Draft
Programmatic Environmental Assessment

Anadromous Fish Restoration Actions in the Butte Creek Watershed

Prepared For
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LIST OF ACRONYMS

AFRP	Anadromous Fish Restoration Program
BCWC	Butte Creek Watershed Conservancy
BLM	Bureau of Land Management
CALFED	California Bay-Delta Program
CAMP	Comprehensive Assessment and Monitoring Program
CDFG	California Department of Fish and Game
CDWR	California Department of Water Resources
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
CVPIA	Central Valley Project Improvement Act
DOI	U.S. Department of the Interior
EA	Environmental Assessment
EIS	Environmental Impact Statement
EQIP	Environmental Quality Incentives Program (NRCS)
ERPP	CALFED Environmental Restoration Program Plan
ESA	Federal Endangered Species Act of 1973, as amended
FONSI	Finding of No Significant Impact
FWCA	Fish and Wildlife Coordination Act
LBCP	Lower Butte Creek Project
LRMP	Lassen Land and Resource Management Plan (USFS)
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NRCS	Natural Resources Conservation Service
PEA	Programmatic Environmental Assessment
RMP	Redding Resource Management Plan (BLM)
RWQCB	Regional Water Quality Control Board
SHPO	California State Historic Preservation Officer
SWRCB	State Water Resources Control Board
TNC	The Nature Conservancy
USBR	U.S. Bureau of Reclamation
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
VELB	Valley Elderberry Longhorn Beetle
WHIP	Wildlife Habitat Incentives Program (NRCS)

INTRODUCTION

This programmatic environmental assessment (PEA) was prepared by the U.S. Fish and Wildlife Service (Service) to assist the agencies in planning and decision making for restoration of anadromous fisheries and associated habitats within the Butte Creek watershed, and to exchange information with stakeholders and the general public during the planning process. Because the actions evaluated in this document could be fully or partially funded by Federal agencies or require Federal permits and approvals, environmental documentation under the National Environmental Policy Act (NEPA) was required. As a programmatic-level document, the PEA serves as an "umbrella" for addressing a series of actions that are part of the overall goal. The PEA is broad and general in scope and covers the direct, indirect, and cumulative effects that can be identified without undue speculation. It is especially important in evaluating the "system-wide" impacts of multiple actions.

The geographic scope of the PEA includes Butte Creek from the headwaters downstream to the historical confluence with the Sacramento River at the Butte Slough Outfall Gates, and from the mouth of Butte Slough on lower Butte Creek, through the Sutter Bypass, to the confluence with the Feather River (Fig. 1). Within these reaches, environmental assessment applies to the Butte Creek, Butte Sink, Butte Slough, and Sutter Bypass borrow canals, and all adjacent riparian habitat that is relevant to habitat restoration efforts benefitting anadromous fisheries within the channels. The riparian zone borders the stream and is the transition area to the adjacent uplands. This zone interacts with the channel and strongly influences the health of the aquatic ecosystem by providing temperature-reducing shade, nutrient cycling, input of invertebrates used for food, bank cohesion, gravel recruitment, woody debris used for instream cover, and a buffer zone to impacts from adjacent uplands. The near shore zone, termed shaded riverine aquatic habitat is especially important to young fish and a wide range of other aquatic and terrestrial wildlife. A healthy riparian zone also assists in flood control as it provides space for flood waters and can reduce flood velocities.

The PEA covers effects of potential actions identified under several planning programs involving Federal, State, and public entities that address protection, enhancement, and restoration of aquatic and riparian ecosystems within the Central Valley, Sacramento Valley, and Butte Creek watersheds. These programs have produced the Upper Sacramento River Fisheries and Riparian Habitat Management Plan (California Resources Agency 1989), Restoring Central Valley Streams: A Plan For Action (CDFG 1993a), the Revised Draft Restoration Plan for the Anadromous Fish Restoration Program (AFRP) (USFWS 1997a), and the CALFED Bay-Delta Ecosystem Restoration Program Plan (CALFED 1999a,b), among others. Additional programs for the Butte Creek watershed are under development by stakeholder organizations including the Butte Creek Watershed Conservancy (BCWC), Butte Creek Watershed Project (BCWP), Lower Butte Creek Project (LBCP), the Nature Conservancy (TNC), Ducks Unlimited, California Waterfowl Association, and other affiliated stakeholder groups. The principles and goals of these programs overlap, and provide the basis for the Proposed Actions.

