

CHAPTER 4 - AFFECTED ENVIRONMENT*

This chapter describes the existing or without-project conditions in the study area. The without-project conditions provide a framework to compare to with-project conditions and to determine the effects described in Chapter 5. Resources not evaluated in detail are described first, followed by the resources that may be significantly affected by the alternatives.

4.1 RESOURCES NOT EVALUATED IN DETAIL

This section describes the resources that would not be significantly affected by the alternatives. These resources are presented to add to the overall understanding of the study area.

4.1.1 Physical Environment

Topography, Geology, and Soils

As the major river in the Sacramento Basin, the Sacramento River originates in the northern part of the State and flows southward through Shasta Lake to the Sacramento Valley. On the is characterized by varied topography, consisting of natural levees along the river, abandoned river terraces, channels, oxbows and swales draining into the river or adjacent basins. Portions of these features have been leveled into fields of differing elevations. The original swale topography has been smoothed by earth moving, but not completely obliterated.

Soils in the area are derived from Modesto Formation on the west side of Dunning Slough. Soils from this formation are marked by a noticeable increase in silt content and a distinct, red color. The sedimentary Tehama Formation is exposed along vertical banks in a number of places such as Hamilton City. Sacramento River Conservation Area Forum (SRCAF) considers the area between river miles (RM) 193-198.5 as an area of high bank erosion with a meandering channel shape with a width of 1300-1600 feet. The area between RM 198.5 - 201 is considered an area of low bank erosion with a straight channel shape with a width of 800 feet.

Stream channel deposits are located within the historic meander belt between Dunning Slough and immediately north and south of the slough continuing toward the river. The SRCAF has identified the 100-year meander zone for the Sacramento River.

There are paleochannel deposits located along the eastern margin of the Sacramento River from RM 226 (Thomes Creek) to RM 144 (Colusa) (Robertson 1987). The paleochannels are braided with multiple branches and islands, suggesting a higher bedload, a higher width-to-depth ratio, and higher discharges than the present day Sacramento River (Robertson 1987). The western edge of the paleochannel is the eastern edge of the historic meander belt of the Sacramento River (Robertson 1987). The study reach is bound on the eastern side by paleodeposits from RM 193 to RM 185.

The Chico monocline is the dominant geological structure of the Chico domain. The Chico monocline and associated faults are the result of the uplift of the Sierra Nevada and fracturing along the major controlling fault (Harwood and Helley 1987). The Chico monocline trends northwest and bounds the northeast side of the Sacramento Valley between Chico and Red Bluff. The basement rocks beneath the monocline show a displacement of 350 meters and there is evidence that the monocline is still active (Harwood and Helley 1987).

West of the Chico domain is the Corning domain, with structures oriented northwest to north (Harwood and Helley 1987). The Willows fault and the Corning fault are within this domain. They are close to parallel orientation to the Chico monocline. The Willows fault is an active northwest trending fault that crosses the Sacramento River north of Colusa, with uplift to the east (Harwood and Helley 1987). The faults described above dominate the structure of the northern Sacramento Valley, however, the course and behavior of the Sacramento River is controlled by the smaller structures of the Los Molinos and Glenn synclines and the Corning Domes (Harwood and Helley 1987).

Once the Sacramento River flows down the Los Molinos and Glenn syncline axes, the channel and floodplain of the river widens. For this particular study reach, RM 201- RM 185, the river flows near the axis of the Glenn syncline. Upon entering the Glenn syncline at RM 205, the width of the channel and floodplain increases. The river is narrow from RM 200 to RM 197, and the river parallels the axis of the Glenn syncline from RM 197 to RM 193. The channel crosses the axis of the syncline at RM 191, and then generally flows along the axis of the syncline until RM 180. None of the alternatives would affect the topography, geology, or soils in the Hamilton City area.

Climate

The climate in the watershed varies with elevation. Ground-surface elevations in the northern portion of the Sacramento Valley range from about 14,000 feet in the headwaters of the Sacramento River to about 1,070 feet at Shasta Lake. In the headwater area, total annual precipitation averages between 60 and 70 inches and is as high as 95 inches in the Sierra Nevada and the Cascade Range. Lassen Peak in the Cascade Range exceeds 10,000 feet and receives as much as 90 inches of precipitation. Other mountainous areas bordering the valley reach elevations higher than 5,000 feet and receive an average of 42 inches of precipitation per year, with snow prevalent at higher elevations.

The study area is in the northern portion of the Sacramento River basin where the Sacramento Valley floor is relatively flat. Elevations range from sea level to about 300 feet above sea level. Hot, dry summers and mild winters characterize the valley floor. Precipitation on the valley floor occurs mostly as rain from October through May with an average of 20 inches of precipitation per year. Virtually no rain falls from June to September. Historically, large rainstorms in winter and early spring have resulted in maximum flows from December through March. None of the alternatives would affect the climate of the Hamilton City area. The average weather in Hamilton City, California, is shown in Table 4-1.

TABLE 4-1: AVERAGE WEATHER IN HAMILTON CITY, CALIFORNIA

Item	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Precipitation (in)	3.4	3.2	2.5	0.9	0.6	0.3	0.1	0.1	0.4	0.8	2.0	2.3
Days with precip.	10	9	9	5	3	1	0	0	1	3	7	9
Average temp. (°F)	44.4	49.3	52.8	57.3	64.1	70.4	74.8	74.1	70.3	62.5	51.4	44.0
Max temperature (°F)	53	59	64	70	79	87	92	91	87	77	62	53
Min temperature (°F)	36	40	42	44	49	54	57	57	54	48	40	35
Wind speed (mph)	6.8	7.1	8.2	8.4	8.7	9.2	8.6	8.1	7.1	6.2	5.8	6.2
Morning humidity (%)	89	87	84	81	80	76	75	76	76	78	86	87
Afternoon humidity (%)	68	58	50	42	36	31	28	28	30	36	55	65
Sunshine (%)	50	65	74	81	89	93	96	95	93	85	66	51
Days clear of clouds	7	8	10	11	16	21	26	25	23	18	10	8
Partly cloudy days	6	7	9	10	9	6	3	4	4	6	8	6
Cloudy days	19	13	13	9	6	3	1	1	2	6	12	17
Snowfall (in)	0.8	0.7	0.6	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.6

Source: Glenn County, 2003

Hydrology

The Sacramento Valley contains the Sacramento, Feather, and American River basins, covering an area of more than 26,300 square miles in the northern portion of the Central Valley. The Sacramento River basin encompasses four major sub-basins: the McCloud River, Pit River, and Goose Lake in the north; the Sacramento-San Joaquin River Delta in the south; the Sierra Nevada and Cascade Range in the east, and the Coast Range and Klamath Mountains in the west.

The Sacramento River is the largest river in California. It has an average annual runoff of 22.4 million acre-feet (maf) and yields 35 percent of the State's developed water supply. Upper Sacramento River flows are largely controlled by the Central Valley Project (CVP) storage and diversion facilities operated by the United States Bureau of Reclamation (USBR) and local irrigation districts. CVP facilities affecting upper Sacramento River flows include Shasta, Keswick, Trinity, Lewiston, and Whiskeytown, dams, and the Spring Creek Debris Dam, Red Bluff Diversion Dam, and the Tehama-Colusa and Corning Canals. Shasta is the largest CVP reservoir, storing up to 4.5 maf of water.

Scheduling water releases from Keswick Dam involves day-to-day operational adjustments by the USBR so that fisheries, navigation, the Glenn-Colusa Irrigation District (GCID), other water diversions, water transfer, and water quality needs are met. The Hamilton City Pumping Plant, located 3.5 miles north of Hamilton City, supplies water to the Glenn-Colusa Canal and can be a significant water diversion structure during the irrigation season - April to September.

A large drainage area contributes flow to the Sacramento River. The contributing drainage area is generally too large for most major storms to be centered over the entire basin. For example, the 1997 flood was the flood of record above Shasta Dam, but it was not the flood of record for most of the local tributaries between Keswick Dam and Bend Bridge. Various storms centered throughout the basin have resulted in several historical observed high flows of similar magnitude.

When the Sacramento River reaches the valley floor, flows spread out across low-lying basins, over weirs, and through wide bypasses. Flow distribution affects the computation of reliable estimates of unregulated flows. None of the alternatives would affect the hydrology of the Sacramento River.

Wild and Scenic Rivers

Near the study area, Upper Big Chico, Upper Butte Creek, Upper Deer Creek, and the middle fork of Upper Stony Creek above Black Butte Reservoir have been designated Wild and Scenic Rivers. These are all outside of the project area of effect and therefore no alternatives would have an effect on wild and scenic rivers.

4.2 SIGNIFICANT RESOURCES

This section highlights the existing conditions with respect to each resource. Assumptions regarding future projects are discussed. Each resource is described in terms of its location, quantity and quality, and significance.

4.2.1 Physical Environment

Geomorphology

The study covers the river reach from RM 195- RM 202. Ayres Associates evaluated historical migration of the river from 1896 to 2002 at river mile 197 and 201. Based on the historical data, both locations have seen migration rates as high as 200 feet/year. However, the geotechnical properties of the Modesto Formation in the two areas would indicate that migration rates and directions could be significantly different than recent observations. The river reach between RM 201-198 has been characterized by channel stability since 1904. The Pine Creek Bend (RM 199) became established after a cutoff between 1887 and 1896. The confluence of Pine Creek and the Sacramento River migrated east between the late 1800s and 1904. Pine Creek Bend migrated downstream over the years. This is as far east as the river channel has moved in recorded history. The main channel was abandoned and a secondary channel, or "cutoff channel," was occupied by 1980. The river essentially has not migrated again in this area. A more detailed explanation is presented in the Hydraulic Appendix C3.

The Chico Landing to Red Bluff Project consisted primarily of bank protection, in the form of riprap, on bank slopes at grades varying between 1 vertical to 2.5 horizontal to 1 vertical to 3 horizontal. Riprap was installed at 29 bank protection sites totaling approximately 86,915 feet or 16.5 miles. Sites are situated primarily at outer bends of meanders in the river. It is not certain how much of this bank protection remains on the banks.

While rock has constrained river meander to some extent in the study area, there is currently about 36,755 lf on the right bank and 38,477 lf on the left bank of the river with no bank protection. The Jenny Lind Bend, RM 196-193, has shown a decrease in the amplitude of the meander bends, but the wavelength has remained relatively constant. Between 1870 and 1920, the Jenny Lind Bend experienced a cutoff. This subreach of the river experiences small movement and sinuosity changes. The channel width has also been relatively constant since 1904. There is no obvious geological control on the channel. However, this is the location of

the axis of the Glenn Syncline. The full effects of the Glenn syncline on the Sacramento River are not known, but evidence suggests that channel location and shape is influenced by this subsurface structure. The apex of the bend at RM 198 migrated downstream until between 1974-1980, at which time, revetment was installed along the outer bank.

River Hydraulics

Over the years, a complex system of levees, weirs, bypasses, upstream dams and reservoirs, and related systems were built to help reduce flooding along the Sacramento River. This flood management system was designed to protect lives and property along the River and in the floodplain by increasing conveyance of floodwaters through the system. The design goal of the facilities was to aid navigation and flush sediment remaining from earlier hydraulic mining. These conveyance facilities improved flood protection and navigation and allowed continued agricultural and urban development. They also constrained the river to specific alignments, significantly reducing channel meandering and further isolating the river from its historic floodplains.

The flood management system along the Sacramento River includes portions of the CVP, the Sacramento River Flood Control Project (SRFCP), and the Chico Landing to Red Bluff Project. The Sacramento River is included in the Designated Floodway Program administered by the Reclamation Board. A discussion of each of these flood management systems is included in Section 1.6: Existing Programs, Studies and Projects

The Sacramento River enters the Sacramento Valley about 5 miles north of Red Bluff and meanders through alluvial deposits about 50 miles between Red Bluff (RM 244) and Chico Landing (RM 194). Major Tributaries enter from the east—Antelope, Mill, Deer, Big Chico, Rock, and Pine Creeks and from the west—Thomes, Elder, Reeds, Cottonwood, Red Bank and Stony Creeks. These tributaries influence Sacramento River flows during storms.

In the project area, the Sacramento River, Chico Landing to Red Bluff Project provides bank protection and channel modifications at many locations. The project helps reduce erosion and stabilizes the main river channel, thereby preserving and protecting mostly agricultural lands and reducing sediment in the river that can impair downstream flood control and navigation channels. An existing private levee, constructed by landowners in about 1904 and known as the “J” levee, also provides some flood protection to the town and surrounding area. The “J” levee is not constructed to any formal engineering standards and is largely made of silty sand. It is extremely susceptible to erosion. Flood fighting is often necessary to prevent levee failure and flooding when river levels rise. Since the construction of Shasta Dam in 1945, flooding in Hamilton City due to failure of the “J” levee has occurred once, in 1974. In addition, extensive flood fighting has been necessary to avoid levee failure and flooding in 1983, 1986, 1995, 1997, and 1998.

