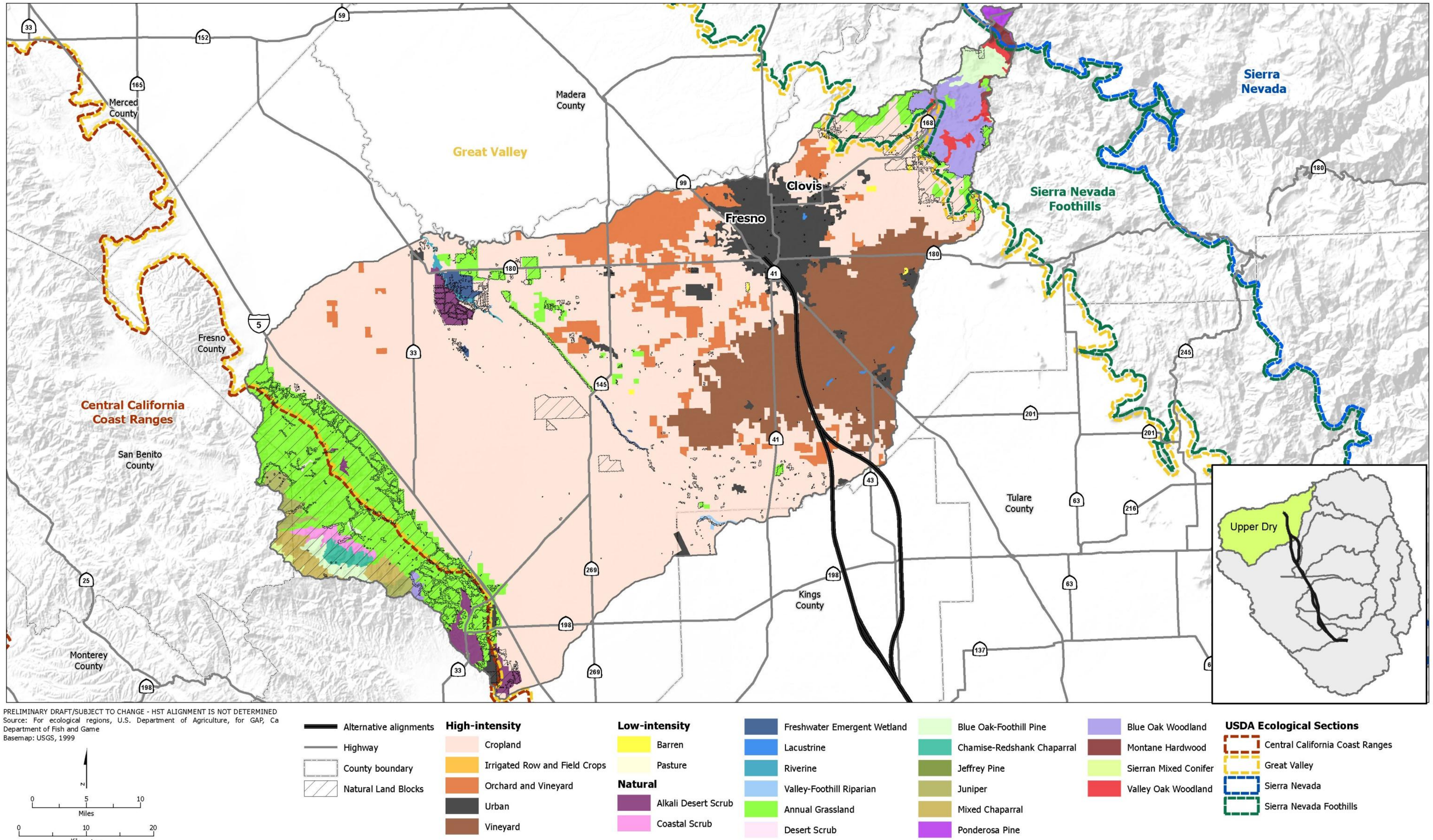

Figure 5-1a
Land use in the Upper Dry Watershed

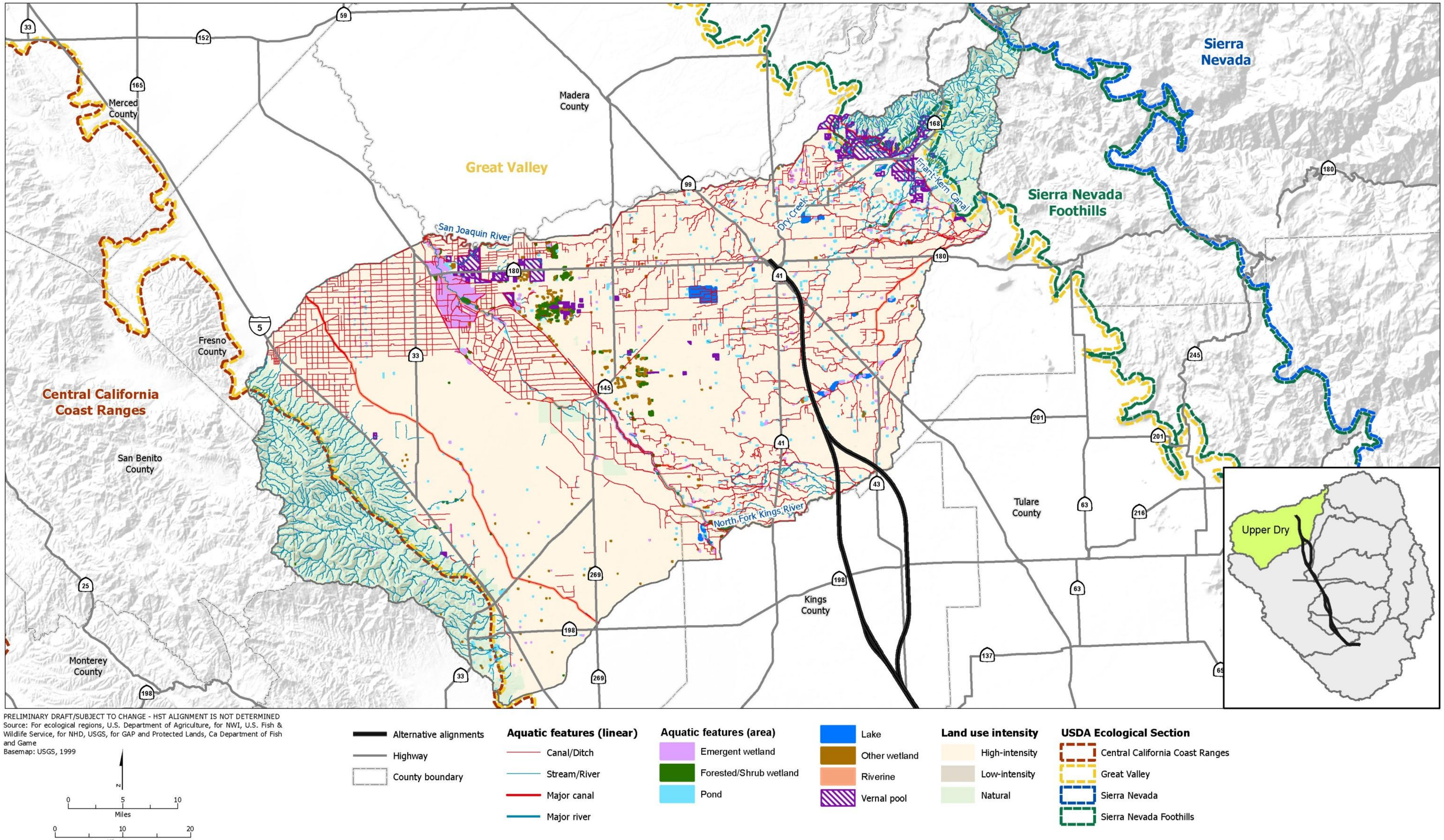

Figure 5-1b
Aquatic features in the Upper Dry Watershed

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.