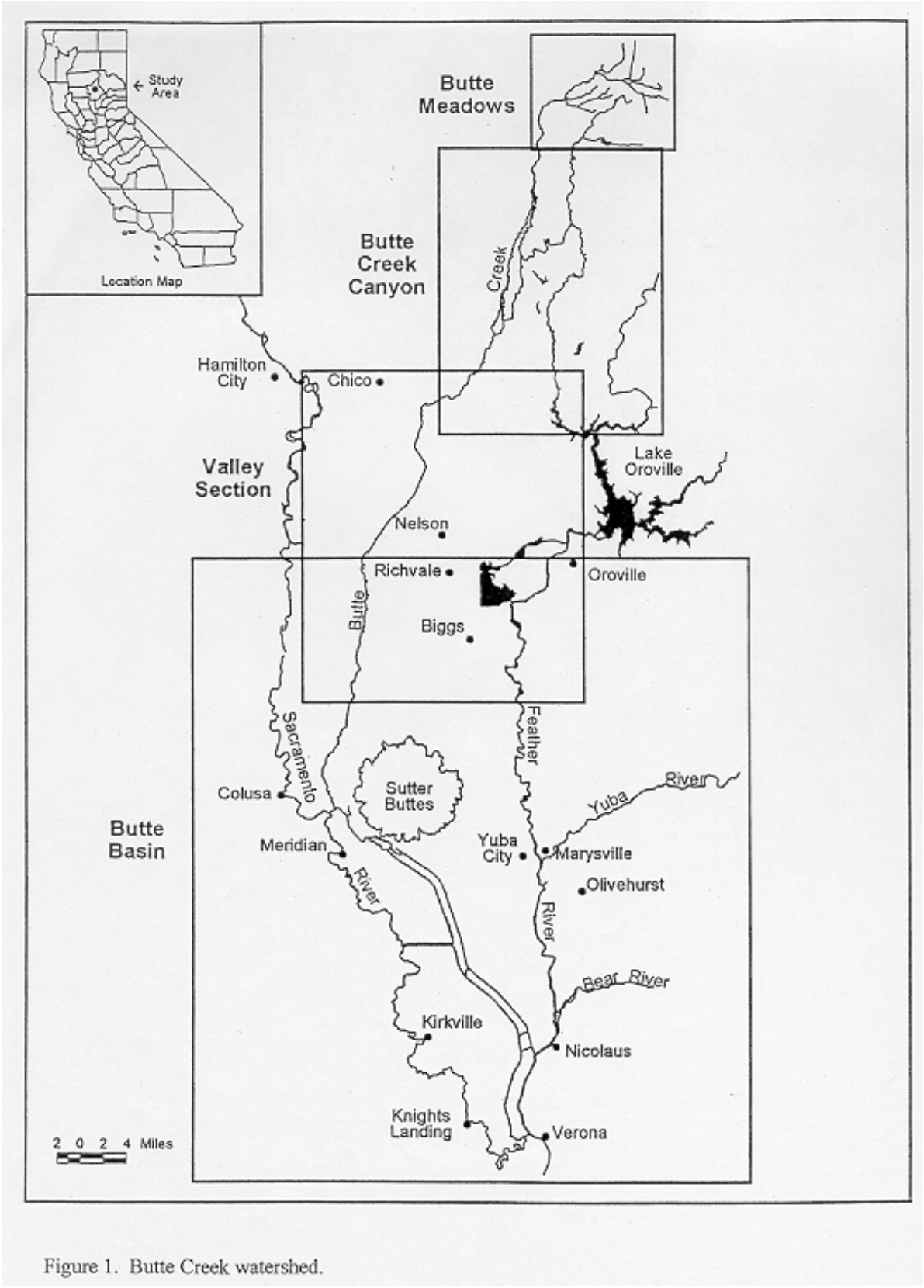


Figure 1. Butte Creek watershed.

The Proposed Actions are supported by the AFRP, which may provide entire or partial financing for habitat restoration actions. Successful implementation of fisheries restoration on Butte Creek depends heavily on local involvement and partnerships with property owners, watershed workgroups, public and private organizations, county and local governments, and State and Federal agencies. For efficiency, the AFRP will coordinate with other restoration programs and supplemental sources of funding.