Currently, the Sacramento River is actively eroding into the toe of the “J” levee at the northern end of the study area. Glenn County built a backup levee, about 1,000 feet in length, to protect the community in the event the toe erosion causes failure at the northern end of the “J” levee. The southern end of the “J” levee does not tie into high ground and backwater can flood agricultural lands behind (west of) the “J” levee.

Although with flood fighting the “J” levee has historically passed high flood events, statistically it only has about a 66 percent chance of passing a 10-year event assuming

significant flood fighting efforts. This would also equate to a 90 percent chance of passing an event smaller than a 10-year event. Another way to state this is that on an annual basis, the community currently has about a 9 percent chance of flooding in any given year, again assuming flood-fighting efforts.

Water Quality

This section describes the water resources for existing water quality conditions for the Sacramento River as well as the study area. The study area is under the jurisdiction of the Central Valley RWQCB. Hamilton City is considered in the basin plan for the Sacramento and San Joaquin River Basins. The basin plan, developed by the regional board, is a prevention plan that covers specific watershed areas and establishes water quality objectives for specific water bodies.

The specifics in the plan for this area of the Sacramento River state that temperatures shall not be elevated above 56 degrees Fahrenheit (°F) in the reach from Keswick Dam to Hamilton City, nor above 68° F in the reach from Hamilton City to the I Street Bridge during periods when temperature increases will be detrimental to the fishery (RWQCB, 1998).

Water quality in Glenn County is generally good. Because the main source of domestic water in Glenn County is groundwater, maintenance of groundwater quality is of primary importance to county residents. The use of individual septic tank systems in areas containing extremely porous soils with a high groundwater table has caused reported cases of groundwater contamination. Other potential sources of groundwater pollutants include chemicals used in the growing and processing of agricultural products, gas well drilling and industrial sources. The Glenn County Health Department regulates the installation of individual septic systems and wells.

Hamilton City's wastewater treatment facility is located on the waterside of the "J" levee. The facility is currently protected by a private levee, and the integrity of that levee is unknown. Although it has not flooded in the past, the facility is at some risk of flooding. Flooding of the facility could cause contamination of surface waters with raw sewage and a risk to public health and safety.

The Sacramento River is the primary source of surface irrigation water in Glenn County. Water from the river is diverted into two major canals, the Glenn-Colusa and the Tehama-Colusa. Stony Creek is also a predominant source of surface water, supporting two reservoirs within the county, Stony Gorge and Black Butte. Hydroelectric power generating facilities are located at both of these reservoirs.

The eastern portion of the county overlies the Sacramento Valley Groundwater Basin, which contains abundant supplies of high quality groundwater to depths of 800 feet. Groundwater is the primary source of domestic water supply in the county and is also used for irrigation in areas where surface water is not available.

The Glenn County General Plan (Glenn County, 1993) promotes the zoning of floodways and stream channels in a manner that promotes protection of water quality.

Glenn-Colusa Irrigation District (GCID). Glenn-Colusa Irrigation District (GCID), the largest irrigation district in Northern California, draws its water primarily from the

Sacramento River at Hamilton City. GCID's delivery system consists of a 65-mile long main canal and 430 miles of lateral canals. With the demands of 141,000 acres of farming and 20,000 acres of wildlife refuge, GCID services 2,500 turnouts that deliver, on average, 500,000 to 800,000 acre/feet of irrigation water each year.

Water Quality Conditions in the Sacramento River. Average monthly water temperatures under existing conditions in the Sacramento River were simulated using USBR temperature models (see Table 4-2). The hydrologic period from 1922 to 1990 was simulated in order to determine the ranges of temperatures experienced in the river for various flows and current CVP operations. The results of the simulation are summarized in Table 4-2 for Vina and Butte City locations. The table includes the average, maximum, and minimum monthly temperatures over the 70-year period of record.

TABLE 4-2: SIMULATED AVERAGE MONTHLY TEMPERATURES (°F) IN THE SACRAMENTO RIVER - EXISTING CONDITIONS, 1922-1990

Vina			
Month	Average	Maximum	Minimum
October	55.7	63.0	50.6
November	51.4	55.9	47.0
December	46.7	51.3	42.1
January	44.5	47.3	39.2
February	47.9	50.5	45.0
March	51.8	55.7	49.0
April	55.6	58.6	52.4
May	58.2	63.0	55.1
June	60.4	64.3	56.7
July	60.9	67.6	56.8
August	61.4	70.1	59.0
September	58.7	67.8	53.6
Butte City			
October	57.3	63.7	52.3
November	51.3	55.1	47.6
December	46.0	50.7	40.9
January	44.1	47.0	38.3
February	48.2	50.9	45.4
March	52.5	57.6	49.5
April	57.6	61.9	52.9
May	61.8	68.0	57.5
June	65.8	70.8	62.0
July	67.2	75.0	61.7
August	67.0	74.0	63.7
September	62.8	70.7	57.4

Water quality in the Sacramento River is variable and depends on flows in the river, temperature, agricultural return flow quality, and inflow from tributaries. Monitoring has shown levels of pesticides; disinfection by-product precursors, toxic metals, and other constituents of concern are generally not detectable or have been present in small concentrations (DWR, 1994). Levels of rice pesticides in the river water have been within performance goals since the early 1980's (Gorder and Lee, 1995). Electrical conductivity

levels in the Sacramento River above Knights Landing at the confluence of the Colusa Basin Drain and the river typically do not exceed water quality objectives (DWR, 1988).

Waters of the U.S. and associated wetlands subject to jurisdiction under Section 404 of the Clean Water Act and occurring in the project area were identified by the Corps. They included the Sacramento River and riparian habitat on the waterside of the J levee, including the riparian vegetation along and surrounding Dunning Slough. The Hamilton City Irrigation ditch runs along the eastern edge of Hamilton City. This irrigation ditch is considered a seasonal wetland habitat and was defined by the USFWS as providing a "small but significant parcel of emergent wetland habitat." However, the ditch is not considered to be a jurisdictional wetland due to the fact it is located on the landside of the J levee and does not connect with the Sacramento River.

A review of Environmental Data Resources, Inc. (EDR) ground water quality records indicated that water quality data exists for several wells within the subject study area. Five wells were sampled between 1984 and 1996 and samples were analyzed for inorganic and organic compounds and other parameters. The data indicate generally good water quality.

The Glenn County General Plan promotes the zoning of floodways and stream channels in a manner that promotes protection of water quality.

Air Quality

State and Federal Air Quality Standards are provided in Table 4-3.

Hamilton City is located within the Sacramento Valley Air Basin (SVAB). The SVAB consists of the northern half of the Central Valley and approximates the drainage of the Sacramento River. The Coast Range, Cascade Range, Sierra Nevada, and the San Joaquin Basin bound the basin.

The air quality in the SVAB is generally influenced by a variety of factors including wind direction and velocity, climate, vegetation, geography, and the volume of pollutants introduced into the air basin. Agricultural, industrial, and other human activities are the sources of pollutants in the Sacramento Valley. Motorized vehicles on the roadways are the greatest source of organic gases, carbon monoxide, and oxides of nitrogen. Agricultural equipment and activities in Glenn County also generate hydrocarbons and fugitive dust.

The Glenn County Air Pollution Control District (GCAPCD) regulates air quality within the cities, communities, and unincorporated areas of the Glenn County. Under the direction of the Glenn County Air Pollution Control Board, the GCAPCD uses the State's ambient air quality standards to monitor and regulate the outdoor air pollution in the county. An air quality monitoring station for Glenn County is located in Willows, 18 miles southwest from the project site. Because of the distance, this station does not serve as a good indicator for the current air quality conditions in Hamilton City. The nearest air quality monitoring station is about 8 miles to the east in Chico in Butte County. This station serves as a better indicator of the existing air quality in the study area. However, since the study area is not an urbanized area, it is expected that the Hamilton City area would have less pollutants than Chico.

TABLE 4-3: STATE AND FEDERAL AMBIENT AIR QUALITY STANDARDS

Air Pollutant	State	Federal	Federal
	Concentration	Primary	Secondary
Ozone (O ₃)	0.09 ppm, 1-hr. avg. >	0.08 ppm, 8-hr. avg. >	0.12 ppm, 1-hr. avg. >
Carbon monoxide (CO)	9 ppm, 8-hr. avg. >	9 ppm 8-hr. avg.	9 ppm, 8-hr. avg.
Nitrogen dioxide (NO ₂)	0.04 ppm, 24hr. avg. ≥ with ozone ≥ 0.10 ppm, 1-hr. avg. or TSP ≥ 100 µg/m ³ , 24-hr. avg. 0.25 ppm, 1-hr. avg. >	0.03 ppm, annual avg. 0.14 ppm, 24-hr. avg.	0.50 ppm, 3-hr. avg.
Particulate matter (PM)			
<2.5 microns (PM _{2.5})	N/A	15 µg/m ³ , annual arithmetic mean 65 µg/m ³ , 24-hr. avg.	N/A
< 10 microns (PM ₁₀)	50 µg/m ³ , 24-hr. avg. >	150 µg/m ³ , 24-hr. avg.	150 µg/m ³ , 24-hr. avg.
Sulfates (SO ₄)	25 µg/m ³ , 24-hr. avg. ≥	N/A	N/A
Lead (Pb)	1.5 µ/m ³ , 30-day avg	1.5 µ/m ³ calendar quarter	1.5 µ/m ³ , calendar quarter
Hydrogen sulfide (HS)	0.03 ppm, 1-hr. avg. ≥	N/A	N/A
Vinyl chloride CH ₂ CHCl	0.01	N/A	N/A
Visibility reducing particles	In sufficient amount to reduce the visual range less that 10 miles at relative humidity less than 70%, 8-hr. avg. (9 a.m.-5 p.m.)	N/A	N/A

ppm - parts per million
 µg/m³ - micrograms per cubic meter
 N/A - not applicable
 Source: California Air Resources Board, 2001

The Federal and State attainment or non-attainment designations for criteria pollutions for Glenn and Butte counties are shown in Tables 4-4 and 4-5. Butte County is included because Hamilton City is located only about one-half mile from the boundary of

Butte County, which is under the jurisdiction of the Butte County Air Quality Control Board. Atmospheric gases are free to disperse from the Hamilton City area into nearby Butte County. These designations are based on current levels of pollutants measured at the monitoring stations.

TABLE 4-4: FEDERAL AND STATE AIR QUALITY ATTAINMENT DESIGNATION FOR GLENN COUNTY

Criteria Pollutants	Federal Designation	State Designation
Ozone	Attainment	Nonattainment transitional ¹
Carbon monoxide	Attainment	Unclassified
PM10	Unclassified	Nonattainment
Sulfate	--	Attainment
Hydrogen sulfide	--	Unclassified

¹Nonattainment/transitional is a subcategory of the nonattainment designation. An area is designated as nonattainment/transitional to signify that the area is close to attaining the standard for that pollutant. Source: California Air Resources Board, 2002

TABLE 4-5: FEDERAL AND STATE AIR QUALITY ATTAINMENT DESIGNATIONS FOR BUTTE COUNTY

Criteria Pollutants	Federal Designation	State Designation
Ozone	Nonattainment	Nonattainment
Carbon monoxide	Attainment	Attainment
PM ₁₀	Unclassified	Nonattainment
Sulfate	--	Attainment
Hydrogen sulfide	Unclassified	Unclassified

Source: Williams, 2003

According to the GCAPCD, Glenn County has adopted no specific daily emission standards for construction (Stewart, 2003). Butte County has adopted a standard of 137 pounds per day for all criteria pollutants (Williams, 2003).

Sensitive Receptors. Sensitive receptors include sensitive land uses and those individuals and/or wildlife that could be affected by changes in air quality due to emissions from the alternatives. Examples of sensitive land uses include residences, schools, playgrounds and parks, and hospitals. Within Hamilton City, the sensitive land uses include family homes and schools, but there are no sensitive land uses outside the city in the undeveloped project area. Sensitive receptors in the project area include residents, visitors, motorists, and wildlife.

4.2.2 Biological Environment

Vegetation

Before European settlement in the early 1800s, there was a wide strip of riparian forest along the Sacramento River (WET 1988). The first type of land converted to agriculture was known as rimland, which is adjacent to the river and at a higher elevation than the tule (swamp and overflow lands) in the basins (Buer, 1994). By 1871, almost all of this area was privately owned and being converted to agriculture (Buer, 1994). The floodplains were also progressively converted from riparian forest and tule swamp to agriculture, primarily fruit and nut orchards (Katibah 1984). By 1989, 98 percent of the original forest was gone (SRCAF, 2000 (rev.)).