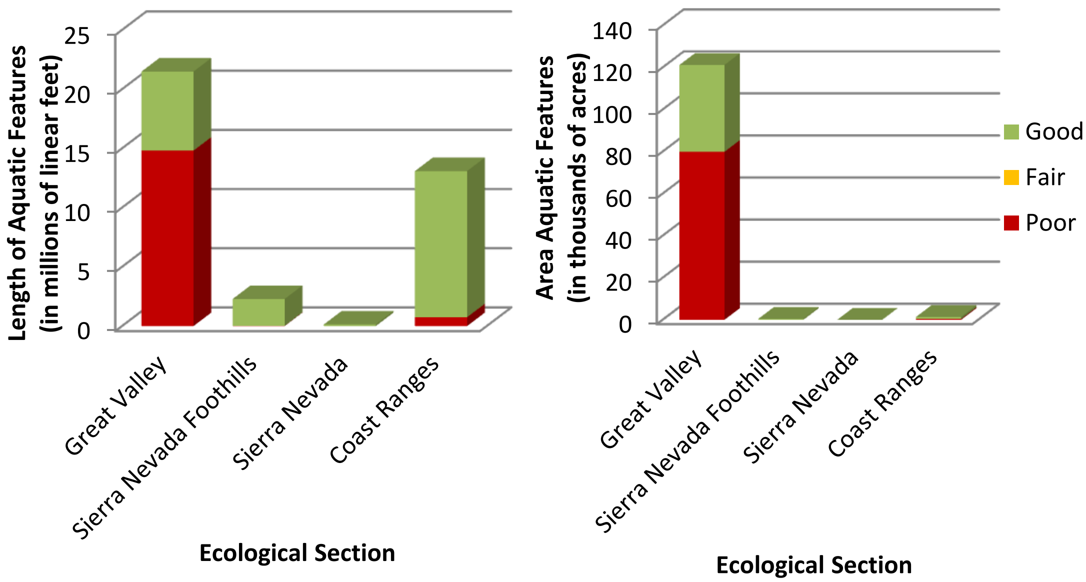

Chart 5-3

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

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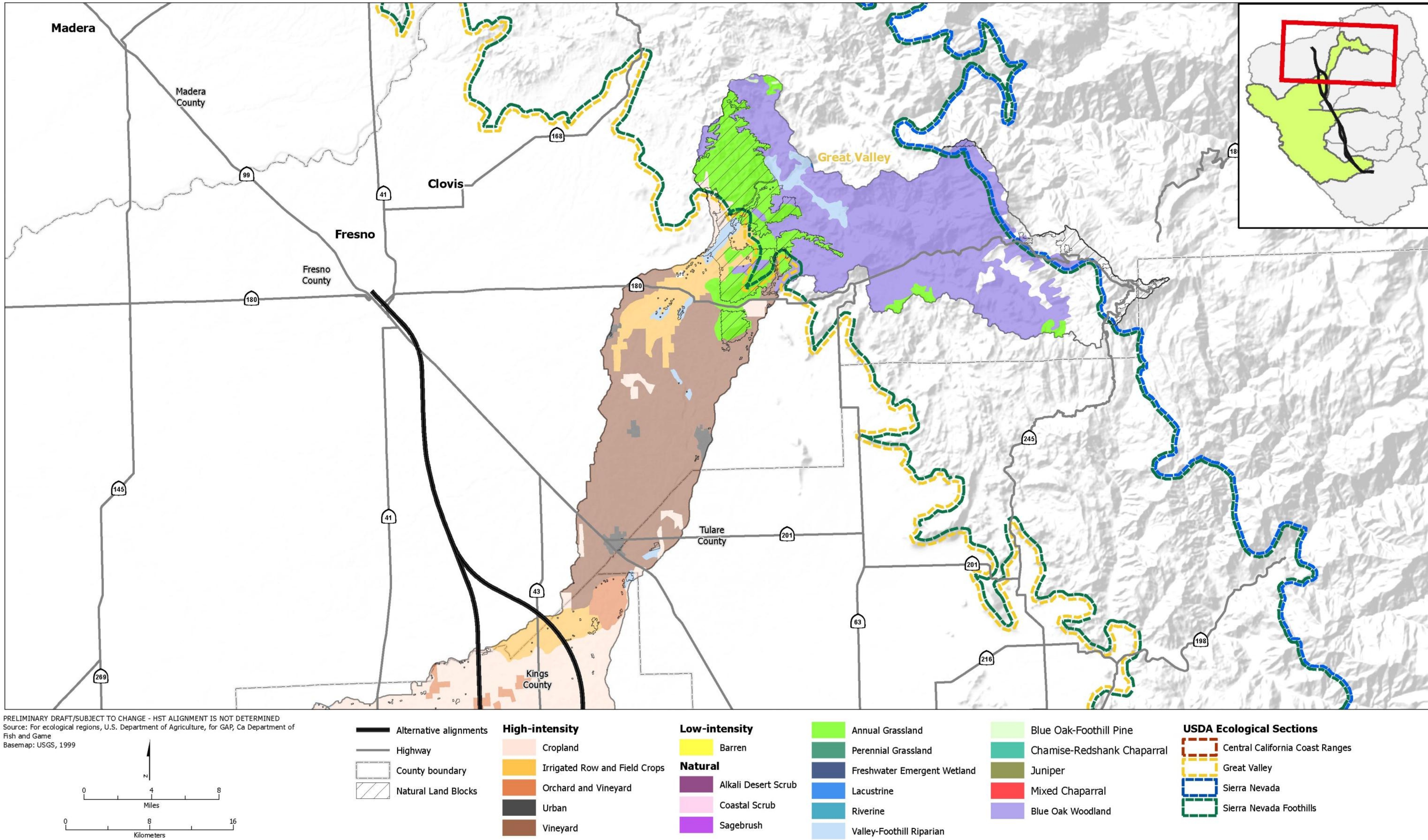


Figure 5-2a
Land use in the Tulare–Buena Vista Lakes Watershed (Sheet 1 of 3)

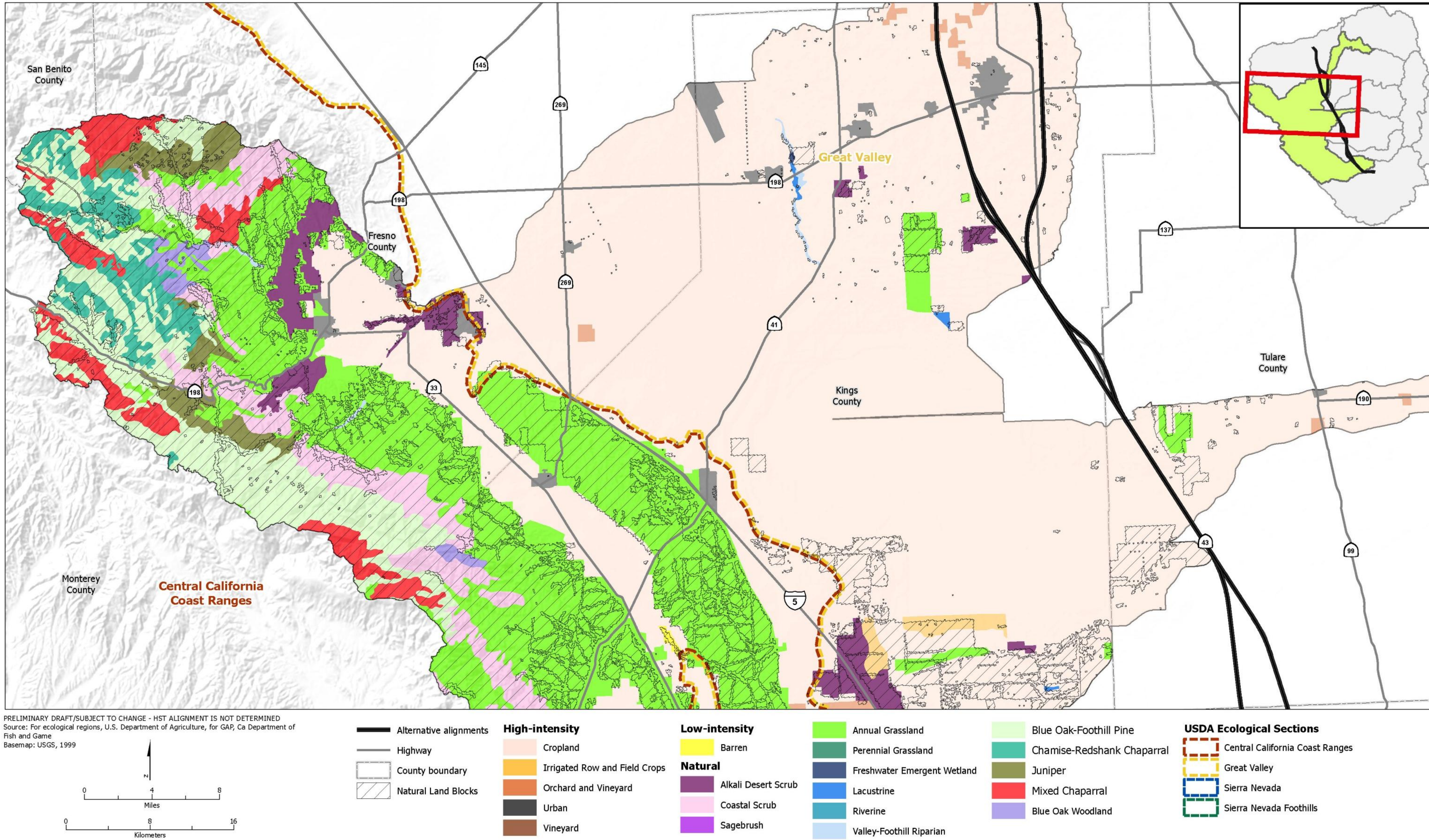


Figure 5-2a
Land use in the Tulare–Buena Vista Lakes Watershed (Sheet 2)

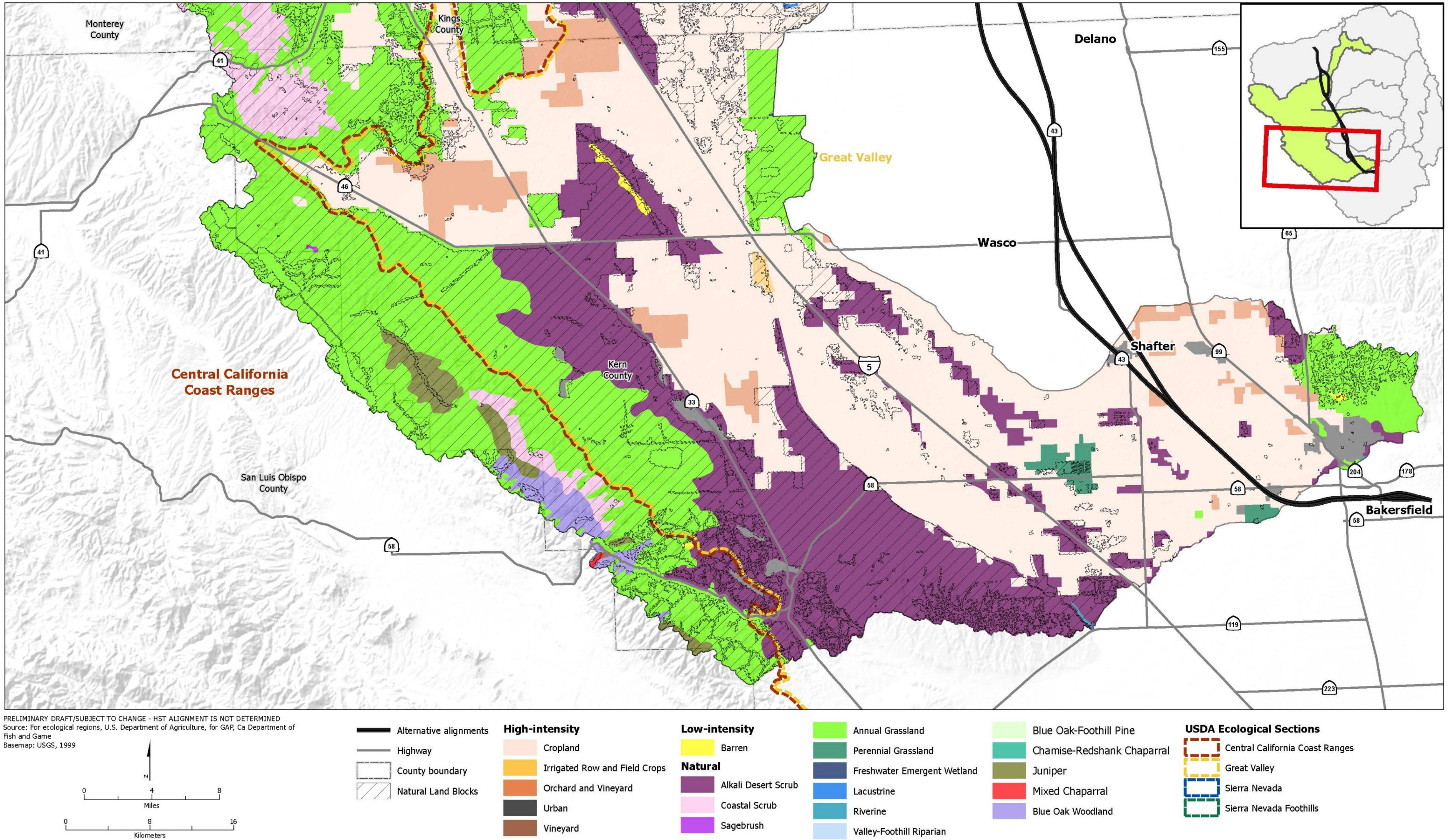


Figure 5-2a
Land use in the Tulare–Buena Vista Lakes Watershed (Sheet 3)