The Proposed Actions include only "restorative" actions (modification or establishment of habitat or facilities). Potential actions that are "administrative" (planning, education, negotiations, legal proceedings, law enforcement) are included only in the PEA's Related Activities and Cumulative Effects sections. Actions involving water purchase, water rights acquisition, water management, adjudication of water rights, and water master service are not included in the PEA. Some of these actions are to be addressed by other restoration programs (e.g., water purchase and water rights acquisition), or would require exceptional procedures that are not practical for evaluation in this programmatic assessment (water master service and adjudication of water rights).

PURPOSE AND NEED

The purpose for taking action in the Butte Creek watershed is to protect, enhance, and restore to the maximum extent possible the watershed's anadromous fisheries and their habitats, while maintaining an equitable balance among other land and water uses such as agriculture, managed wetlands, municipal and industrial needs, power generation, flood control, and recreation. This would be conducted on a willing provider basis as opportunities permit through cooperation among Federal and State agencies, watershed planning groups, private landowners, and other stakeholders. These efforts within the Butte Creek watershed would contribute toward the implementation goals of several existing Central Valley fish and wildlife restoration plans to create a healthier, more naturally functioning ecosystem; enhance and restore aquatic and riparian habitats; protect threatened and endangered species; and augment cumulative efforts to at least double populations of anadromous fish in Central Valley streams.

Preserving the remaining spawning and rearing habitat is necessary for the continued survival of Central Valley anadromous salmonids. Major modifications of the Central Valley aquatic ecosystem began during the first major settlement of California that followed the 1849 gold rush. Since then, an estimated 95% of historical chinook salmon (*Oncorhynchus tshawytscha*) and steelhead trout (*Oncorhynchus mykiss*) habitat in Central Valley streams and tributaries has been lost due to habitat degradation and blockage by dams (Reynolds et al. 1993; USBR 1997a). Riparian habitat, which provides a variety of critical functions in stream ecosystems for fisheries and terrestrial wildlife, has been reduced to only 5% of its historical extent along the Sacramento River (California Resources Agency 1989), and 5-15% on tributary streams (Mills and Fisher 1993). In addition to direct degradation of instream habitats, riparian habitats adjacent to stream channels in the Butte Creek watershed have been degraded to the detriment of the aquatic ecosystem and its anadromous fisheries. Degradation of the riparian zone within the Butte Creek watershed has resulted from construction of levees, bank revetment, agricultural encroachment,

grazing of livestock, land development, and other factors. Virtually all species and races of Central Valley anadromous fish have declined to record low levels in recent years and some have been extirpated from areas in which they evolved (Reynolds et al. 1993).

A general decline has been observed in Central Valley spring-run salmon populations since the 1940s (BCWP 1999). Populations of spawning spring-run salmon in Butte Creek have been shown to fluctuate significantly since estimates began in the 1950s (CDFG 1998). Before 1998, estimated numbers ranged from a low of 10 fish in 1979 to a high of more than 8,700 in 1960 (CDFG 1998). In 1998, a record run of more than 20,000 spring-run spawners was recorded. Fish surveys indicate that typically, few adult spring-run salmon reach upper Butte Creek where conditions are most favorable for holding and spawning. Adult fall-run salmon on Butte Creek vary between a few fish to 1,000 (California Resources Agency 1989), and have been at record lows for most Sacramento River tributaries in recent years (USFWS 1995b). Population data for steelhead trout on Butte Creek are incomplete, but populations are believed to have declined on most Sacramento River tributaries since the 1950's and 1960's (USFWS 1995b), including Butte Creek (CDFG 1993a).

ALTERNATIVES

NO-ACTION ALTERNATIVE

The No-Action Alternative is used as a basis for comparison of the Proposed Actions. The No-Action Alternative includes the actions, practices, and land uses that would be assumed to occur in the Butte Creek watershed without Federal funding authorized by the Central Valley Project Improvement Act (CVPIA). Under the No-Action Alternative, actions taken to enhance and preserve these habitats would be fewer, and would more likely be necessitated by environmental protection laws, such as the Endangered Species Act of 1973, as amended (ESA), California Endangered Species Act (CESA), and water quality regulations. Implementing measures to enhance and protect the watershed would depend on alternative funding sources, such as from individual land owners, nonprofit organizations, State and local governments, and other Federal sources.

PROPOSED ACTIONS

The set of Proposed Actions is a departure from traditional alternatives. Rather than develop multiple alternatives composed of different combinations of actions with different capabilities to fulfill the stated Purpose and Need, a composite of Proposed Actions was developed to maximize flexibility and opportunities to restore anadromous fisheries and their habitats. The set of Proposed Actions could be either comprehensively implemented, or partially implemented on an incremental basis as needs and opportunities are identified. Proposed Actions would need to be implemented over a 10-year period – the life of the PEA. After 10 years, the environmental baseline would require reassessment to consider implemented actions and other influences before continuing implementation of additional actions.