The natural hydrologic and geomorphic processes that prevailed historically on the middle and lower reaches of the Sacramento River have been largely lost as a result of confining flood flows in reservoirs and between engineered levees. Releases for water supply from Shasta Dam are made at rates that inhibit the re-propagation of riparian vegetation due to the timing that interferes with historic natural seed propagation. As a result of the loss of natural processes, fish and wildlife habitat has been eliminated or severely degraded. Bank protection from the Chico Landing to Red Bluff Project has destroyed riparian habitats and prevents new land surfaces from being formed consequently preventing new (primary succession) riparian forests from colonizing. The Sacramento River lacks a continuous riparian corridor. Colonization by exotic species adversely affects native populations.

Vegetative communities in the proposed project area, which encompasses a 7-mile reach of the river, include riparian woodland bordering the Sacramento River, shaded riverine aquatic (SRA) cover, grasslands, agricultural lands, and a seasonal emergent wetland. The area is intensively farmed with walnut, almond and plum orchards. The acreages of the cover-types are shown in Table 4-6.

TABLE 4-6: ACREAGES OF COVER-TYPES

Cover-Type	Acreage
Riparian	208
Grassland	690
Orchards	
Almonds	705
Plums	527
Walnuts	479
Grain/Hay	90

Areas next to the river are vegetated with riparian vegetation including SRA cover. However, private interests and public agencies have placed revetment or rubble on the banks in several locations to prevent erosion. The main channel of the Sacramento River was abandoned and a cutoff channel was occupied by 1980. This area has developed into a large riparian forest and has become one of the few remaining areas where the yellow-billed cuckoo, a state-listed endangered species, is known to nest. Riparian vegetation is found along the eastern boundary of the project area adjacent to the Sacramento River, and along

Dunning Slough located at the southern end of the project area. This riparian habitat consists of a narrow band of vegetation varying in width from 10 to 40 feet. This band is fairly consistent for a length of about 6 miles.

Riparian vegetation and its associated understory plants play a significant role in the area ecology. The canopy provides excellent nesting habitat for bird and mammal species. The canopy shades the edge of the river, blocking sunlight penetration, thereby providing water temperature control along the banks during the warmer summer and fall months. The canopy and other overhanging bank vegetation also provide physical cover for fish, and inputs nutrients such as falling insects, leaf and detritus matter. Tributary and groundwater flows are a major source of nutrient inflow for the stream ecosystem. Resident and migrant songbirds, reptiles, amphibians, and mammals use riparian forests entirely or during parts of the year.

Common riparian vegetation along the Sacramento River, adjacent to Hamilton City, consists of mature oaks, cottonwood, willows, wild grapes, wild rose, poison oak, and blackberry. Elderberry bushes are found in the project area. A survey was completed by the United States Fish and Wildlife Service (USFWS) of the elderberry bushes in the project area and a summary is attached in Appendix B.

Land use adjacent to the riparian corridor is primarily agricultural. Orchards, field crops, and row crops are the main crop types in agricultural production within and surrounding the project area. A large unpaved road is located adjacent to the riparian zone.

A seasonal wetland habitat exists in a low-lying area located along the eastern edge of Hamilton City and adjacent to a trailer park. This wetland occurs on the landside of the "J" levee, just south of Highway 32 (Figure 2-2). This low area frequently pools with Hamilton City's storm water drain system outfall, and provides a small (15 acres), but significant, parcel of emergent wetland habitat.

DWR measured 47.41 miles of SRA cover in this reach (36 percent of total bank length). In 1994, 2,300 acres (in Red Bluff - Chico Landing Reach) of mature riparian forests were privately owned. The area is intensively farmed with walnut, almond and prune orchards, as well as row crops. Areas next to the river contain riparian vegetation including SRA cover. However, private and public agencies have placed revetment or rubble on the banks in several locations to prevent erosion.

The area bordering the river in the southern half of the study area has a lower elevation than the rest of the area. There is a diverse array of riparian plant communities on the eastern portion of the study area, the area closer to the river. Willow dominated shrublands cover the swales where water tables and flood flow velocities are likely high. Cottonwood forest covers the ridge areas (in excess of 100 meters wide) parallel to the river channel. This natural forest area includes native woody and herbaceous species. Cottonwood creates a canopy. Arroyo willow and box elder dominate the middle story. California blackberry, stinging nettle and mugwort form the understory.

Forest covering the Dunning Slough oxbow is dominated by sycamore, valley oak, cottonwood, and Gooding's willow. Buttonbush and sandbar willow dominate the shrub community. There is also tree of heaven in the community. Under the canopy of large mature trees a mixture of mid-canopy trees, such as box elders, a forb layer of native

blackberry, stinging nettle, mugwort, and goldenrod. Large amounts of woody debris and sandy soils indicate that this area floods frequently.

Borrow sites for the project include the existing "J" levee, which is included in the general project area described above, and the GCID dredged spoil pile found between the Glenn-Colusa Canal and County Road 203/Highway 45 from the fish screen south. This spoil pile is only very sparsely vegetated with ruderal species.

Wildlife

A wide variety of songbirds, small and large mammals, and various water-associated birds inhabit the Sacramento River Basin. Each vegetative community, including farmed areas, in the study area supports a different assemblage of wildlife species.

The riparian plant community along the Sacramento River supports a great diversity and abundance of animal life. Common wildlife species of the riparian corridor and adjacent areas include mammals such as striped skunk, opossum, brush and cottontail rabbits, black-tailed hare, raccoon, beaver, otter, muskrat, mink, coyote, deer, and many small rodents. Small mammals utilize the cover provided by streamside vegetation to move upstream and downstream while foraging for food.

Riparian forests provide habitat for a large number of bird species. Many small passerine birds (smaller perching birds) use riparian areas. Migrant songbirds nest in this habitat. Wild grape, elderberries, blackberries and wild California rose provide nectar, seeds and berries for birds. Reptiles and amphibians also utilize riparian areas include the king snake, garter snake, Western fence lizard, pond turtles, Pacific tree frog, western toad, California newt, and slender salamander.

An intact riparian forest, fallow fields with tall grasses and forbs, and the slough area, combine to create a diversity of habitats that sustain a high diversity of birds as well as a strong bird community. The site supports a diversity of cavity nesters, cup, and mid-canopy nester. Fall migrants pass through the area. Shore birds utilize the slough area and the fields support several raptor species. The area supports a large cowbird population.

SRA cover provides opportunities for birds to perch or seek cover in trees along banks. Other birds, such as the double crested cormorant, heron, belted kingfisher, and black phoebe forage in or above the water. The soft banks and woody vegetation of SRA also provide opportunities for various bat species, beavers and river otters. Large sections of riverbank occasionally become undermined and fall into the water, leaving a vertical cut bank. This provides nesting habitat for bank swallows.

Agricultural lands utilized for field crops, row crops, and orchards surrounding Hamilton City provide forage areas for small mammals; occasionally black-tailed deer, coyotes, and other mammals; upland game birds such as ring-necked pheasant; and various other bird species as well as raptor species. The small, but significant seasonal wetland area provides habitat for small mammals, a variety of passerine bird species, and various migratory waterfowl species.

Fisheries and Aquatic Resources

The Sacramento River provides important habitat for an array of anadromous and resident fish species. The Sacramento River supports anadromous fish including chinook salmon (*Oncorhynchus tshawytscha*), steelhead trout (*O. m. irideus*), green sturgeon (*Acipenser medirostris*), white sturgeon (*Acipenser transmontanus*), American shad (*Alosa sapidissima*), striped bass (*Morone saxatilis*), and Pacific lamprey (*Lampetra tridentata* ssp.1). Four different runs of chinook salmon utilize the river as a migration corridor: fall/late-fall and spring-run, winter-run, and late-fall-run. The Sacramento River system north of the confluence of the Feather River is the largest producer of chinook salmon in California (Richardson and Harrison 1990). The Sacramento River channel above Colusa provides an excellent supply of gravel (85 percent from bank erosion) essential to both young and adult salmon. About one third of the river's naturally spawning salmon, or 35,000 fish, spawn directly in the Sacramento River upstream of Colusa; it is also used for rearing and migration. The majority of winter-run chinook salmon spawning presently occurs just downstream of the Keswick Dam to the vicinity of Cottonwood Creek. Anadromous fish spawn in the river and the young rear in the SRA cover and use the river to migrate to the ocean. Most salmon spawning occurs where bank erosion and meandering processes are active and gravel is available. Peak spawning generally occurs from May through June. Salmonid spawning habitat occurs above the study area.

Resident fish include warm water fish such as largemouth bass (*Micropterus salmoides*), white (*Pomoxis annularis*) and black crappie (*Pomoxis nigromaculatus*), Sacramento pike minnow (formerly called Sacramento squawfish) (*Ptychocheilus oregonesis*), Sacramento sucker (*Catostomus occidentalis*), channel catfish (*Ictalurus punctatus*), white catfish (*Genidens barbatus*), brown bullhead (*Ameiurus nebulosus*), yellow bullhead (*Ictalurus natalis*), threespine stickleback (*Gasterosteus aculeatus*), bluegill (*Lepomis macrochirus*), green sunfish (*Lepomis cyanellus*), smallmouth bass (*Micropterus dolomieu*), Sacramento perch (*Archoplites interruptus*), Tule perch (*Hysterocarpus traski*), and prickly sculpin (*Cottus asper*); as well as coldwater fish, such as and rainbow (*Oncorhynchus mykiss*) and brown trout (*Salmo trutta*).

Also of importance are the highly diverse channel characteristics, including naturally eroding and vegetated banks, runs, riffles, pools, and backwaters. The quality of the stream habitat bordering Hamilton City is moderate. Development has contributed to the degradation of the stream habitat through the removal of riparian vegetation and the placement of revetment along the bank. However, because of the value of riparian vegetation and its growing scarcity along the Sacramento River, its presence alone is important to the fishery resources in the area. Although some banks have been treated with revetment to prevent erosion by either government agencies (Chico Landing to Red Bluff Project by the Corps and The Reclamation Board) or private parties, the reach in the project area includes more SRA than most downstream reaches.

The Sacramento River provides a diversity of aquatic habitats, ranging from fast water riffles (relatively shallow, turbulent water flowing over cobbles) and glides (deeper, slower moving water) in the upper reaches to shallow-water pool and glide habitats under tidal influence in the lower reaches.

Essential Fisheries Habitat

Essential Fisheries Habitat (EFH) is defined by Congress as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802(10)). The designation of EFH enables the National Marine Fisheries Service (NMFS) to provide guidance to Federal action agencies on ways to tailor their projects to minimize harm to EFH by requiring the consideration of impacts on EFH from both fishing and non-fishing activities. The Pacific Coast Salmon Fishery EFH includes those waters and substrate necessary for salmon production needed to support long-term sustainable salmon fishery and salmon contributions to a healthy ecosystem. In freshwater, the salmon fishery EFH includes all those streams, lakes, ponds, wetlands, and other currently viable water bodies and most of the habitat historically accessible to salmon (except above certain impassable natural barriers). The project area from the existing levee outboard toward the river is considered essential fish habitat.

Special-Status Species

The USFWS provided an official list dated April 11, 2001, of the Federally-recognized special status species that may occur within the proposed project area. The list was updated on October 21, 2002 and again on November 6, 2003 (Appendix B). A search of the California Natural Diversity Database (see Figure 4-1) was done on November 20, 2002 to determine presence of State listed special status species in the project area.

Table 4-7 identifies special status species that are potentially present in the vicinity of the study area. Special status species included in this list but not found or not likely to be found in the study area include Conservancy fairy shrimp (*Branchinecta conservatio*), vernal pool fairy shrimp (*Branchinecta lynchi*), vernal pool tadpole shrimp (*Lepidurus packardii*), delta smelt (*H. transpacificus*), California red-legged frog (*Rana aurora draytonii*), giant garter snake (*Thamnophis gigas*), greater sandhill crane (*Grus canadensis*), little willow flycatcher (*E. t. brewsteri* and *E.t. adastus*), Butte County (Shippee) meadowfoam (*Limnathes alba Benth*), and Hoover's spurge (*Chamaesyce hooveri*). Of these species, the red-legged frog is extirpated from the Sacramento Valley, and the giant garter snake is not known to be present north of Gridley in Butte County. The Delta smelt, greater sandhill crane, little willow flycatcher, and vernal pool habitat and its associated plants and animals are also not likely to be found in the project area. Special status species potentially present in the study area include valley elderberry longhorn beetle (VELB) (*Desmocerus californicus dimorphus*), Central Valley fall/late fall-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley steelhead, winter-run chinook salmon, bald eagle (*Haliaeetus leucocephalus*), bank swallow (*Riparia riparia*), Swainson's hawk (*Buteo swainsoni*), and Western yellow-billed cuckoo (*Coccyzus americanus*). Table 4-8 identifies elderberry shrubs in the study area. Table 4-9 identifies the occurrence windows of the special status species.