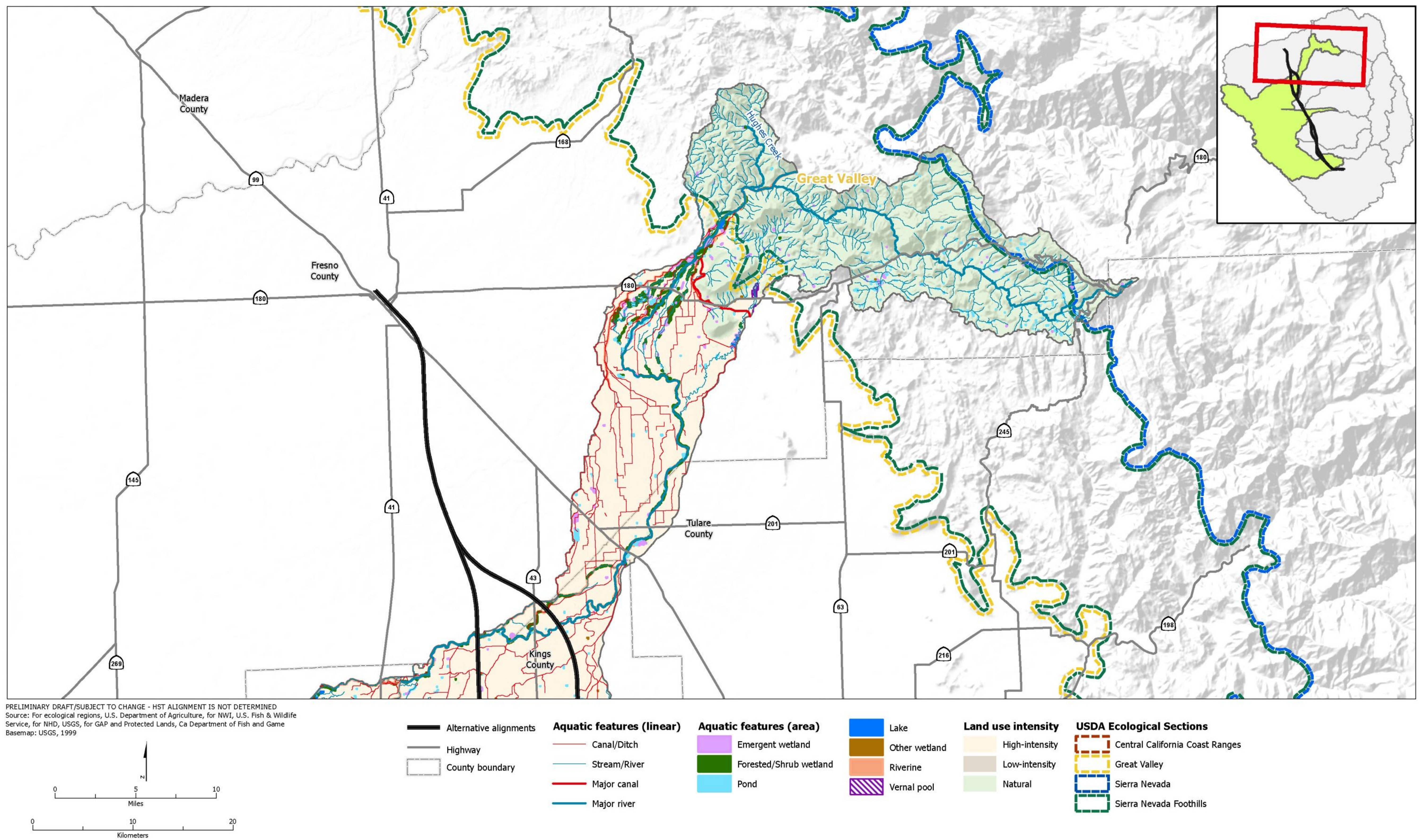
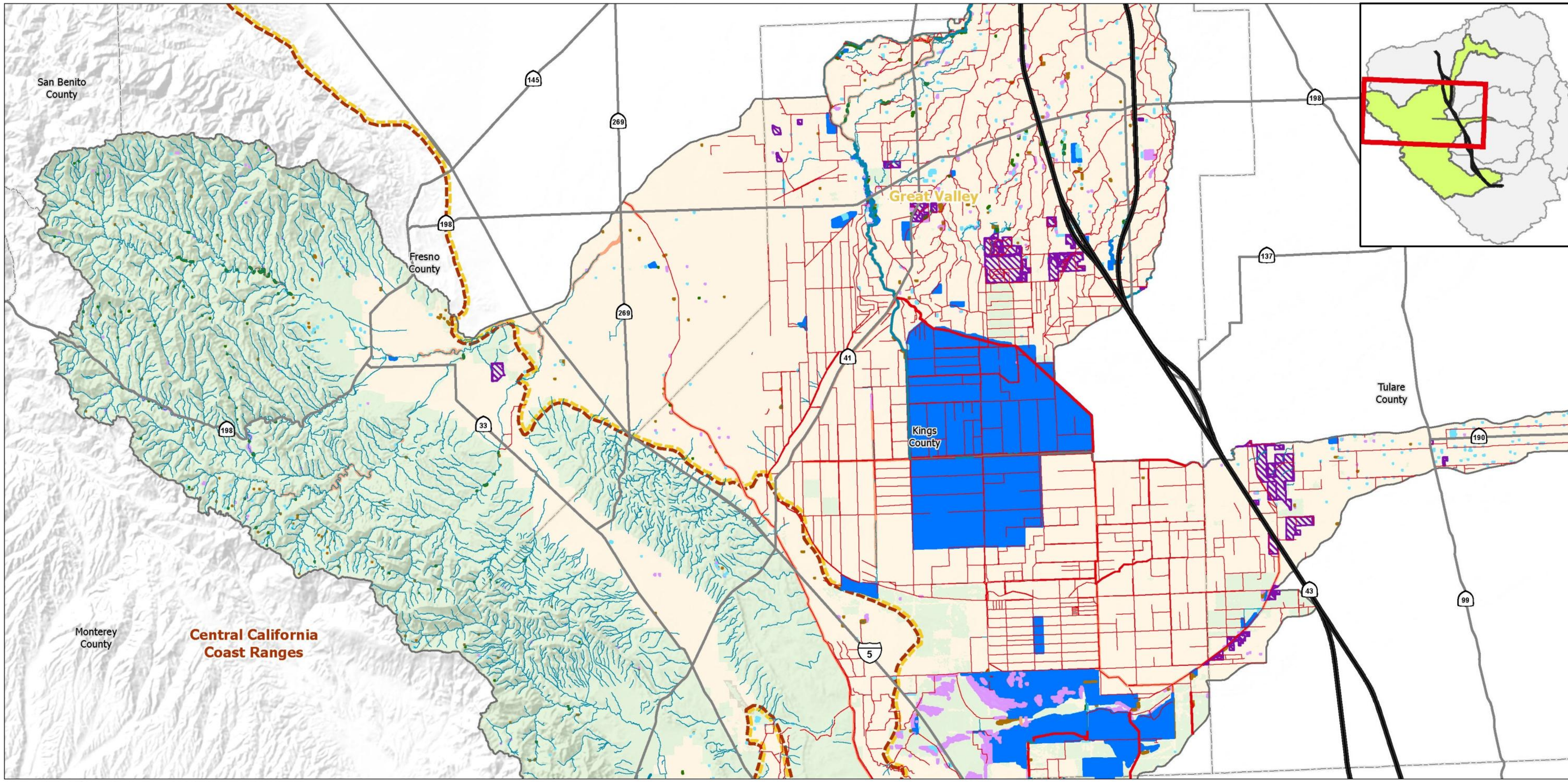


Figure 5-2b
Aquatic features in the Tulare–Buena Vista Lakes Watershed (Sheet 1 of 3)



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

N

0 5 10 Miles

0 10 20 Kilometers

Alternative alignments
Highway
County boundary

Aquatic features (linear)
Canal/Ditch
Stream/River
Major canal
Major river

Aquatic features (area)
Emergent wetland
Forested/Shrub wetland
Pond
Lake
Other wetland
Riverine
Vernal pool