The incremental approach incorporates concepts of adaptive management, whereby, actions most likely to achieve objectives are implemented first and monitored. Modifications or supplemental actions are subsequently implemented depending on monitoring results. The incremental approach also has advantages of flexibility in handling unforseen circumstances, and when working through partnerships, which may or may not be fully developed prior to environmental analysis. Because all Proposed Actions depend on willing landowners, commitments to specific actions and sites will depend on where opportunities exist. By covering the broad range of potential actions in the environmental analyses, individual actions can be selected and proposed for implementation, as opportunities permit, to best meet restoration needs in the Butte Creek watershed.

DEVELOPMENT OF THE PROPOSED ACTIONS

Several past and present planning programs have contributed to the development of the Proposed Actions. The Proposed Actions are consistent with recommendations for Butte Creek in the Revised Draft Restoration Plan for the AFRP (AFRP Plan) (USFWS 1997a). This plan was synthesized by the AFRP from pre-existing restoration strategies and newly acquired information from several sources, including the Service's Working Paper on Restoration Needs (Working Paper) (USFWS 1995a,b,c), public and private organizations, and individual contributors. The Working Paper was developed under direction of a scientific Core Group represented by the Service, California Department of Fish and Game (CDFG), U.S. Bureau of Reclamation (USBR), National Marine Fisheries Service (NMFS), U.S. Environmental Protection Agency (USEPA), and California Department of Water Resources (CDWR). The Working Paper incorporated the best available science and sources to identify factors potentially limiting natural production of anadromous fish, and a comprehensive list of potential restoration actions.

The AFRP Plan was released for public review in December, 1995, and presented potential restoration actions deemed reasonable with respect to their technical and legal basis, authority for implementation, and public support. Following further public outreach, the AFRP Plan was revised in 1997 (USFWS 1997a). The plan intended to comprise a list of actions, that if entirely implemented, would be expected to meet the AFRP goal of at least doubling the natural production of anadromous fish in the Central Valley rivers and streams by the year 2002. The AFRP states six general objectives that need to be met to achieve the program goal:

- Improve habitat for all life stages of anadromous fish through provision of flows of suitable quality, quantity, and timing, and improved physical habitat;
- Improve survival rates by reducing or eliminating entrainment of juveniles at diversions;
- Improve the opportunity for adult fish to reach their spawning habitats in a timely manner;
- Collect fish population, health, and habitat data to facilitate evaluation of restoration actions;
- Integrate habitat restoration efforts with fish harvest management; and
- Involve partners (e.g., landowners and other government agencies) in the implementation and evaluation of restoration actions.

The AFRP Plan took an ecosystem-level approach that considered the physical environment, biological environment, and human environment. An advantage of ecosystem-level problem-solving is that other aspects of the environment in addition to anadromous fish benefit from restoration actions. The Butte Creek watershed was evaluated as a whole, recognizing the

interdependencies of stream hydrology; sedimentation; riparian vegetation; aquatic and terrestrial wildlife, including rare and sensitive species; and human-induced influences. It was understood that only through comprehensive consideration could maximum benefits to anadromous fish be realized.

The Proposed Actions were coordinated with the BCWC and the LBCP. The BCWC, a stakeholder-driven effort focusing primarily upstream of Sanborn Slough (Fig. 2), identify ten fundamental issues and concerns for the Butte Creek watershed (BCWP 1999). These issues and concerns are stated as follows:

1. Increased population over the last ten years in the canyon and surrounding areas has increased recreational pressures in the watershed without increased infrastructure to accommodate use (Note: infrastructure has not kept up with the increase in population; i.e., the number of wardens).

2. The decline of the fisheries has resulted in a Threatened Species Candidate listing for the Spring Run Chinook salmon [now federally-listed as threatened and state-listed as endangered], leading to restrictions on sportfishing, the elimination of salmon and trout fishing, and could lead to further watershed-wide restrictions for multiple uses such as agriculture, timber management, recreation, urban development, and property rights.