The red-legged frog historically resided in the Sacramento Valley. The range of this species currently is restricted to drainages in the central coast range of California and an isolated location on Pinkard Creek in Butte County. No locations in the study area were registered in the California Natural Diversity Database (CNDDDB) and no suitable habitat occurs in the study area. The giant garter snake occupies habitats that contain permanent or seasonal water, mud bottoms, and vegetated dirt banks. They are commonly found within irrigation canals, flooded rice fields, ditches, or agricultural drains. The present northern-

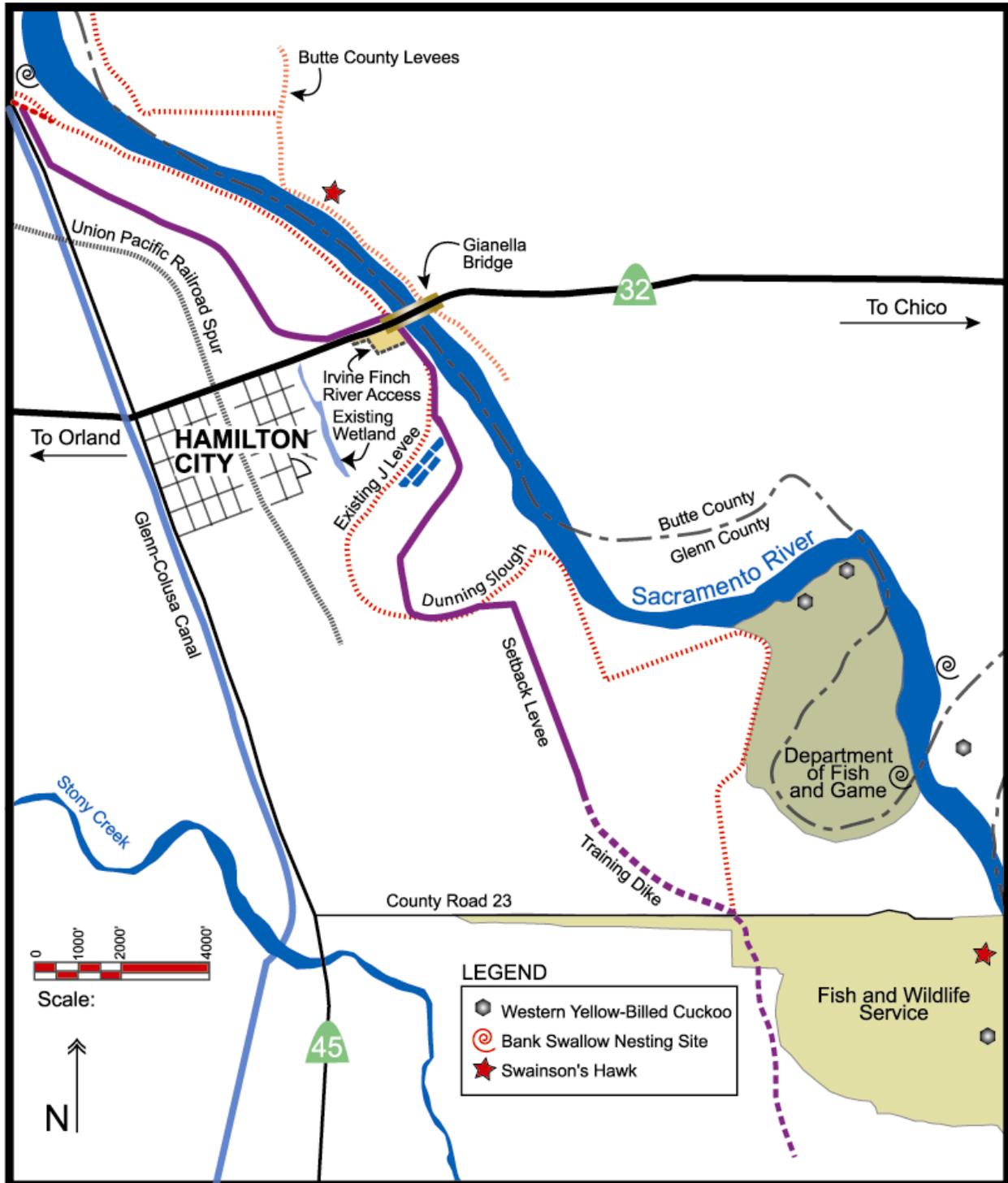


Figure 4-1: Occurrence of Special Status Species in the Study Area from the National Diversity Database (NDDB).

TABLE 4-7: LISTED OR PROPOSED SPECIES POTENTIALLY PRESENT IN THE PROJECT AREA

Species	Federal/ State Status	California Distribution	Habitat Requirements	Occurrence in Project area
valley elderberry longhorn beetle (<i>Desmocerus californicus dimorphus</i>)	T/-	Occurs only in the Central Valley of California, in association with blue elderberry (<i>Sambucus mexicana</i>). Sacramento, American, San Joaquin, Kings, Kaweah, and Tule Rivers and their tributaries, including Butte and Glenn Counties.	Elderberry shrubs (<i>Sambucus</i> spp.) in riparian areas. Prefers to lay eggs in elderberry stems 2-8 inches in diameter; some preference shown for "stressed" elderberries.	Found in project area.
Central Valley fall/late fall- run chinook salmon (<i>Oncorhynchus tshawytscha</i>)	C/-	Currently spawn in the Merced, Tuolumne, Sacramento, and Stanislaus Rivers.	Ocean and freshwater rivers and streams.	Found in project area.
Central Valley spring-run chinook salmon (<i>Oncorhynchus tshawytscha</i>)	T/T	Sacramento River and tributaries downstream to and including San Francisco Bay to Golden Gate Bridge.	Ocean and freshwater rivers and streams.	Found in project area.
Central Valley steelhead (<i>Oncorhynchus mykiss</i>)	T/-	Sacramento River and tributaries; San Francisco Bay/Delta estuary and the open ocean.	Ocean and freshwater rivers and streams.	Found in project area.
winter-run chinook salmon (<i>Oncorhynchus tshawytscha</i>)	E/E	Sacramento River, tributaries, distributaries, and related riparian zones from Keswick Dam downstream to and including San Francisco Bay.	Freshwater rivers and streams.	Found in project area.

Species	Federal/ State Status	California Distribution	Habitat Requirements	Occurrence in Project area
bank swallow (<i>riparia riparia</i>)	-/T	The swallow has been extirpated from much of its range in California and now nests only on the Sacramento and Feather Rivers, including in Butte and Glenn Counties.	Colonial nester. Nests primarily in riparian and other lowland habitats west of the desert. Nests in vertical banks/cliffs, usually adjacent to water, where the soil consists of fine textured sand or sandy loam to allow digging nesting hole. Banks of rivers, creeks, and lakes; seashores. Originally only nested in steep, sandy riverbanks, but have adapted to humans and now nest in the sides of man-made excavations.	Found in project area.
Swainson's hawk (<i>buteo swainsoni</i>)	-/T	Butte and Glenn Counties.	Breeds in stands with few trees in juniper-sage flats, riparian areas, and in oak savannah. Nests in oaks or cottonwoods in or near riparian habitats. Forages in grasslands, irrigated pastures, alfalfa, and grain fields supporting rodent populations.	Found in project area.

Species	Federal/ State Status	California Distribution	Habitat Requirements	Occurrence in Project area
Western yellow-billed cuckoo (<i>Coccyzus Americanus Occidentalis</i>)	C/E	Butte and Glenn Counties.	Riparian forest nester, along the broad, lower flood-bottoms of larger river systems. Nests in riparian jungles of willow, often mixed with cottonwood, box elder, and white alder with a thick understory of blackberry, nettles, or wild grape. Sites with a dominant cottonwood overstory are preferred for foraging; may avoid valley oak riparian habitats where scrub jays are abundant.	Found in project area.
<p>Federal status</p> <p>E = listed as endangered under the Federal Endangered Species Act. T = listed as threatened under the Federal Endangered Species Act. P = proposed for Federal listing as endangered under the Federal Endangered Species Act. C = species for which the U.S. Fish and Wildlife Service has on file sufficient information on biological vulnerability and threat(s) to support issuance of a proposed rule to list. PX = proposed critical habitat -- = no listing.</p> <p>State status</p> <p>E = listed as endangered under the California Endangered Species Act. T = listed as threatened under the California Endangered Species Act. -- = no listing.</p>				

most extent of the giant garter snake is in the Llano Seco area south of Chico. Giant garter snakes are also found at the Sacramento, Colusa, and Delevan national wildlife refuges. No locations are identified for this species in the vicinity of the study area.

The Sacramento River supports four races of chinook salmon, fall-run, late fall-run, winter-run, and spring-run. In the Sacramento River, juvenile chinook salmon belonging to one or more of the four extant runs may be migrating in any month of the year (Nicholas and Hankin 1989). In the past, the river produced large numbers of salmon that were an important part of the diet of California's native peoples. Habitat destruction, first in the

form of mining debris and sediments that covered spawning grounds and muddied the waters, reduced the salmon populations beginning as early as the 1850's, and later 1860's and 1870's by the cutting of riparian trees for fuel for steamboats. In the twentieth century, agricultural conversion, dam building, gravel mining and flood protection works have further decimated the SRA cover, and the gravel spawning habitats the salmon depends on to complete its life cycle.

TABLE 4-8: ELDERBERRY SHRUBS IN THE STUDY AREA

Location	Total Shrubs	1-<3" stems	3-<5" stems	5" or greater	Shrubs showing presence of VELB exit holes
Hamilton City North	41	37	36	53	16
Dunning Slough	66	95	93	71	5

TABLE 4-9: SPECIAL STATUS SPECIES OCCURRENCE WINDOWS

POTENTIAL CONSTRUCTION WORK WINDOWS FOR SELECT SPECIAL STATUS SPECIES IN SACRAMENTO VALLEY CALIFORNIA*

U.S. Army Corps of Engineers, Sacramento District, Environmental Resources Branch
February 2003

Species	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Valley elderberry longhorn beetle	Transplant											
Swainson's hawk	X											
Giant garter snake	■											
Spring-run chinook salmon (S. River)	■											
Winter-run chinook salmon (S. River)	■											
Central Valley steelhead (Rivers)	■											
Bank swallow	■											
Yellow billed cuckoo	■											

* NOT a comprehensive list of species

** Species that are known to occur in the Central Valley but do not have work windows.

- Potential work window
- Work window for Swainson's hawk may be increased if nesting surveys are conducted
- Species potentially present

Of the four chinook salmon runs (fall, late fall, winter and spring) that use the river, the greatest concern is for the winter-run. In recent years, the winter-run has dwindled from an annual escapement of 80,000 adult fish to about 2,000; with a low of 191 winter-run chinook in 1991 (Federal Register, 1994). This steep decline, due to a variety of causes, including habitat degradation, has prompted the listing of the winter-run under both State and Federal Endangered Species Acts. Currently, the Federal and State Endangered Species Acts list the winter-run salmon as State-endangered, and Federally-endangered; the spring-run salmon as State-threatened and Federally-threatened; and fall/late fall salmon are Federal candidates. In December to August, the winter-run chinook salmon migrates past the area upstream, where it spawns. From August to December, winter-run juveniles use the SRA cover in the river for feeding, to rest and escape from predators. The NOAA Fisheries has classified the entire Sacramento River from Keswick Dam to San Francisco Bay as critical habitat for winter-run chinook.

Central Valley steelhead populations are all considered to be winter-run steelhead that typically spend two years rearing in fresh water before out-migrating to the ocean (McEwan and Jackson 1996, IEP Steelhead Project Workteam 1999). Like chinook salmon, steelhead primarily use habitat in the area during the juvenile rearing period. During the warmer parts of the year, steelhead parr appear to prefer habitat with cover provided by rocky substrates, overhanging vegetation and large woody debris (LWD), and low light intensities (Hartman 1965, Facchin and Slaney 1977, Ward and Slaney 1979, Fausch 1993). During the winter, when they are believed to be less active, juvenile steelhead use pools with large rocky substrates or LWD cover (Hartman 1965, Swales et al. 1986, Raleigh et al. 1984, Fontaine 1988). In winter and spring, when high flows inundate floodplains, backwaters, and side channels, these low-velocity areas may be important feeding areas and velocity refuge habitat for rearing juvenile steelhead and out-migrating smolts (Sommer et al., 1997). Rearing juvenile steelhead and out-migrating smolts may be present in the project area throughout the year. Adult steelhead require deep pools for resting during their upstream spawning migration. Some upstream migrants may use pools in the lower Sacramento River, where available.