Land use intensity
High-intensity
Low-intensity
Natural

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

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

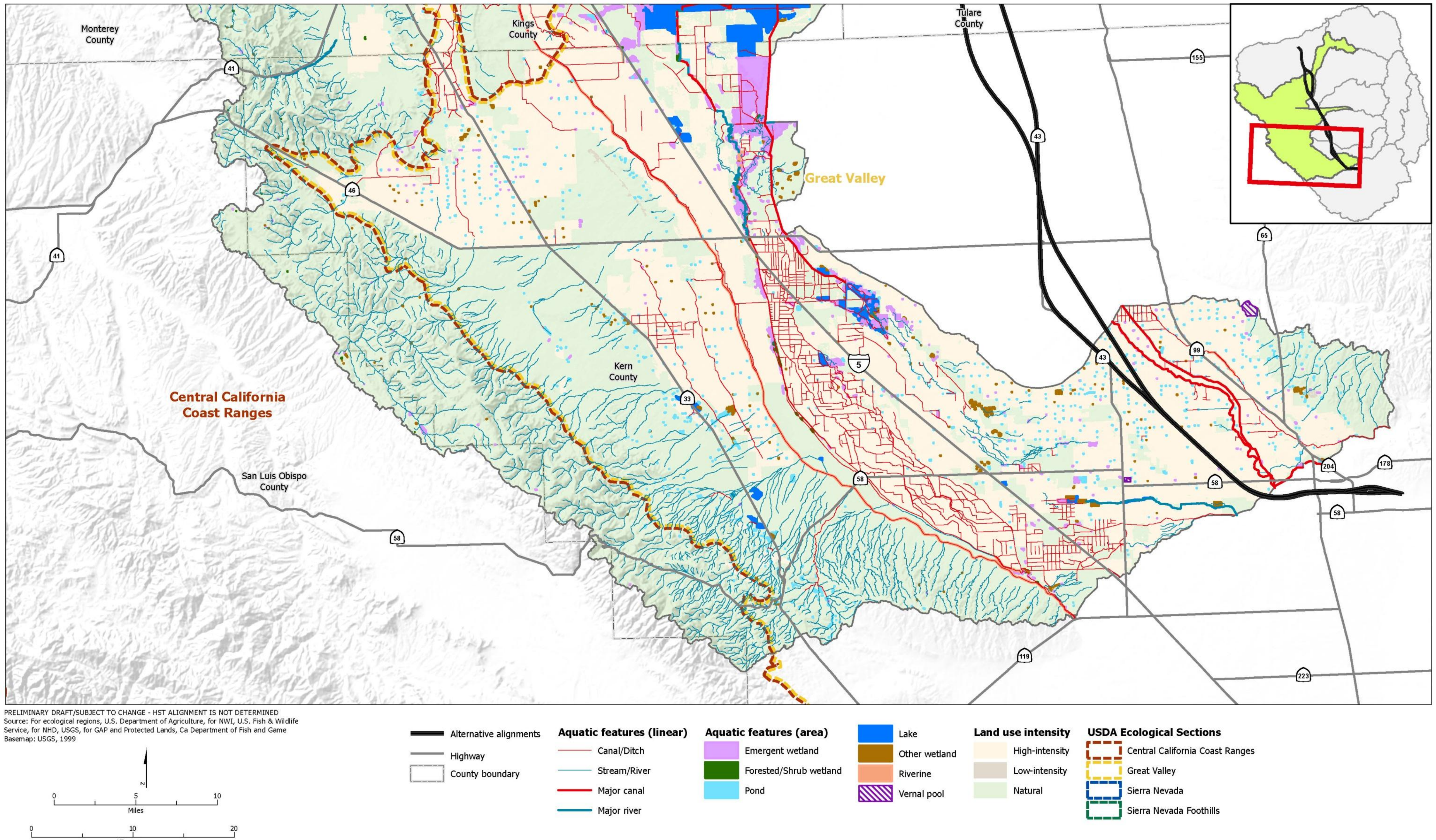


Figure 5-2b
Aquatic features in the Tulare–Buena Vista Lakes Watershed (Sheet 3)

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.

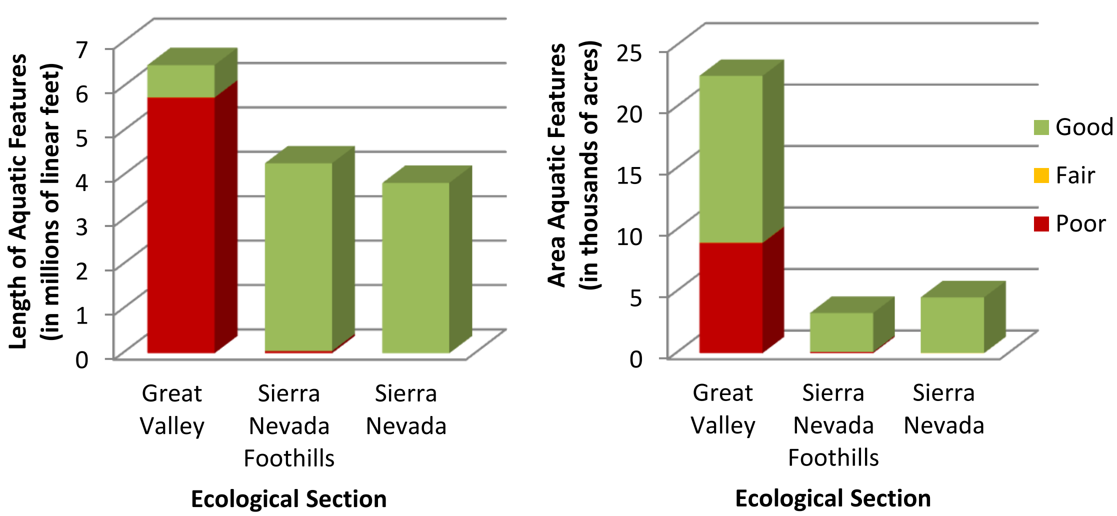


Chart 5-4
Area aquatic feature by conditions (in acres and linear feet) within the Upper Kaweah Watershed grouped by ecological section.

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

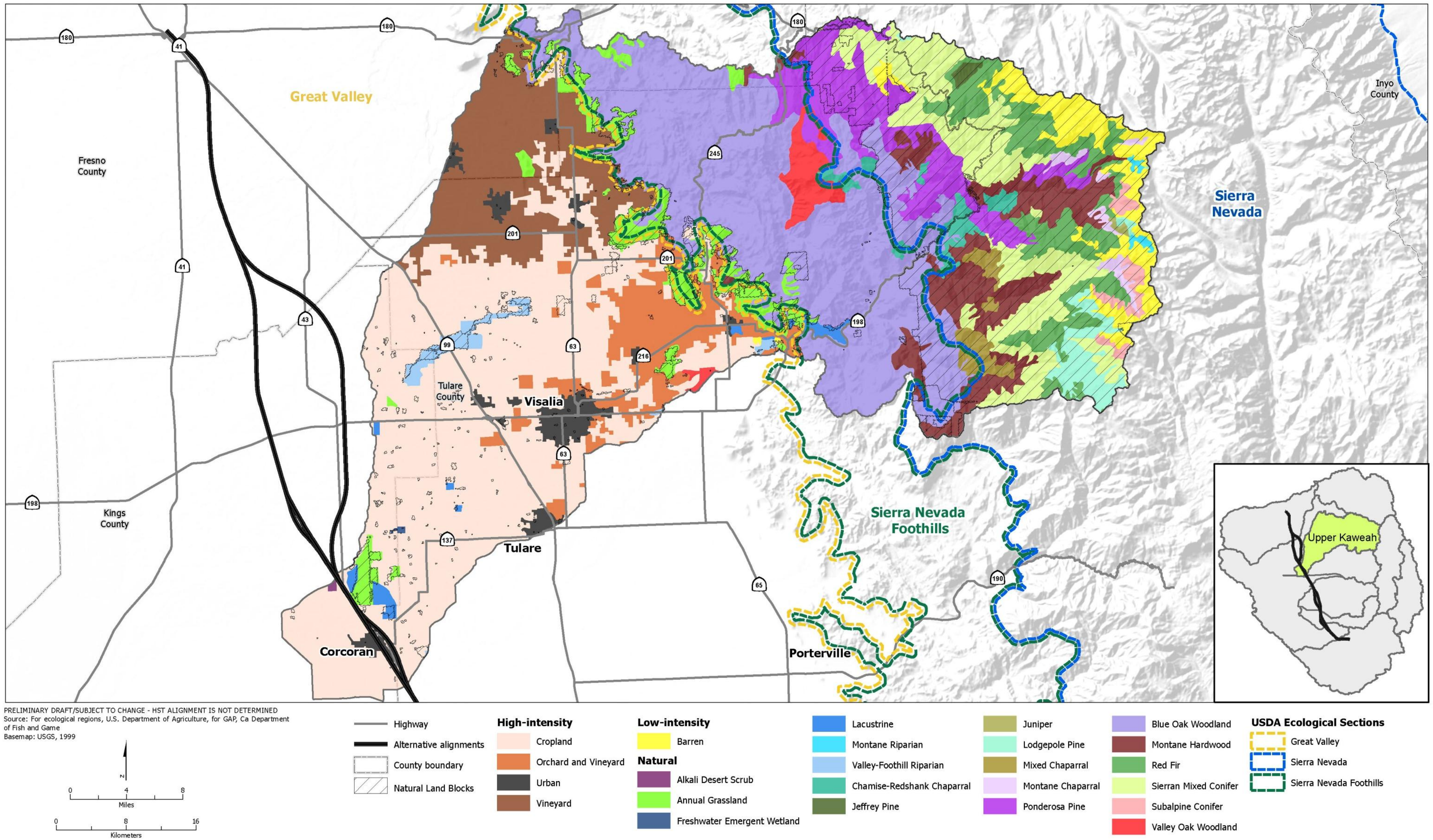
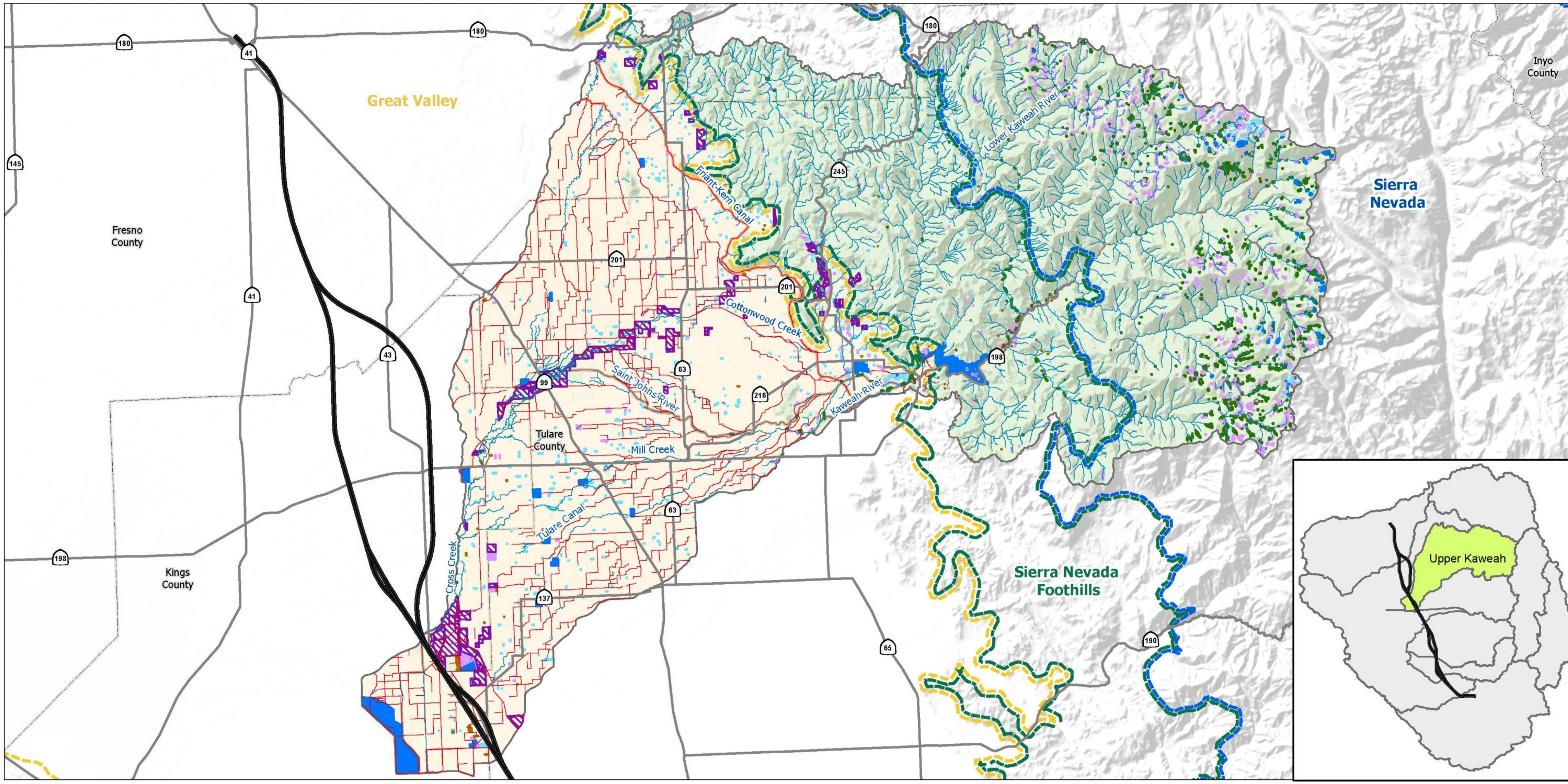