Existing valley elderberry bushes provide potential habitat for the VELB. The VELB depends exclusively on the blue elderberry bush for its habitat. Both the larvae and adults feed on the plant, and much of its 2-year life span is spent as larvae inside the stems of the plant. Elderberry bushes are frequently found near the Sacramento River. The beetle occurs naturally in small populations. The beetle was recognized as a Federal threatened species because of loss and alteration of its habitat by agricultural expansion into riparian areas and flood control activities. Some elderberries do exist within the study area. The total elderberry shrubs located in the study area are presented in Table 4-8.

The large riparian forest that has developed near Pine Creek, just east of the project area, provides one of the few remaining areas where the yellow-billed cuckoo is known to nest. The yellow-billed cuckoo nests in large dense riparian areas such as the area that developed in Pine Creek when the Sacramento River abandoned its channel in 1974.

The bald eagle is a temporary visitor during the winter months. This species is not commonly found in the project area and would not even be potentially present during construction. Therefore, the bald eagle is not considered further in this document.

The Swainson's hawk nests in large trees surrounded by suitable foraging habitat, which consists of grasslands or agricultural fields with seasonal crops. Orchards are usually not suitable for the hawks. Swainson's hawks are reported from a variety of locations along the Sacramento River.

The bank swallow is listed as threatened by the State of California under the California Endangered Species Act. Bank swallows nest on eroding banks within the area. This type of swallow is a migratory bird that nests in burrows it digs into in vertical sandy banks in areas it can find food and where it is protected from most predators. In most instances, these banks are riverbanks, where erosion continually provides newly-cut banks. The swallow has been extirpated from much of its range in California. The majority of the population that remains is now centered in the Sacramento Valley along the Sacramento and Feather Rivers. The Department of Fish and Game has found that habitat loss is continuing to threaten the species and that bank protection is the main cause of its decline along the Sacramento River. The species is short lived; it lives only about 2 years, and is therefore very sensitive to changes in habitat conditions. Biologists from the Department of Fish and Game (DFG) counted 44 colonies in 2002 with a total of 16,150 burrows. Not all burrows are occupied, and DFG estimates the number of pairs to be 8,330. This is significantly below the estimated 10,000 pairs required for a stable population (Buechner, Population Viability Analysis, 1992). In 2002, 490 burrows active bank swallow nesting sites were located in the study area.

A summary of occurrence windows for various special status species are presented in Table 4-9.

4.2.3 Socioeconomic Conditions

This section describes the existing conditions of socioeconomic resources in the study area. Socioeconomic conditions include population, employment, and economic activity.

Glenn County population has increased from 24,798 to 26,453, a 6.7 percent increase, since 1990. The Hamilton City community has a population of about 1,800 (U.S. Bureau of Census, 2000). A socioeconomic profile of Hamilton City is presented in Table 4-10. Based on this table, the population of Hamilton City can be described as primarily a minority, low-income population. The 1999 Glenn County per capita income was about \$18,015, which was about 60 percent of the California average (Table 4-10). The 1999 Hamilton City per capita income was about \$9,015, which was about 50 percent of the Glenn County figure. Median household values in Hamilton City are below the state average. The foreign-born population percentage of Hamilton City is significantly above the state average.

The economy of the study area is based on the agricultural industry. The county has one of the highest unemployment rates in the State of California. At 13.8 percent, Hamilton City's unemployment rate is significantly above the state average. Employment, because of its historic dependence upon agriculture, fluctuates substantially on a seasonal basis. Agriculture, agriculturally dependent industries, and government employment comprise a disproportionately high percentage of employment in Glenn County. These sectors of the economy are potentially susceptible to economically disadvantageous characteristics such as low prevailing wages, seasonal fluctuations, (agriculture), and increasingly constrained funding resources (government). Several Federal Agencies have offices and staff in Willows, Glenn County, which contribute Federal funds to the County. Local government expenditures

are generally derived from locally raised tax dollars, and do not, therefore, bring net new income into the county from outside. Consumer expenditures are generally regarded to "leak" from Glenn County to larger retail trade centers, such as Chico and Sacramento. At the same time, economic expansion pressures in the Chico area are known to be creating residential demand in Glenn County, and creating demands for public services without a corresponding expansion of the County's tax base to help offset the costs of such services. Competition with Chico, Williams, and other regional locations for a new economic activities influences Glenn County's practical economic development potential.

TABLE 4-10: SOCIOECONOMIC PROFILE OF HAMILTON CITY

2000 Population (2)	
Hispanic/Latino	1,533
White	330
American Indian	10
Asian	6
Black/African American	5
Other	19
Total	1,903
1999 Per Capita Income	
Hamilton City ¹	\$9,050
Glenn County ²	\$18,015
California ³	\$29,910

¹ CDP = census designated place, which is a densely settled concentration of population that is not within an incorporated place but is locally identified by a name

² US Bureau of Census

³ CA Department of Finance

As set forth in its General Plan, Glenn County is currently pursuing a pro-economic growth policy to enhance the socioeconomic conditions of the county, including measures such as preserving agriculture while increasing the stability of, and diversifying, the county's economy; expanding existing businesses; attracting new businesses and industry; capturing new or underutilized market potentials; creating new employment opportunities; increasing average income of residents; and expanding and diversifying the tax base.

The local community has developed a sense of community cohesion in their long and persistent efforts to address the flood damage problem that they have faced. This cohesion has been displayed by the community's response to an annual levee festival to develop support and raise funds for levee improvements. The community also displayed this cohesion by their efforts to support a workgroup that met every other month to provide a forum to discuss and coordinate water resources related studies, projects, and other issues affecting the Hamilton City area. Finally, the level of community involvement in public workshops held by the study team was noteworthy.

It is not clear whether current property values within Hamilton City are being negatively influenced by the flood threat. Most of the community lies outside of the FEMA 100-year floodplain and the community has not suffered major flood damage (primarily because of significant flood fighting efforts along the "J" levee). The only new major

development in the community (Pallisades subdivision with 116 single-family residential units) is located within the FEMA floodplain; however, the structures are on raised pads.

4.2.4 Agriculture/Prime and Unique Farmlands/Land Use

With the exception of cities/towns of Tehama, Hamilton City, and Nord, land use in the study area is primarily agricultural. Primary crops include barley, alfalfa, beans, sugar beets, and nut (walnut) and fruit (prune) orchards. Ongoing and planned development for Hamilton City includes the construction of a housing development and an elementary school. Lands west of Chico are predominantly agricultural orchards with the exception of the small residential area of Nord.

Agriculture/Prime and Unique Farmlands

The majority of lands within the project area are in agricultural production. As indicated in Table 4-6, the area is primarily in orchard crops, including almonds, plums, and walnuts. Some grain and hay crops are also being grown. These agricultural lands are currently subject to seepage, erosion, flooding, and scouring due to their proximity to the Sacramento River. This condition adversely affects the economic return on the agricultural management investment.

Lands located in Glenn County only are classified as Orchard and Field Crop in the County General Plan. The Orchard and Field Crop classification is used to identify those areas where it is desirable to preserve agriculture as the primary land use. Two zoning designations apply: (1) Agricultural with a minimum parcel size of 160 acres, and (2) Agricultural with a minimum parcel size of 40 acres. Public facilities are considered permitted uses in this zoning designation.

The California Department of Conservation uses the U.S. Department of Agriculture's modern classification when administering the Farmland Mapping and Monitoring Program to characterize the types and amounts of agricultural land in an area. Agricultural lands in the study area are primarily characterized as:

- Prime Farmland. Lands which are considered to be the best combination of physical and chemical features able to sustain long-term agricultural production;
- Farmland of Statewide Importance. Farmlands similar to Prime Farmland but with minor shortcomings, such as greater slopes or less ambient moisture;
- Other Land. Land not included in any other mapping category, such as low-density rural development, wetland, and riparian areas not suitable for livestock grazing.

There are about 1,440 acres classified as Prime Farmlands; 61 acres classified as Farmlands of Statewide Importance; and 100 acres classified as Other Lands (see Figure 4-2).

Glenn County administers the Williamson Act and Farmland Security Zone (Super Williamson Act) contracts within the study area (see Figure 4-3). Both are intended to preserve farmland although a landowner could have a permitted mining operation, a hunting club (without permanent facilities), or processing operations for agricultural products. The

*Hamilton City Flood Damage Reduction and Ecosystem Restoration, California
Final Feasibility Report/EIR/EIS*

STATE OF CALIFORNIA
Arnold Schwarzenegger, Governor
THE RESOURCES AGENCY
Michael Christman, Secretary
DEPARTMENT OF CONSERVATION
Darryl Young, Director