Figure 5-3a
Land use in the Upper Kaweah Watershed



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

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.

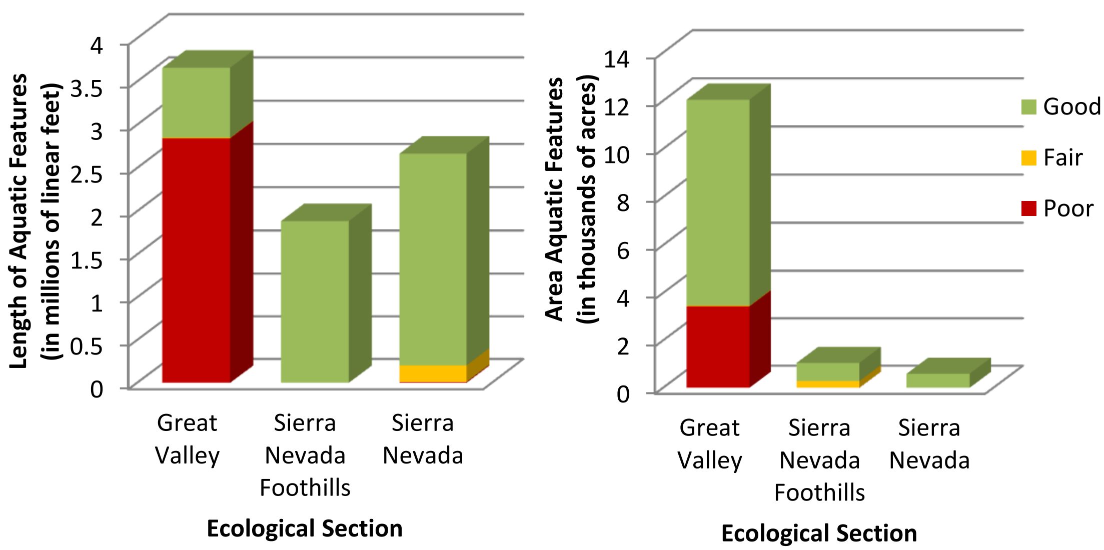


Chart 5-5

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

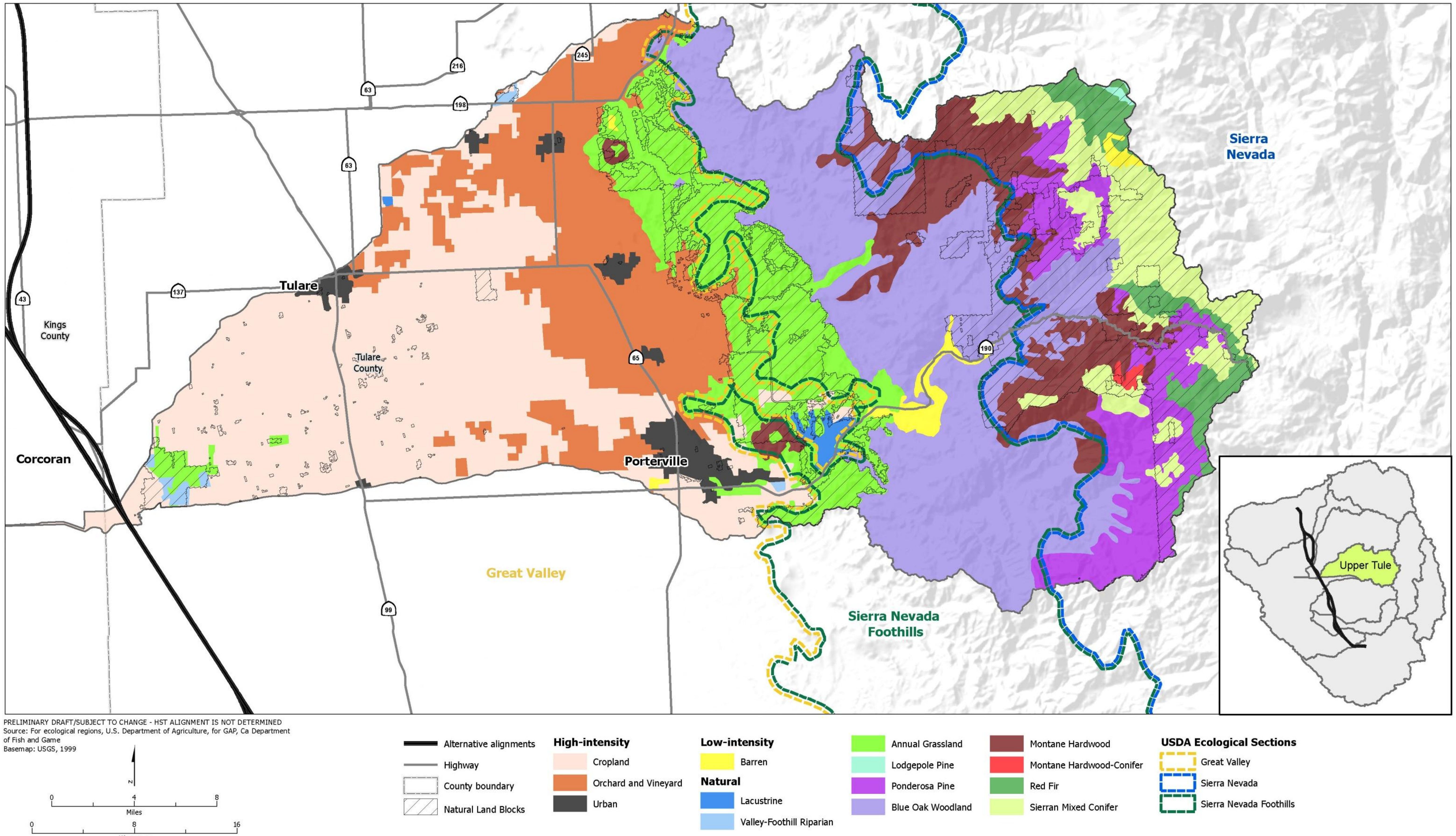


Figure 5-4a
Land use in the Upper Tule Watershed

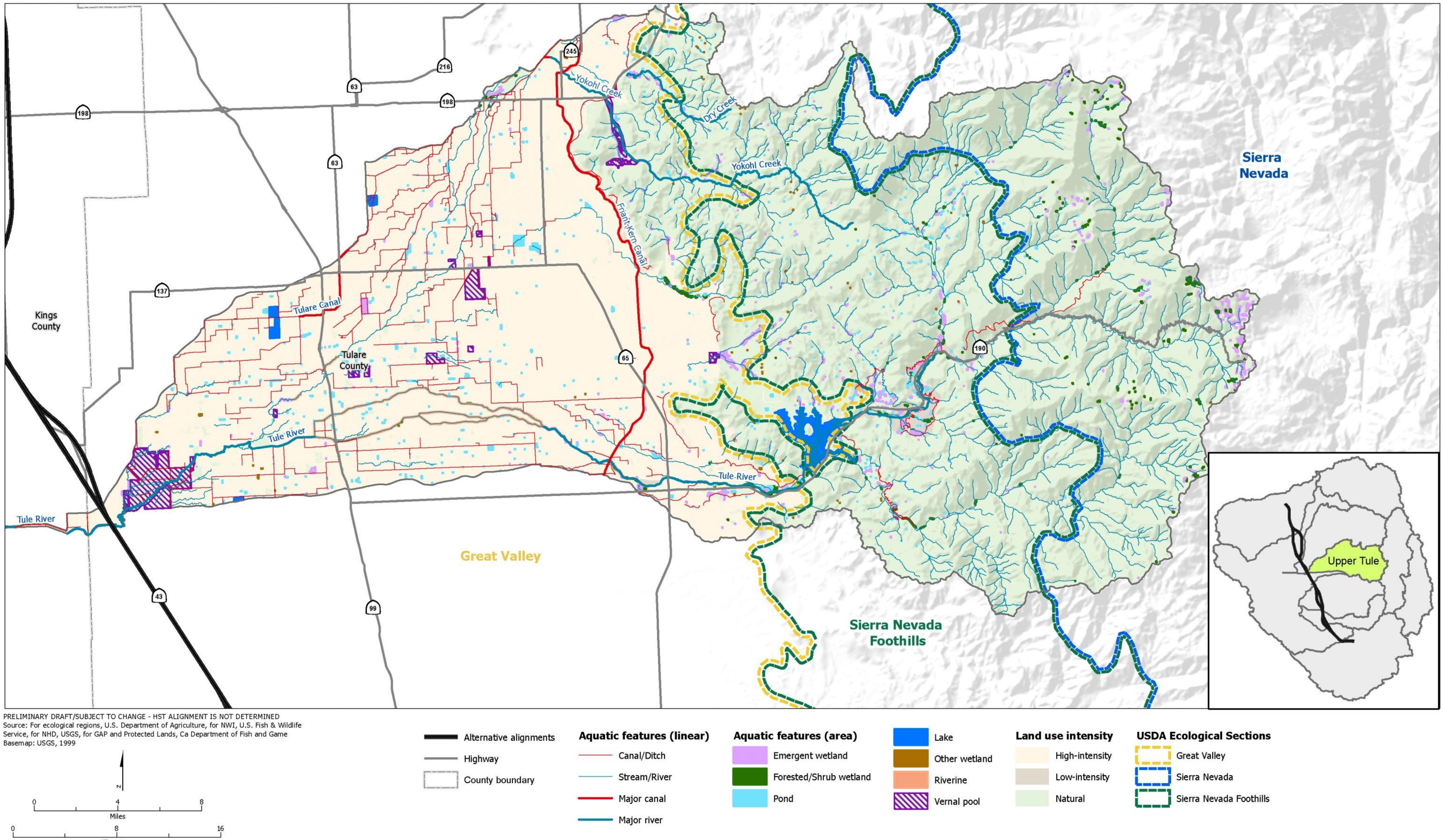


Figure 5-4b
Aquatic features in the Upper Tule Watershed

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.