**Glenn County Important Farmland &
Butte County Interim Farmland
2002**

DEPARTMENT OF CONSERVATION
DIVISION OF LAND RESOURCE PROTECTION
FARMLAND MAPPING AND MONITORING PROGRAM

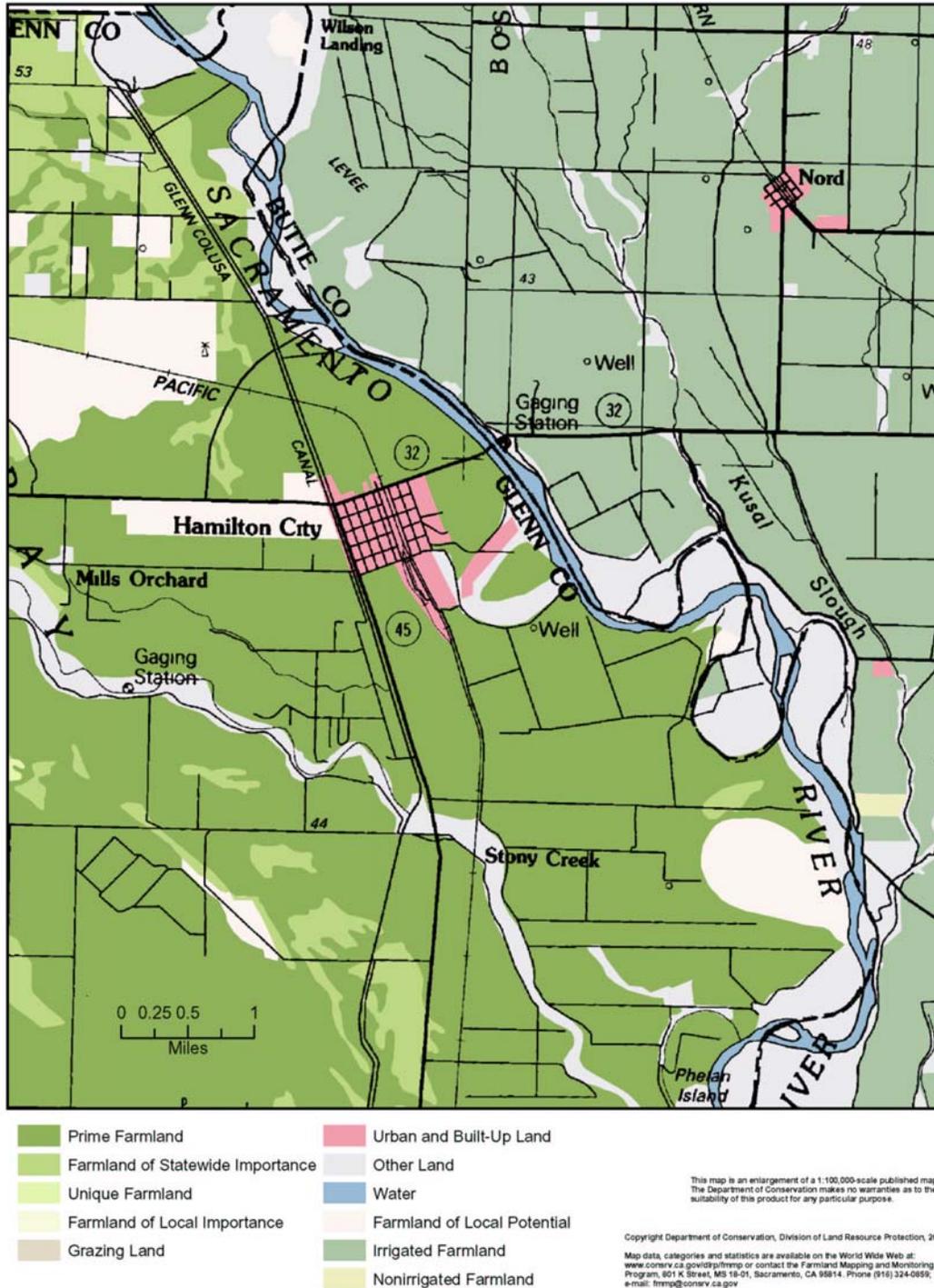


Figure 4-2: Important Farmland in the Study Area

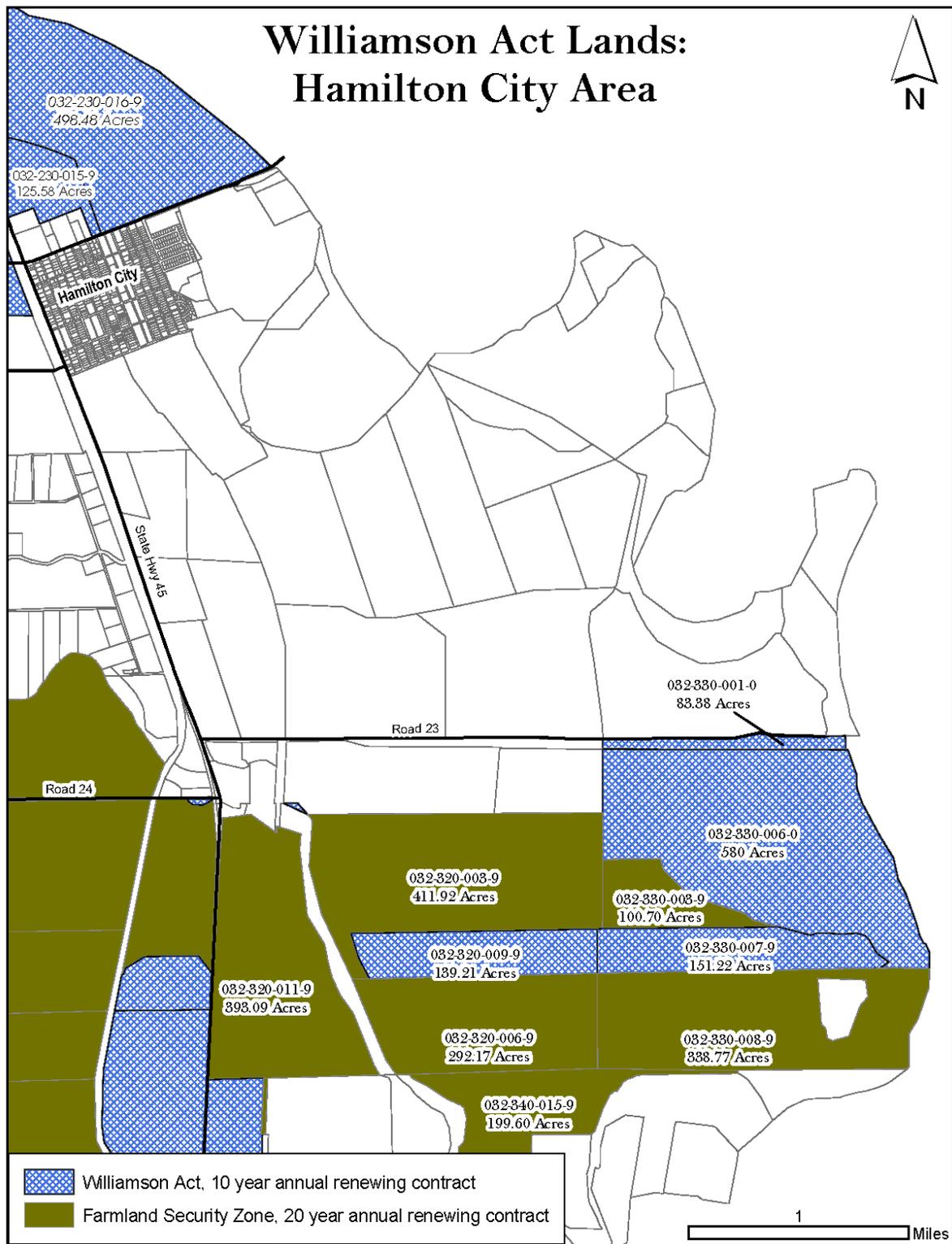


Figure 4-3: Williamson Act Lands: Hamilton City Area

only major difference in the Williamson Act Contracts that the County administers is the length of the renewing contract. For Williamson Act Contracts it is ten years and for the Farmland Security Zone Act it is 20 years.

In compliance with the Farmland Protection Policy Act (FPPA), the NRCS provided a Farmland Conversion Impact Rating, dated September 30, 2003 (on Form AD-1006, Appendix B), which indicated that there are 451,163 acres of farmable land in Glenn County. They also indicated that there are 212,005 acres of farmland in the county that are prime or unique farmlands, or farmland of statewide or local importance, as defined in the FPPA. As of 1998, Glenn County had 88,706 acres enrolled in Williamson Act Prime and Unique agriculture. A net total of 1,668 acres of prime agriculture was converted between 1998 and 2000.

The management of these prime and unique farmland soils for agricultural purposes exposes them to some degree of degradation. The processes under which these soils developed are adversely affected by the current management practices, such as protection from flooding and associated sediment deposition, tilling, and the application of agricultural chemicals. These practices adversely affect nutrient cycling, increase exposure to erosion, and inhibit natural soil microorganisms.

In the study area there are currently 6 parcels under Williamson Act contracts totaling 1,577.87 acres. Two of these parcels are owned by TNC, two of these parcels are owned by the USFWS, and two parcels are privately owned. Also in the study area there are two parcels under Farmland Security Zone Act Contracts totaling 612.62 acres. Both properties are privately owned.

Urban Land Use

Glenn County maintains a policy of developing urban limit lines that will accommodate growth based on population forecast for each community (see Figure 4-4). In addition urban limit lines should follow roads, railroads, watercourses or other physical boundaries and follow parcel lines. Expansion of the urban limit lines may occur only once full urban services and infrastructure have been established and the property is contiguous to existing development. A recent expansion to the city called the Pallasades sub-division has begun on the eastern boundary of the city limits (116 units). A total of about 80 units have been built to date, with the remainder estimated to be completed in about 2006. A school is part of the development plan. Figure 4-4 also depicts the FEMA 100-year regulatory floodplain.

4.2.5 Transportation

The study area is between Interstate Highway 5 (I-5) and State Highway 99, and the Sacramento River essentially parallels these north-south routes (Figure 2-1). State Highway 32 runs through Hamilton City and is an east-west connection for vehicles traveling between I-5 and State Highway 99 (Figure 4-5). The Gianella Bridge on State Highway 32 crosses the Sacramento River and connects Hamilton City with Chico. This route is particularly important locally since there are few major routes crossing the river in this area. State Highway 45 runs south from Hamilton City to Knights Landing. The California Northern Railroad connects the town to its main line, which in turn has connections to the Union Pacific Railroad.

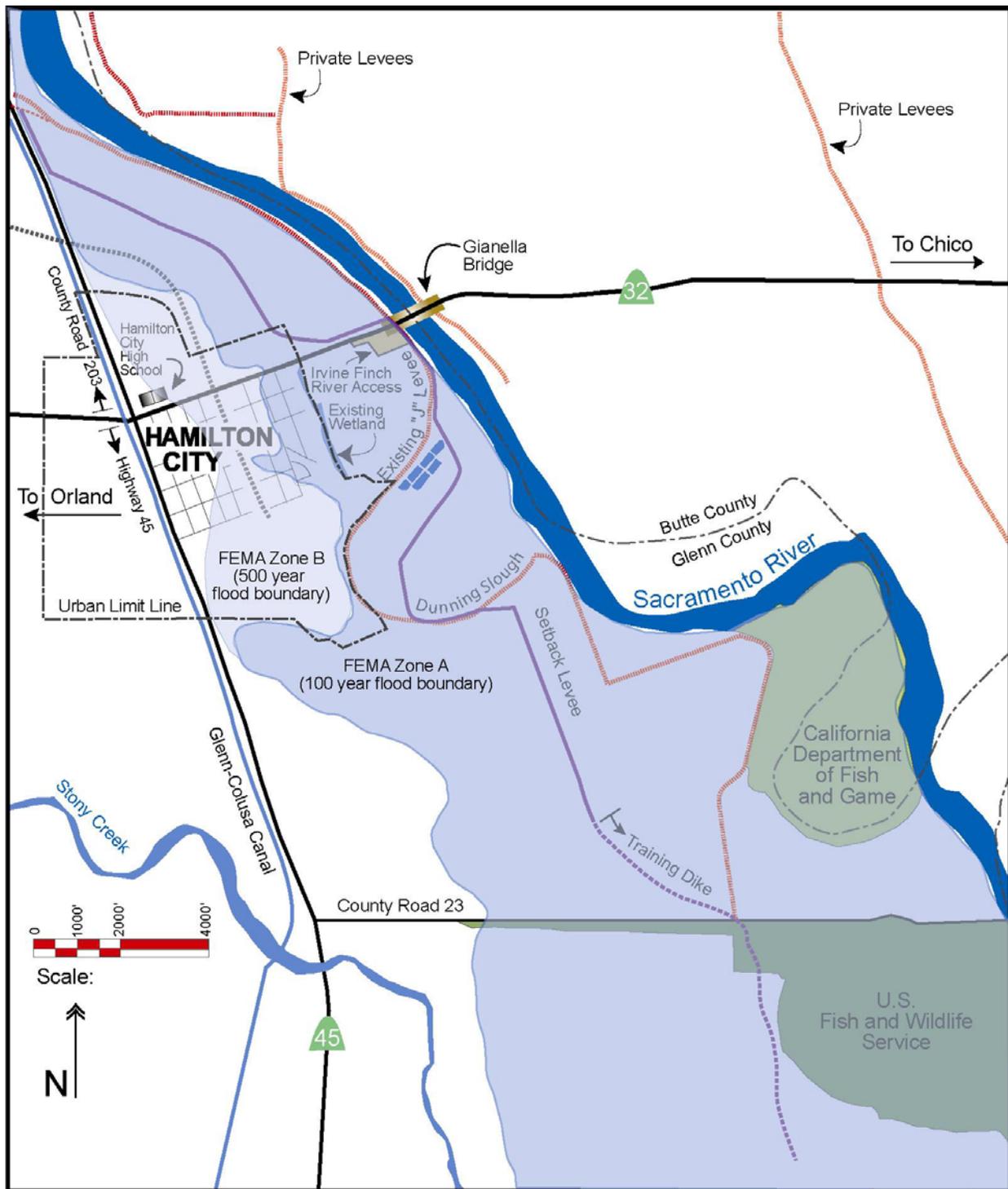


Figure 4-4: Urban Limit Line and FEMA Floodplain Boundary: Hamilton City Area

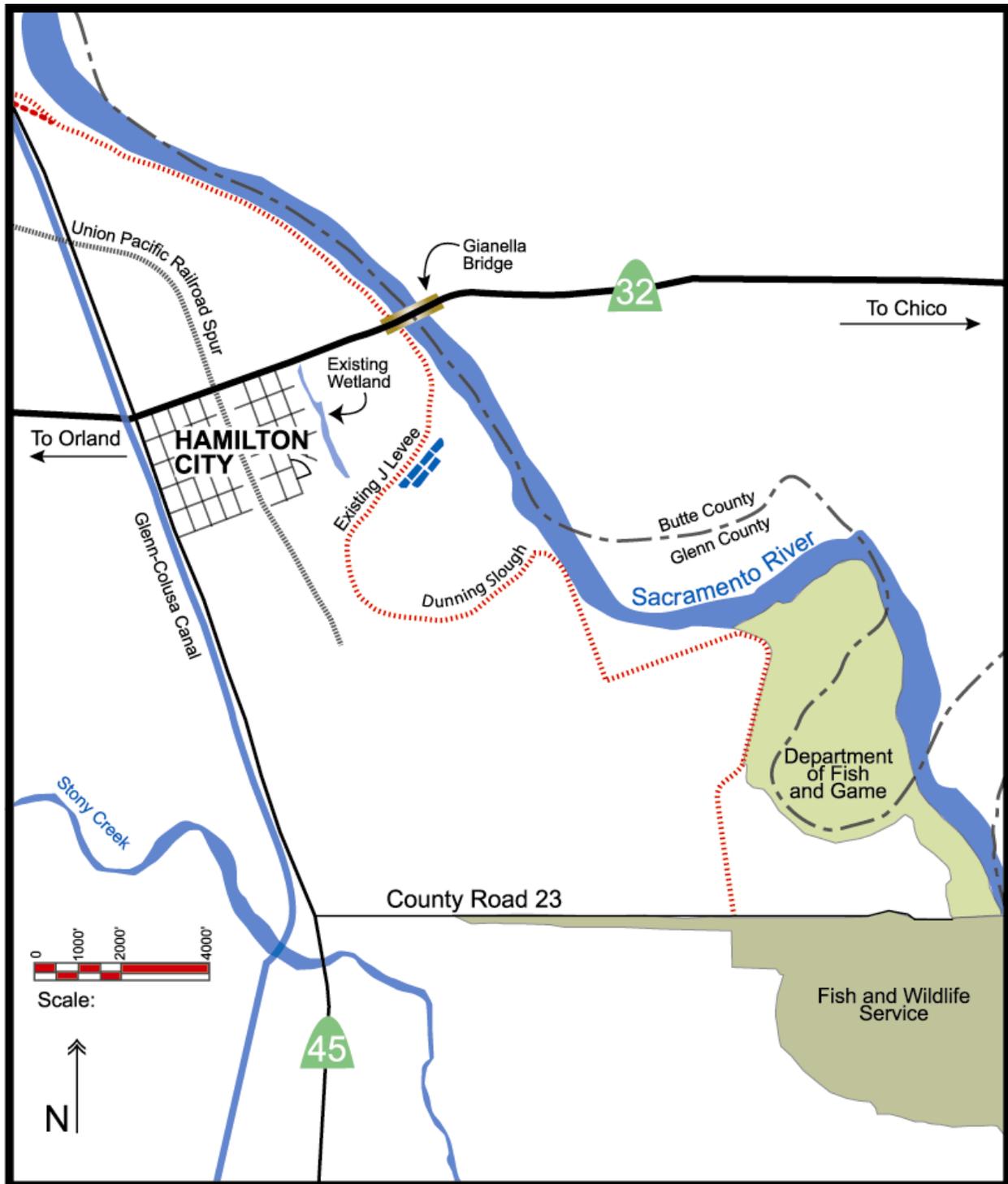


Figure 4-5: Transportation Routes in the Hamilton City Area

The Sacramento River forms the Glenn County (west) and Butte County (east) line. Bus service to the area is provided by Greyhound, which services Chico directly. Airplane travel is available from Sacramento International Airport, about 100 miles south via Interstate Highway 5.

4.2.6 Recreation

Within the affected area, the Sacramento River supports a variety of recreational activities. Recreational boating is the primary recreational activity and the region has a variety of sites for boat launching, including the Irvine Finch River Access within the study area, which is owned and maintained by the California Department of Parks and Recreation. Other recreational opportunities within the study area include hunting, fishing, hiking, day-use/picnicking and wildlife observation. Both motorized and nonmotorized boats use the section of the Sacramento River south of the Woodson Bridge. The most common type of boats used on this part of the river are fishing boats, canoes, rafts, and other inflatable craft. Jet sleds and jet skis are also used in this area during the summer months.

This section describes the recreation facilities available in the affected area. The recreation facilities and used are categorized by Federal, state, local, or private landowners. (See Table 4-11.) Each facility is described in terms of river miles reference, access, site amenities, and site characteristics. This information was taken from the Sacramento River Public Recreation Access Study: Red Bluff to Colusa (EDAW Consulting 2003) that was prepared for TNC. This document identified and characterized existing public recreation opportunities and needs and identified and made recommendations for future public recreation access opportunities and management programs throughout the study area.

4.2.7 Aesthetics

The project area is located in a rural setting adjacent to the Sacramento River. Prominent visual features include the Sacramento River, the Hamilton City Sewage Treatment facility, surrounding agricultural fields, and local roads. Sensitive visual receptors include local residents and river recreationists. The project area is remote, not easily accessible from the land by the general public and cannot be characterized as a destination for travelers, with the exception of recreationists.

4.2.8 Noise

Within Glenn County, typical non-transportation or industrial noise sources include, but are not limited to, the Glenn Growers rice drying facility, Manville Insulation industrial facility, Holly Sugar Corporation, Baldwin Contracting Company, Stony Creek Sand and Gravel, Valley Rock Products Inc., Martin Sand and Gravel, and miscellaneous agricultural operations. The only other non-transportation noise sources in the study area are those associated with mobile noise from agricultural operations on lands zoned for agricultural uses. These activities are exempt from noise ordinances.

Transportation noise sources are defined as traffic on public roadways, railroad line operations, and aircraft in flight. Noise created by new transportation noise sources,

including roadway improvement projects, are mitigated so as not to exceed the specified noise ordinance levels.

TABLE 4-11: RECREATION FACILITIES LOCATED IN THE AFFECTED AREA

Name	Location	Access	Site Amenities	Site Characteristics
Federal Facilities				
Foster Island	River Mile 211	No public access	No amenities	Cut off from land by sloughs and bordered by private agriculture land. It is frequently submerged during the winter and spring and dense riparian vegetation
Sacramento River National Wildlife Refuge (SRNWR)	11 sites from RM 182-RM 216	No public access	No amenities	Vegetation consists of riparian, row and tree crops, and fallow farmland
State Facilities				
Sacramento River Wildlife Area	7 units from River Mile 180.5- RM 214	3 units have public access roads and 4 units do not.	None of these units provide facilities for boating, parking, picnicking, or camping.	Provide wildlife-related public recreation opportunities
Bidwell-Sacramento River State Park (includes Irvine Finch River Access)	4 units from RM 193.2 - RM 200	Public access roads	Regular and boat trailer parking, overnight camping, picnic facilities, drinking fountains, and flushable toilets, unpaved trails and walkways and is ADA accessible.	Provides hiking, fishing, and wildlife observation
Reclamation Board sites for maintaining flood control works	5 sites from RM 190 - RM 196	Public use is neither allowed nor prohibited	No amenities	Vegetation on these sites is dense mixed riparian forest and gravel bars.

Name	Location	Access	Site Amenities	Site Characteristics
Local Facilities				
Ord Bend Park	River Mile 184	Public access via County Road 32 and the river	Boat ramp, paved parking, restrooms with flushable toilets, sinks, picnic facilities, and ball fields.	Primary recreation uses include fishing and wildlife observation.
Private Facilities				
The Nature Conservancy	7 units	No public access.	No amenities.	No public use is allowed
Scotty's Boat Landing	River Mile 196.5	Public access via River Road or by the river	Unpaved parking, boat ramp, boat dock, tent and RV camping sites, picnic tables and potable water, a bar and grill restaurant, a store that sells bait and tackle equipment, and public phones.	The site is vegetated with sparse, mostly non-native species along the bank, however, a few mature cottonwoods are also present.

The noise level standards for Glenn County are the average noise level for an hour period (A-weighted scale). Table 4-12 shows the maximum noise level standards for Glenn County. The Glenn County Planning Division enforces the noise level standards in Glenn County and determines the land use boundary lines, which determines the noise level standards. The noise level standards are established to protect the quality of human health in Glenn County (Glenn County 2003).

TABLE 4-12: MAXIMUM ONE-HOUR AVERAGE NOISE LEVEL THRESHOLD

Item	A-Weighted Scale (dB)
7:00 a.m. - 10:00 p.m.	
Residential	55
Commercial	60
Industrial	65
10:00 p.m. - 7:00 a.m.	
Residential	45
Commercial	55
Industrial	60

Note: the A-weighted is measured in decibels shown as (dB).

Noise production near sensitive receptors is held at a lower threshold than the thresholds found on Table 4-12. The type of land use the sensitive receptor is located in does not determine the noise level standards. The standards near a sensitive receptor are found on Table 4-13 (Glenn County 2003). Sensitive receptors may include schools, residential homes, and hospitals.

**TABLE 4-13: MAXIMUM ONE-HOUR AVERAGE NOISE THRESHOLDS
NEAR A SENSITIVE RECEPTOR**

Item	A-Weighted Scale (dB)
7:00 a.m. - 10:00 p.m.	
Threshold	57
10:00 p.m. - 7:00 a.m.	
Threshold	50

Note: the A-weighted is measured in decibels shown as (dB).

Local noise standards do not apply to the construction site sounds between 7:00 a.m. and 7:00 p.m. The local noise standards also do not apply to agricultural equipment when operated on property zoned for agricultural activities provided standard, reasonable practices are being followed.

4.2.9 Hazardous, Toxic, and Radiological Waste

Federal, State, and local lists were identified and reviewed to determine the extent of known hazardous, toxic, and radiological waste (HTRW) sites in the study area that could require special consideration during further detailed studies. An expanded discussion of HTRW resources in the study area can be found in Appendix C.9, Hazardous, Toxic and/or Radiological Waste.

The Comprehensive Environmental Response, Compensation, and Liability Information System list (CERCLIS) and National Priorities List (NPL) were reviewed and indicated there are no suspected abandoned, inactive, or uncontrolled hazardous waste sites, or Superfund sites, within the study area. The Emergency Response Notification System database showed no hazardous materials spill sites within the study area.

No landfills are listed in the study area. However, the Holly Sugar Lime Disposal Site, which includes mounds of lime, is located ½ mile southeast of First Street. Some of the lime is being hauled and used for soil conditioning at a different location.

There are three Leaking Underground Fuel Tanks (LUFT) within the study area; Double E Market, Jackpot Food Mart, and Kaplan Almond Farm, all located within Hamilton City. There are six Underground Storage Tank (UST) sites; Double E Market, Benjamin's Service Inc., Hamilton High School, James Mills Orchards, James Mills Growers Service Co and Hamilton Elementary School, all located within Hamilton City.

Seven oil and gas wells were identified within the study area. All oil and gas wells are located on the outskirts of Hamilton City between the Glenn-Colusa Canal and the Sacramento River. These wells were drilled in the early to mid-1900's and all were found dry.

There are four hazardous waste generators in the study area: Art Avrit, Bob's Auto & Truck Repair, Martin Byron Vangundy III, and Hamilton Union Elementary School District.

Soils that are the result of a spill or improper disposal and have dichlorodiphenyltrichloroethane (DDT) derivatives including DDD (dichlorodiphenyltrichloroethylene) (DDTR) at concentrations above 1 part per million (ppm), are classified as hazardous waste under California regulations. The samples collected in Glenn County are all below these limits. This does not rule out the possibility that greater concentrations may be encountered in the study area. Most of the study area, outside of Hamilton City has been orchards and farmlands for many years.

4.2.10 Cultural Resources

This section provides a summary of existing conditions of cultural resources in the study area. An expanded discussion of cultural resources can be found in Appendix B.

Prehistory

The study area lies within an archeological sub-region of the Central Valley Region referred to as the Sacramento Valley (Moratto 1984). The potential area of potential effect (APE) for this project crosses the prehistoric territory of the Konkow. Konkow was spoken in a number of dialects along the lower reaches of the Feather River Canyon and in the adjacent parts of the Sacramento Valley. The term Konkow refers only to the Northwestern Maidu whose regional boundaries would have included the lower reaches of the Feather River and adjacent parts of the Sacramento Valley (Riddell 1978). The Konkow territory included part of the Sacramento Valley floor as well as a section of the Sierra foothills east of Chico and Oroville.

Ethnography

The Konkow people derive their name from a native term meaning "meadowland" and their diversity to other Maidu groups, such as the Nisenan, is marked by changes in dialect and location of villages and territory. As a kind of division of the Maidu people, the Konkow share many similarities as well as differences. Precontact villages have been estimated at approximately 35 persons, with a gathering of seven houses per village and five persons per house. Several villages may have made up a village-community that probably did not exceed a population of 200.

Records and Literature Search

A records check at the Northeast Information Center at the California State University, Chico, California, was conducted in July 2001. According to the records check, a small portion of the study area has been previously surveyed for cultural resources. The most recent survey within the project area was conducted in 1997 and encompassed 42 acres of a proposed subdivision project located east of Hamilton City. Two basalt core isolates were noted as a result of the survey. Three other surveys were conducted in 1974, 1975, and 1984 within a ½-mile radius of the potential project area. An archeological reconnaissance survey of another proposed sub-division, east of Hamilton City and south of the 1997 survey was conducted in 1984. No cultural resources were located in this survey. In 1975, an

archeological survey was conducted at 26 erosion sites along the Sacramento River, east of Dunning Slough. Two previously recorded sites, historic debris and a prehistoric processing site, were noted as a result of this survey. In 1974, an archeological reconnaissance survey south east of Dunning Slough along the Sacramento River recorded three previously recorded sites. There is one recorded prehistoric site within the project area. This site is recorded as mounds of dirt with mortars, beds, and projectile points.