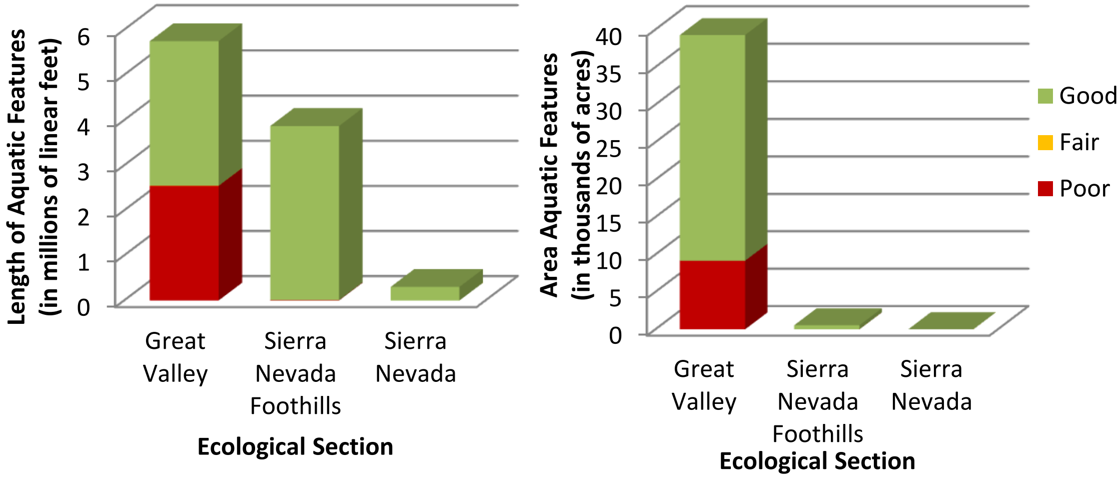
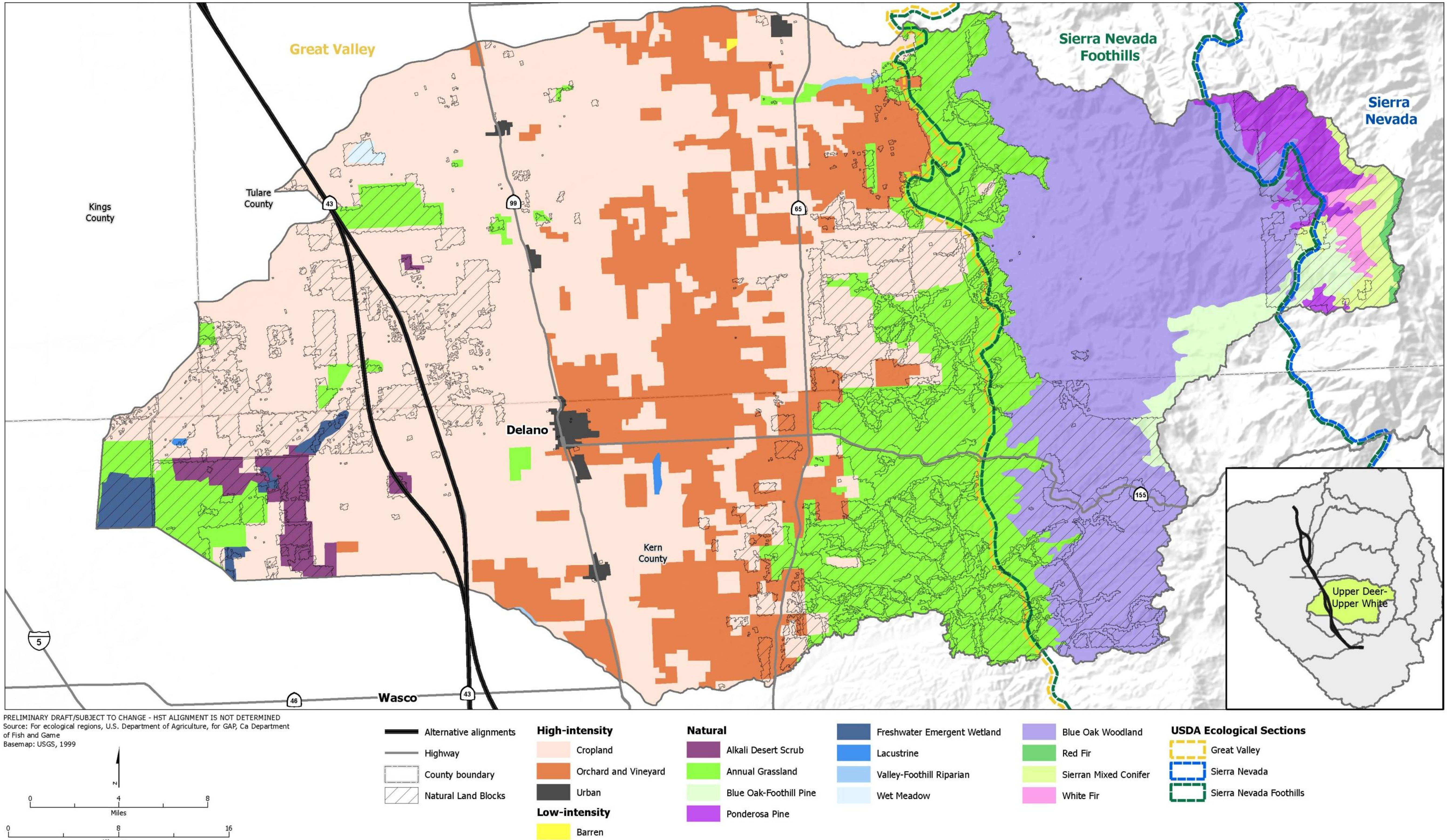


Chart 5-6
Area of aquatic features by conditions (in acres and linear feet) within the Upper Deer–Upper White Watershed grouped by ecological section.

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



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

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

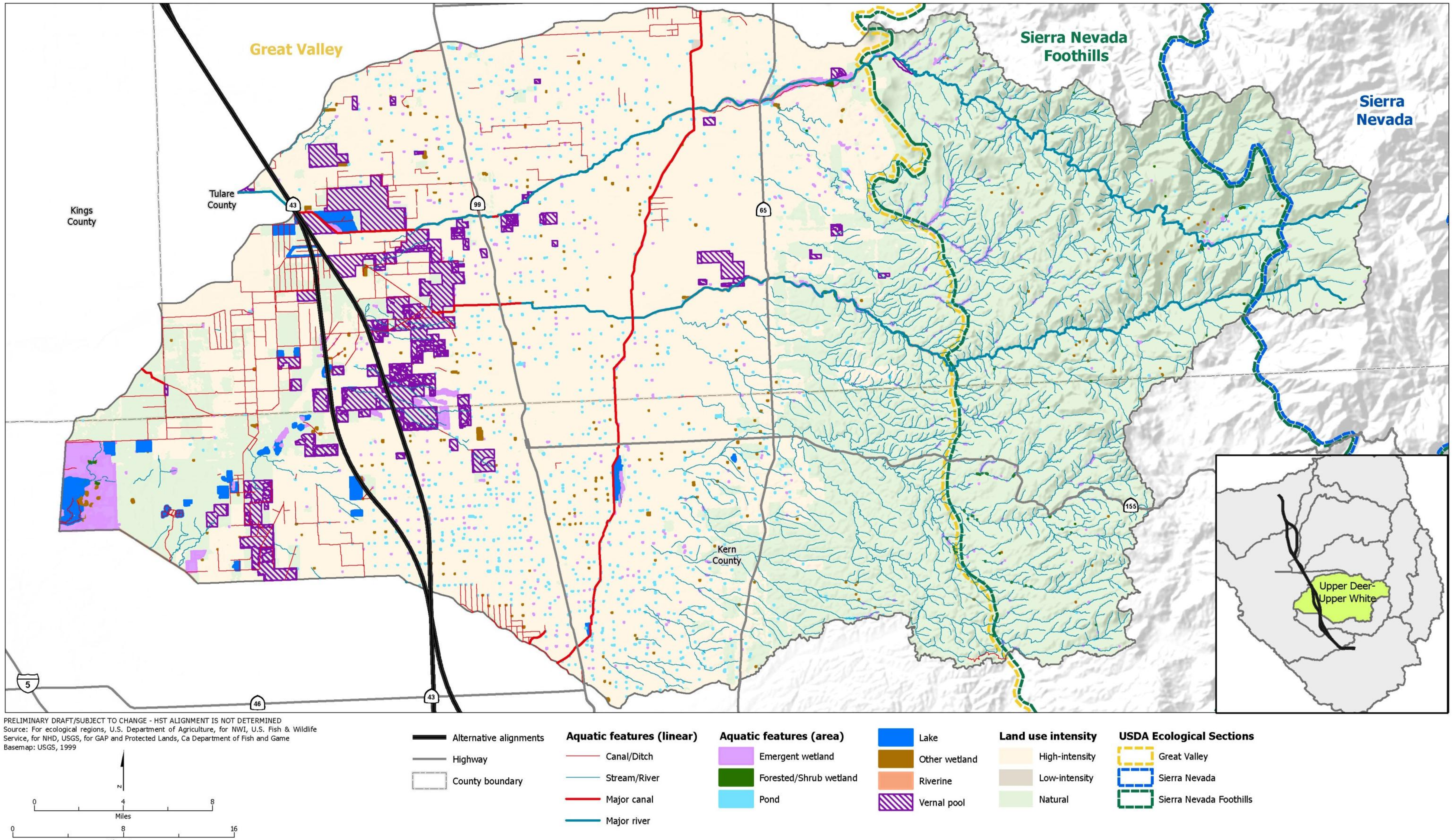


Figure 5-5b
Aquatic features in the Upper Deer–Upper White Watershed

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).

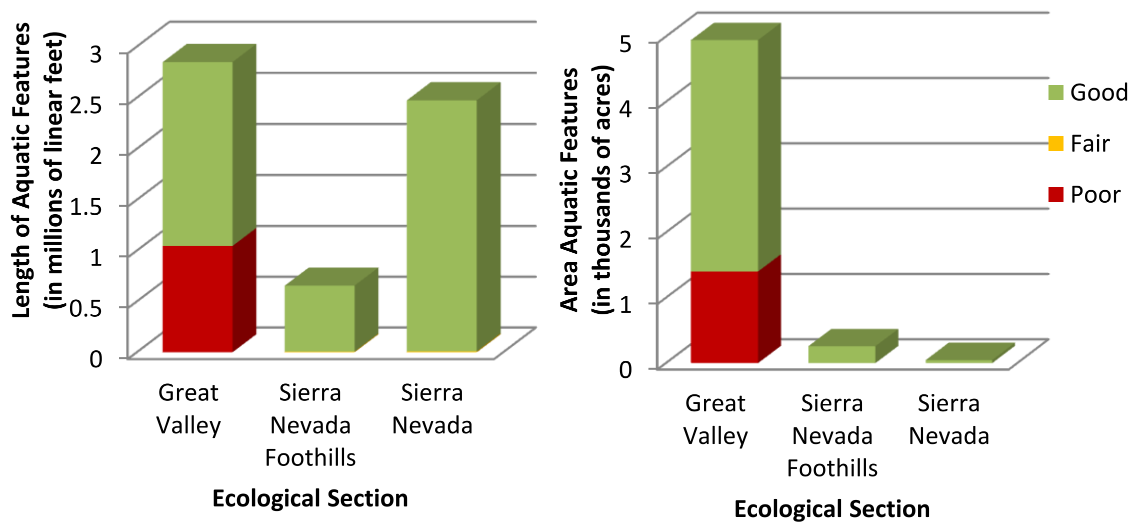


Chart 5-7
Area of aquatic features by condition (in acres and linear feet) within the Upper Poso Watershed grouped by ecological section.

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

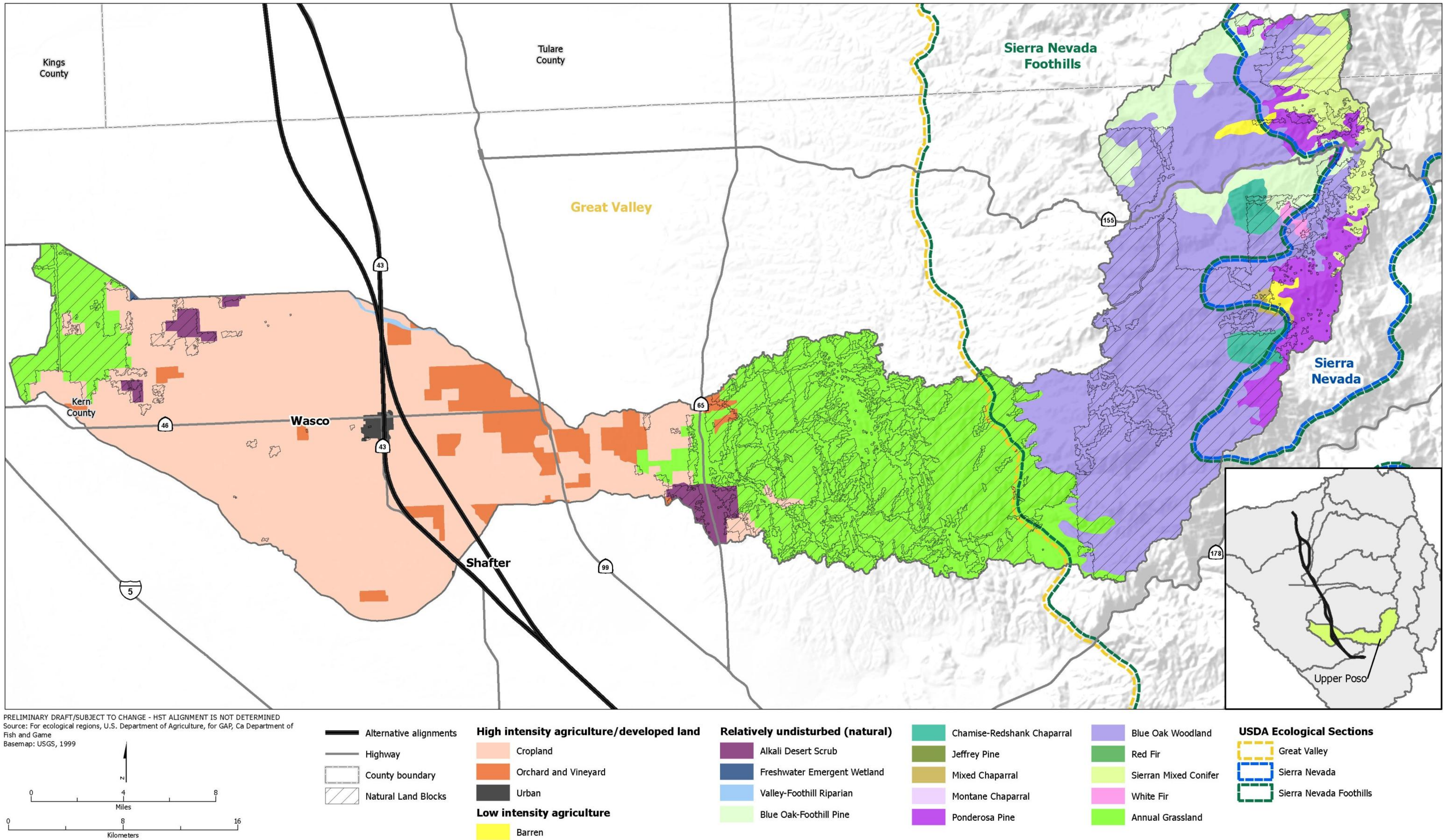


Figure 5-6a
Land uses in the Upper Poso Watershed

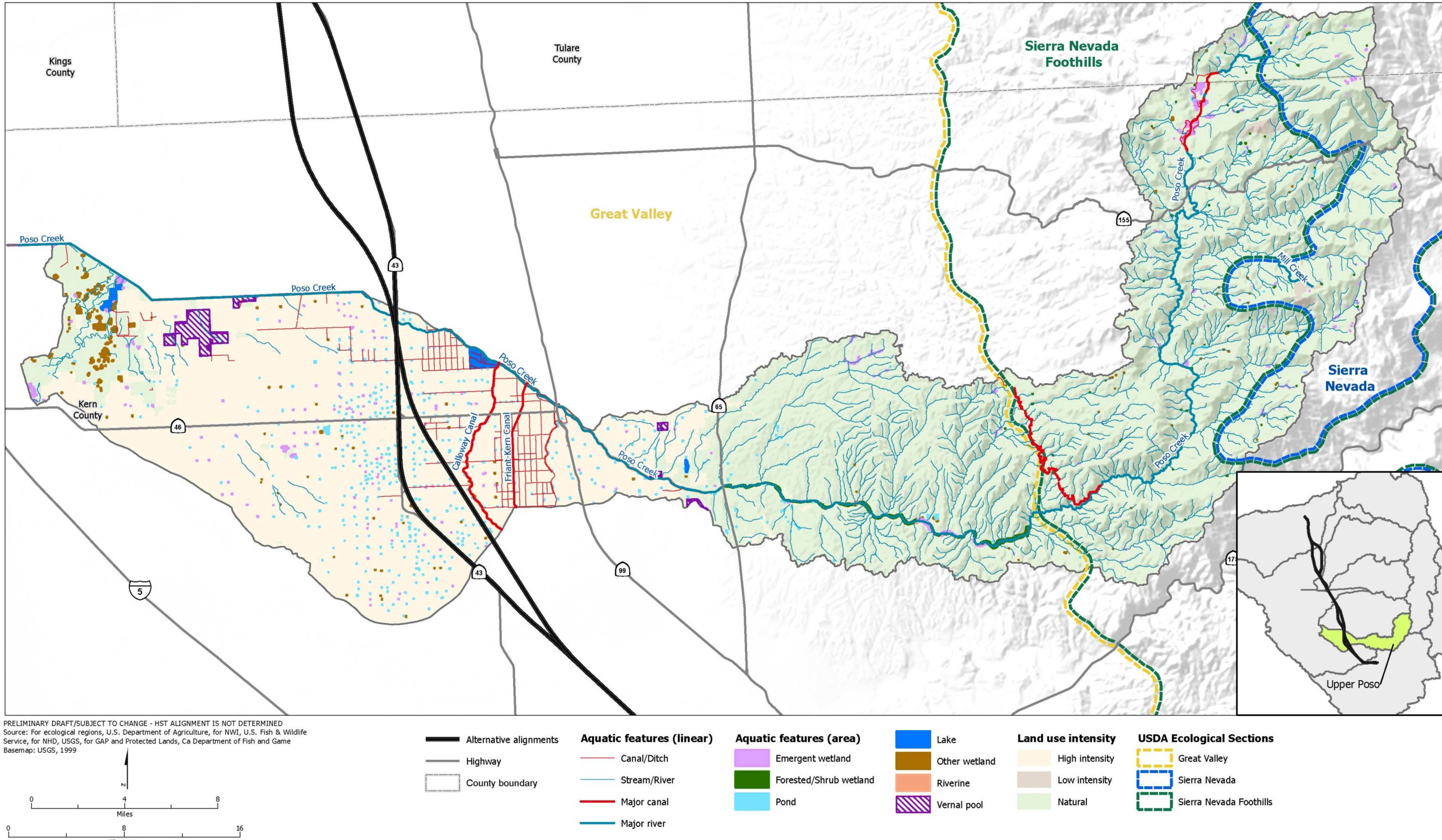


Figure 5-6b
Aquatic features in the Upper Poso Watershed

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.