There are no previously recorded historic sites known to be located within the project area or within a 1/2-mile radius of the project boundaries. The U.S. Geological Survey (USGS) 15-inch quad maps (1949 and 1951) indicate a levee, a well, an oil tank, the Southern Pacific Railroad, the historic community of Hamilton City, a pump, the Central Irrigation Canal, Highway 32, St. John Road, other roads, and structures are within the project area, and the Southern Pacific Railroad, a well, a levee, Mills Orchard Road, a school, churches, the Chico-Orland Road, structures, and roads are in the vicinity of the study area.

The National Register of Historic Places and the Office of Historic Preservation (OHP) Directory of Properties in the Historic Property Data File for Glenn County lists the Gianella Bridge as an historic property. The OHP Directory lists three historic properties located within the community of Hamilton City and five historic properties in the vicinity of Hamilton City. The California Inventory of Historic Resources indicates Swift's Point and St. John as historic properties. The Points of Historical Interest indicates St. John, and Indian Dancehouse, Swift's Point, and Shotover Inn as historic properties.

4.3 FUTURE WITHOUT-PROJECT ASSUMPTIONS

This section describes changes expected in the study area over the period of analysis assuming a flood damage reduction/ecosystem restoration project is not built as a result of this study. This description of the assumed without-project condition serves as the baseline against which alternative plans will be evaluated to determine their effectiveness and to identify effects that would result from them.

The planning period for both the economic and environmental analysis is 50 years. Assuming a minimum of 10 years for planning and implementation, projections for socioeconomic and environmental resource conditions are based on year 2060. The future without-project conditions for the study area with regard to topography, geology, soils, and hydrology will remain relatively unchanged for the foreseeable future. These would remain as described earlier in this chapter.

California's climate may change over the next century due to global warming. With a change in California's climate, warmer temperatures and more severe droughts and floods could have a wide range of impacts. By 2100, temperatures in California could increase by about 5°F in the winter and summer (California Environmental Protection Agency, 2000). Appreciable increases in precipitation are projected at 20-30 percent in spring and fall, with somewhat larger increases in winter (California Environmental Protection Agency, 2000). Winter runoff most likely would increase, while spring and summer runoff would decrease. This shift could be problematic, because the existing reservoirs are not large enough to store the increased winter flows for release in the summer. More intense precipitation could increase flooding. Because evaporation is likely to increase with warmer climate, it could result in lower river flow and lower lake levels, particularly in the summer. Groundwater could also be reduced.

California is an ecologically diverse state and climate change could have an impact on many of California's species and ecosystems. Many species are adapted to specific climate conditions, and an increase in temperatures could force changes in species, geographic extent, and health and productivity. The ranges of many species of plants and animals are restricted and fragmented. Without natural corridors to allow migration, isolated species could be limited in their ability to adapt to climate change. Plant and animal species near the borders of their ranges are likely to be most affected. In addition, climate change could create more opportunity for the establishment and spread of weeds and pests. All these factors can add to existing stresses on resources caused by other influences such as population growth, land-use changes, and pollution.

Flood control and ecosystem restoration projects that have received authorization and/or funding are assumed to be in place. Those that would potentially affect the Hamilton City area are listed below.

Sacramento River Floodplain Acquisition and Monitoring. The Nature Conservancy (TNC), the California Wildlife Conservation Board (WCB), California Department of Fish and Game (DFG), and the USFWS have requested funds for the acquisition and management of fee title or permanent conservation easement interests on floodplain lands within the Conservation Area of the Sacramento River between Keswick and Verona. The acquisitions will facilitate the recovery of ecological processes within the floodplain, including the regeneration of native riparian habitat.

Sacramento River Wildlife Refuge. This USFWS refuge project is one of six refuges in the Sacramento Wildlife Refuge Complex and consists of a land acquisition and habitat restoration program along the Sacramento River from Red Bluff to Colusa. To date, USFWS has acquired slightly more than 14,500 acres of the 18,000 acres Congress authorized in 1989. The remaining lands will be purchased from willing sellers as funds are appropriated and the public disclosure (NEPA) process is completed for each incremental expansion. Much of the lands acquired to date have been used for various crops, and remain in agricultural use. The revenue generated from the crops is used to restore habitat on lands scheduled for conversion.

4.3.1 Geomorphology

Under the future without-project condition, levee removal is not planned for the right bank of the Sacramento River near the Hamilton City area.

While rock has constrained river meander to some extent in the study area, there is currently about 36,755 lf on the right bank and 38,477 lf on the left bank of the river with no bank protection. There is a high uncertainty in any bank erosion and/or channel migration estimate. Based on historical migration rates, current estimates that for RM 196-198, 200 feet of migration could be expected for an exceedence interval of 50-years (see Appendix C-3, and Tables 4-14 and 4-15). The rock riprap bank protection does not last indefinitely and will have less and less impact into the future. The rock riprap bank protection usually lasts about 50-years with significant deterioration starting about 20-years from its time of placement. About 20 percent to 25 percent of the riprap cover has already eroded from the bank, mostly to the south end of the study area.

The Federal government would continue to expect the State of California, as non-Federal sponsor for the existing Chico Landing to Red Bluff Project, to continue to operate and maintain that project. Any future maintenance would need to be accomplished in accordance with the jeopardy opinion issued for that project by the U.S. Fish and Wildlife Service that pertains to the valley elderberry long-horned beetle.

TABLE 4-14. MEANDER BEND AT RIVER MILE 196 TO 198.

Period	Years	Migration Distance(ft)	Migration Rate (ft/yr)
1896-1923	27	1,202	44.5
1923-1937	14	43	3.1
1937-1946	9	1,122	124.7
1946-1955	9	584	64.9
1955-1960	5	258	51.6
1960-1969	9	444	49.3
1969-1972	3	623	207.7
1972-1981 ¹	9	797	88.6
1981-1984	3	355	118.3
1984-1986	2	0	0.0
1986-1991	5	0	0.0
1991-1999	8	28	3.5
1999-2002	3	30	10.0
1896-2002	106	5,486	51.8
1946-2002	56	3,119	55.7
1960-1981	21	1,864	88.8
1981-2002	21	413	19.7

¹ Neck cutoff of tightly compressed meander bend between RM 196 and RM 197 occurred during this period

4.3.2 River Hydraulics

River hydraulics are expected to be much as described above for the affected environment. No significant changes in the flood management system that would alter river hydraulics are currently planned by flood control agencies. Potential future watershed activities could result in lower flood stages in places if some levees are removed or higher stages in places if increased vegetation impedes flood flows.

TABLE 4-15. EROSION RATES ASSOCIATED WITH VARIOUS EXCEEDENCE PROBABILITIES FOR RIVER MILE 196 TO 198.

Flow (cfs)	Stream Power (lb/ft s)	Migration (feet)	Exceedance Interval (years)	Percent Chance Exceedance
520,000	14.29	344	1,000.00	0.10
424,511	11.88	286	500.00	0.20
315,965	9.83	237	200.00	0.50
275,910	8.99	217	100.00	1.00
237,829	8.30	200	50.00	2.00
206,575	8.27	199	25.00	4.00
160,634	7.04	170	10.00	10.00
97,524	3.89	94	2.00	50.00
30,000	1.33	32	1.00	99.99

4.3.3 Flood Management

The flood management for the without-project condition would remain much as described above for the affected environment. Flood events will continue to reduce the structural integrity of levees, potentially causing levee failures. Major flood fights would be needed to reduce the risk of levee failures and emergency repairs would continue on an as needed basis. However, the need for flood fights and emergency repairs may increase since maintenance of the flood management system is becoming more difficult.

4.3.4 Water Quality

Water quality is expected to remain much as described above for the affected environment. While increased population will tend to degrade water quality, existing regulations require mitigation to offset the effects of a growing population. Potential future watershed activities are expected to improve water quality over the long term.

4.3.5 Air Quality

The area occasionally exceeds State levels for ozone. The area occasionally exceeds both Federal and State levels for particulate matter (PM₁₀). An Air Quality Attainment Plan (AQMP) for the Northern Sacramento Valley Air Basin has been adopted. The AQMP is designed to achieve a reduction in basin-wide emissions and proposes control measures to be adopted to achieve mandatory reduction. Under the future without-project scenario, total air emissions are expected to increase over existing conditions, even assuming that emissions allowable from individual and mobile sources would be regulated more strictly.

In the Central Valley, with no other changes in weather or emissions, a 7.2°F warming would increase ozone concentrations by 20 percent and almost double the size of the area not meeting national health standards for air quality. Currently, the national standards for ozone are not attained throughout much of the state. Ground-level ozone has been shown to aggravate existing respiratory illnesses such as asthma, reduce lung function, and induce respiratory inflammation. In addition, ambient ozone reduces agricultural crop yields and impairs ecosystem health.

4.3.6 Biological Conditions

Vegetation and Wildlife

Ongoing restoration efforts along the river are expected to improve the biological conditions. The existing private levee would be subject to continued erosion and potential failure from flood events. Vegetation that has become established on the levee would be subject to erosion. DFG property has been planted and USFWS properties can be expected to be restored as agricultural resources become non-economical; however, the majority of the study area which is currently in agriculture is expected to remain in agriculture.

Fisheries and Aquatic Resources

The without-project perspective is compounded by activities of CALFED, Central Valley Project Improvement Act (CVPIA), and others within the same geographical study area. To date, and potentially within the planning time frame, actions taken within the study area have been targeted at stabilizing downward wildlife population trends. Ongoing ecosystem restoration efforts will improve the quantity and value of fishery and aquatic resources. However, much of this improvement will be based on separate opportunities that are not integrated in a single plan. While many have visions for an integrated ecosystem plan, they lack authority to significantly alter the river system due to its flood management function, therefore, ongoing restoration will likely only provide localized benefits throughout the river corridor. Restoration work for fisheries can be expected to occur throughout the system predominantly where fisheries spawning and rearing habitat occurs.

Special Status Species

The projected conversion of some lands in the Sacramento Valley from production of rice or small grain crops to cotton could reduce habitat for the giant garter snake, and this transformation could also affect waterfowl abundance, indirectly affecting potential prey for Swainson's hawks and bald eagles. Future urban development effects on special-status species could be reduced by compliance with requirements in the Federal and State Endangered Species Act and local ordinances designed to conserve special status species. Overall the trend in increasing numbers of species becoming listed as state or Federal threatened and endangered can be expected to continue.

4.3.7 Socioeconomic Conditions

The projected population growth appears to drive other key trends in water use and land use. Population cannot be reliably estimated to year 2060. Based on California

Department of Finance estimates, the population of the Central Valley will increase from approximately 4 million people in 1995 to about 6.8 million people by 2020. An increase in the population of the Hamilton City area can be expected as population increases in nearby Chico.

4.3.8 Land Use

The population growth will result in conversion of agricultural and other rural land to urban uses. This will increase flood risk and further reduce land available for maintaining and restoring ecosystem values.

Agriculture/Prime and Unique Farmlands

Agriculture is the major industry within the study area, particularly orchards that are considered a long-term investment. Historically, orchards have been planted and grown in the surrounding area and it is expected that the current land use will continue. Land under Williamson Act or Farmland Security Zone Act contracts would remain in agricultural for the remainder of the contract, usually a 10-year or 20-year commitment respectively.

In the future, agricultural lands may decline due to seepage, erosion, flooding and scouring that are associated with the close proximity of the lands to the Sacramento River. Due to these factors, potential investments to keep such lands productive may diminish.

Urban Land Use

It is expected that the current urban growth boundaries for Hamilton City will be utilized with housing developments, business parks, schools, and parks. However, with the exception of the Pallisades subdivision and an associated school, no other housing developments are currently planned within Hamilton City urban use limits. An increase in the population of the Hamilton City area can be expected as population increases in nearby Chico. As the population of Hamilton City grows, there would be an associated increase in pressure for more urban development.

4.3.9 Transportation

The population growth will increase the need for new transportation facilities that will be at risk of flooding. Traffic levels on roadways within Glenn County are projected to be consistent with expected population growth, which countywide is forecast to be 3 percent per year.

4.3.10 Recreation

Recreation facilities within the study area are expected to remain the same; however, recreation use is expected to increase consistent with the increasing population. There will continue to be a demand for recreation facilities (including camping, hiking, sport fishing) as the population increases throughout the affected area.

4.3.11 Noise

Noise levels are expected to increase consistent with an increase in population and urban growth. County noise ordinances will mitigate for the increase in noise levels associated with this growth.

4.3.12 Hazardous, Toxic, and Radioactive Waste

Hazardous, toxic, and radioactive waste at risk of flooding that is currently in the study area is expected to remain, as there is currently no state plan to remove the materials.

4.3.13 Cultural Environment

Conditions of cultural resources sites within the proposed project area would remain the same. Levee failure and resultant flooding could damage archeological sites in the project area.