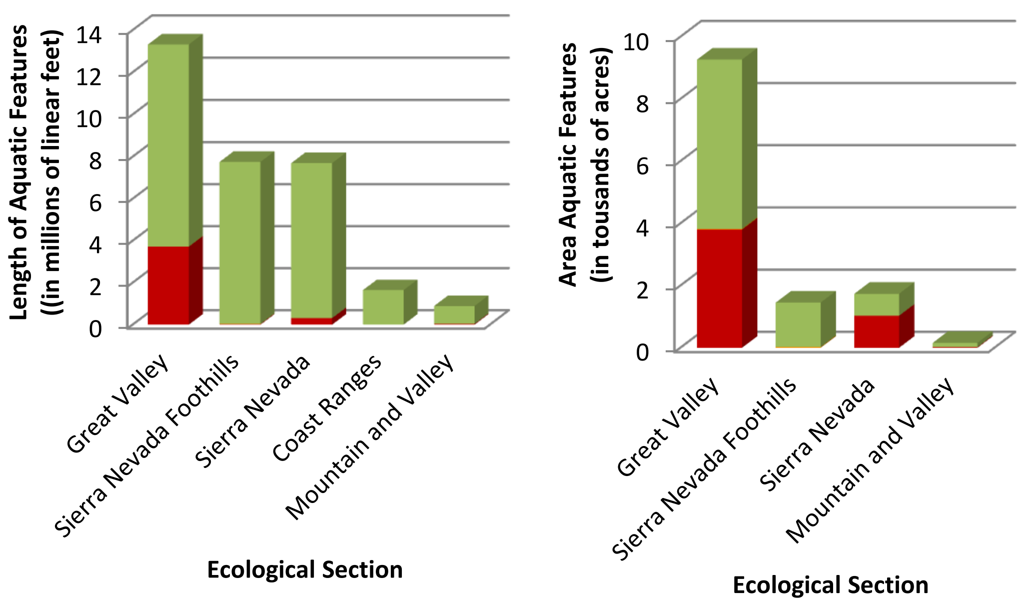


Chart 5-8
Area aquatic features by condition (in acres and linear feet) within the Middle Kern–Upper Tehachapi–Grapevine Watershed grouped by ecological section.

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

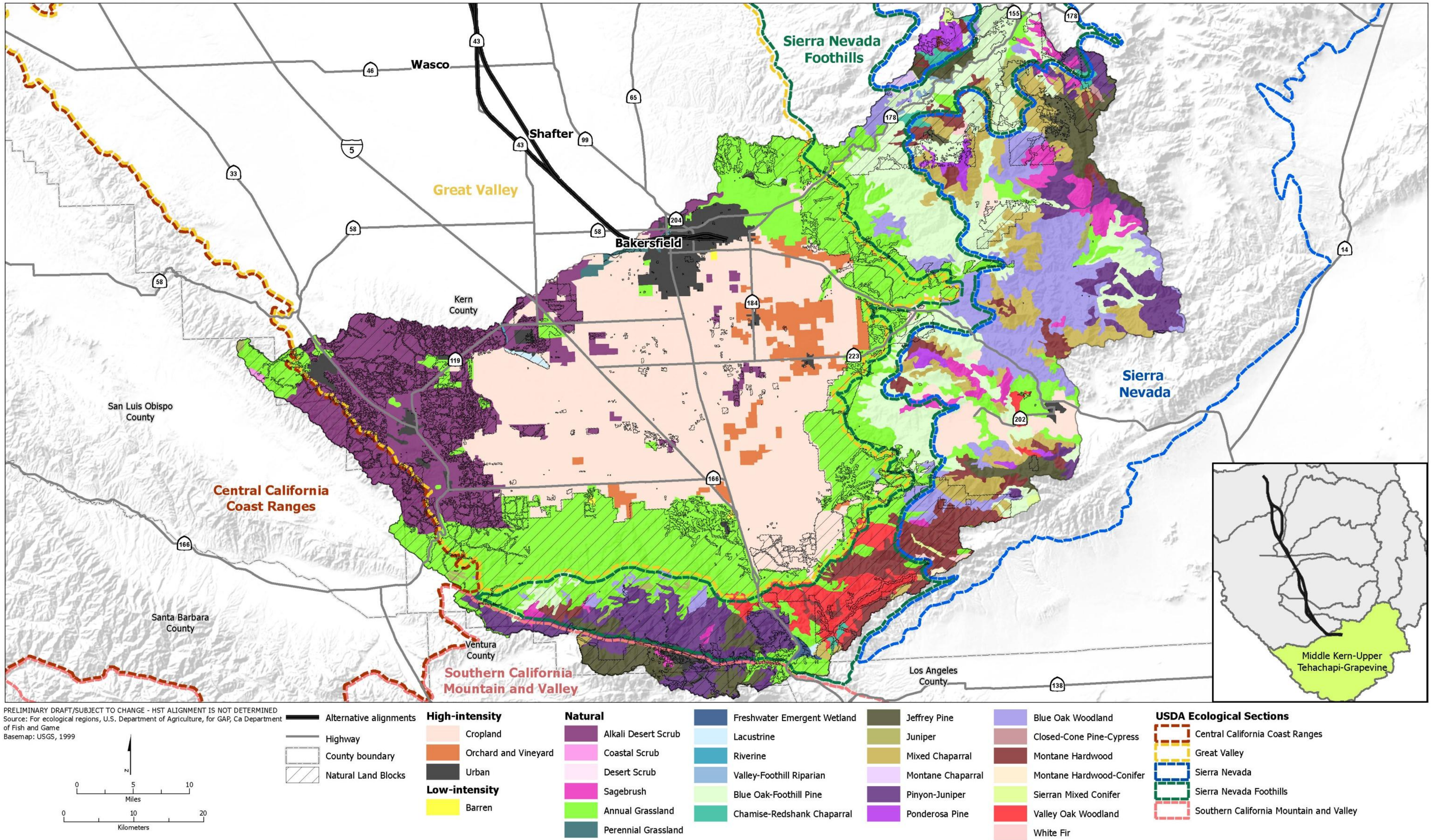


Figure 5-7a
Land use in the Middle Kern–Upper Tehachapi–Grapevine Watershed

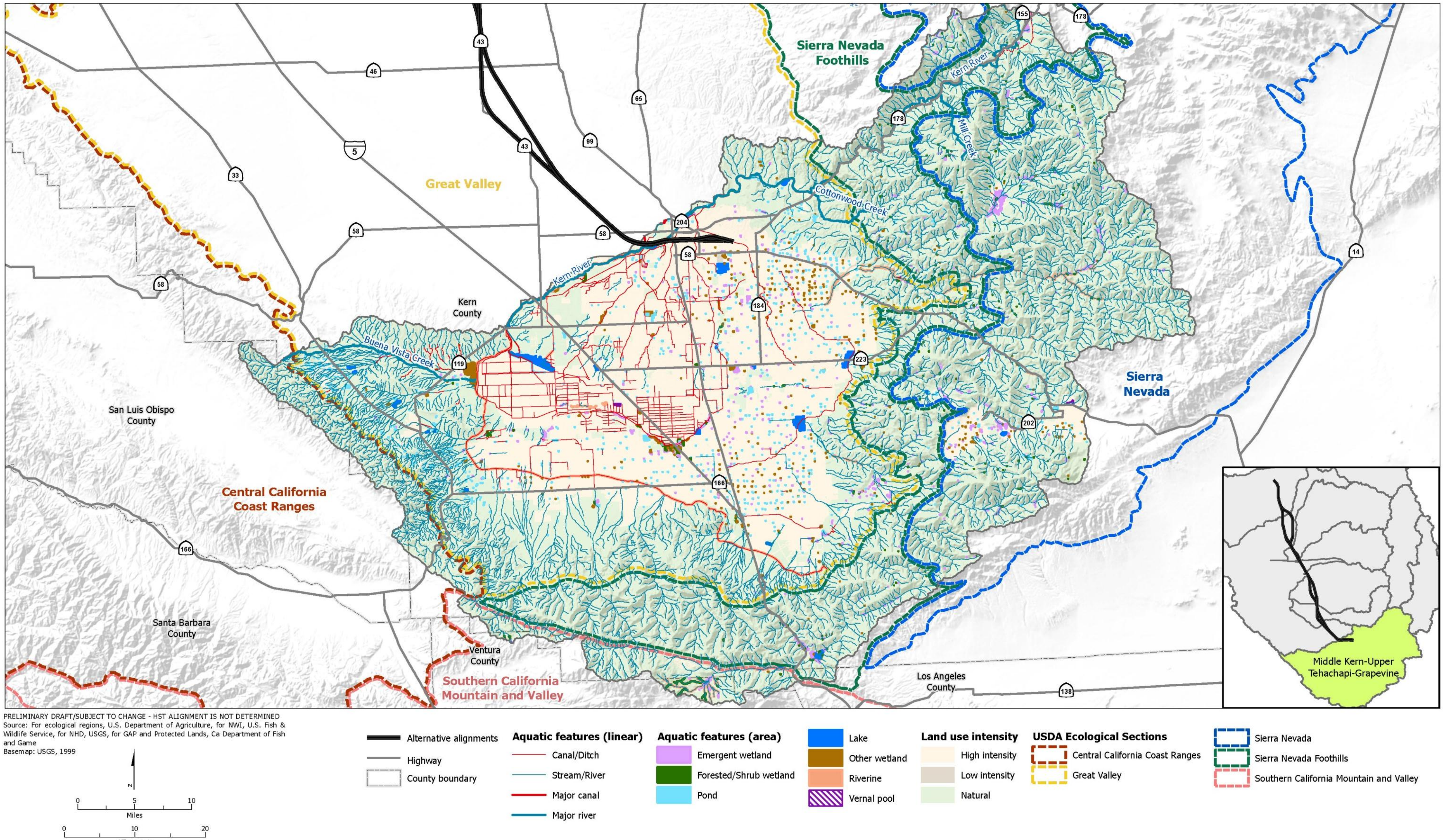


Figure 5-7b
Aquatic features in the Middle Kern–Upper Tehachapi–Grapevine Watershed

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.

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