3. The fuel load in the watershed is at an unacceptable level due to natural response to human-made interventions.

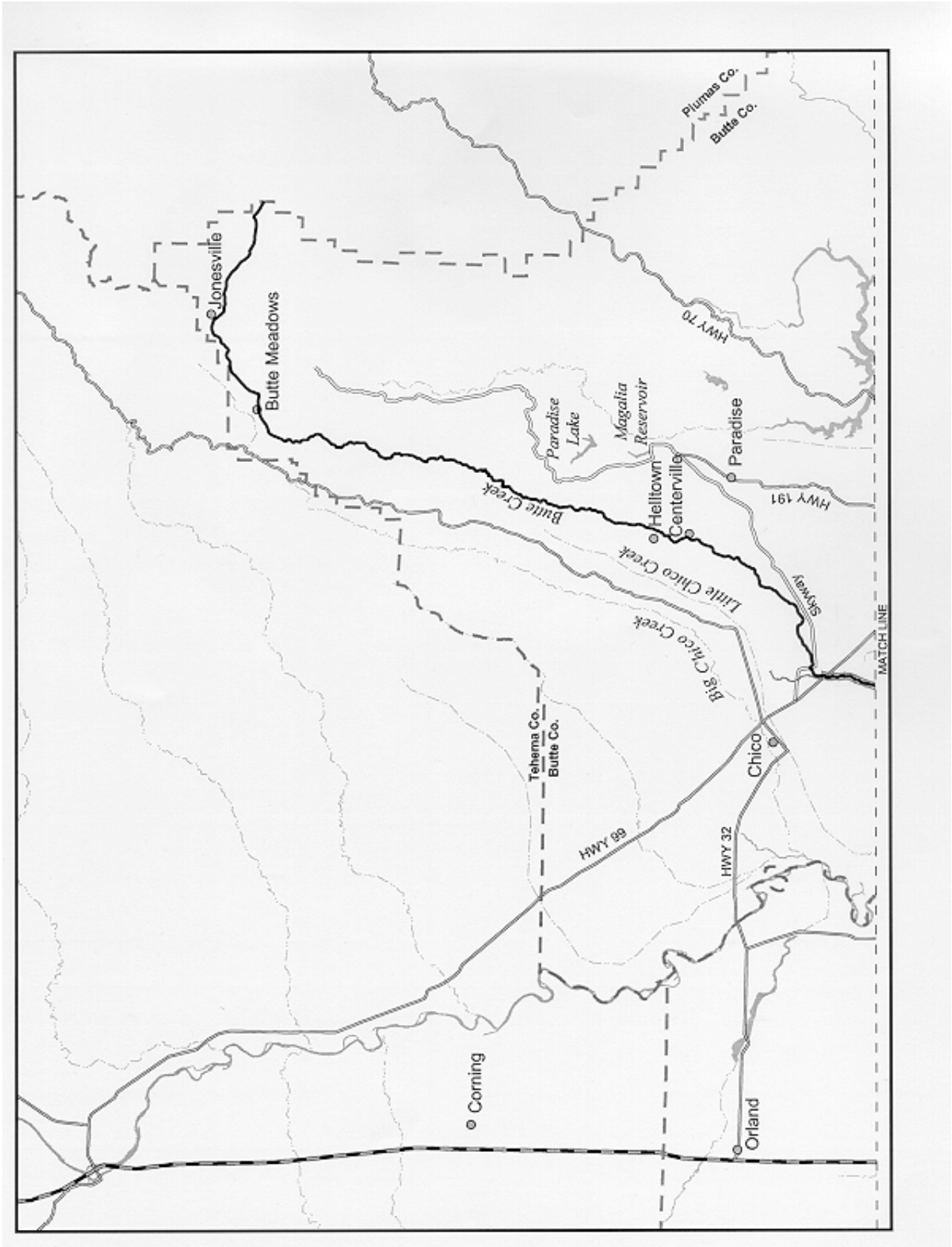
4. Inadequate timber management regulations and practices have potential impact on water quality.

5. Improper road design, construction and maintenance intercepts and redirects runoff, causing erosion and road washouts and may damage the watershed.

6. Groundwater recharge areas are not identified. These areas need to be considered and may need increased protection.

7. The quantity and quality of domestic water supplies need to be understood and protected.

8. Urban run-off due to increased urbanization contributes to water quality degradation.


Plumas Co.
Butte Co.
Jonesville
Butte Meadows
HWY 70
Paradise Lake
Magalia Reservoir
Paradise
Butte Creek
Hellitown
Centerville
HWY 191
Little Chico Creek
Skyway
Big Chico Creek
MATCH LINE
Tehema Co.
Butte Co.
Chico
HWY 99
HWY 32
Corning
Orland

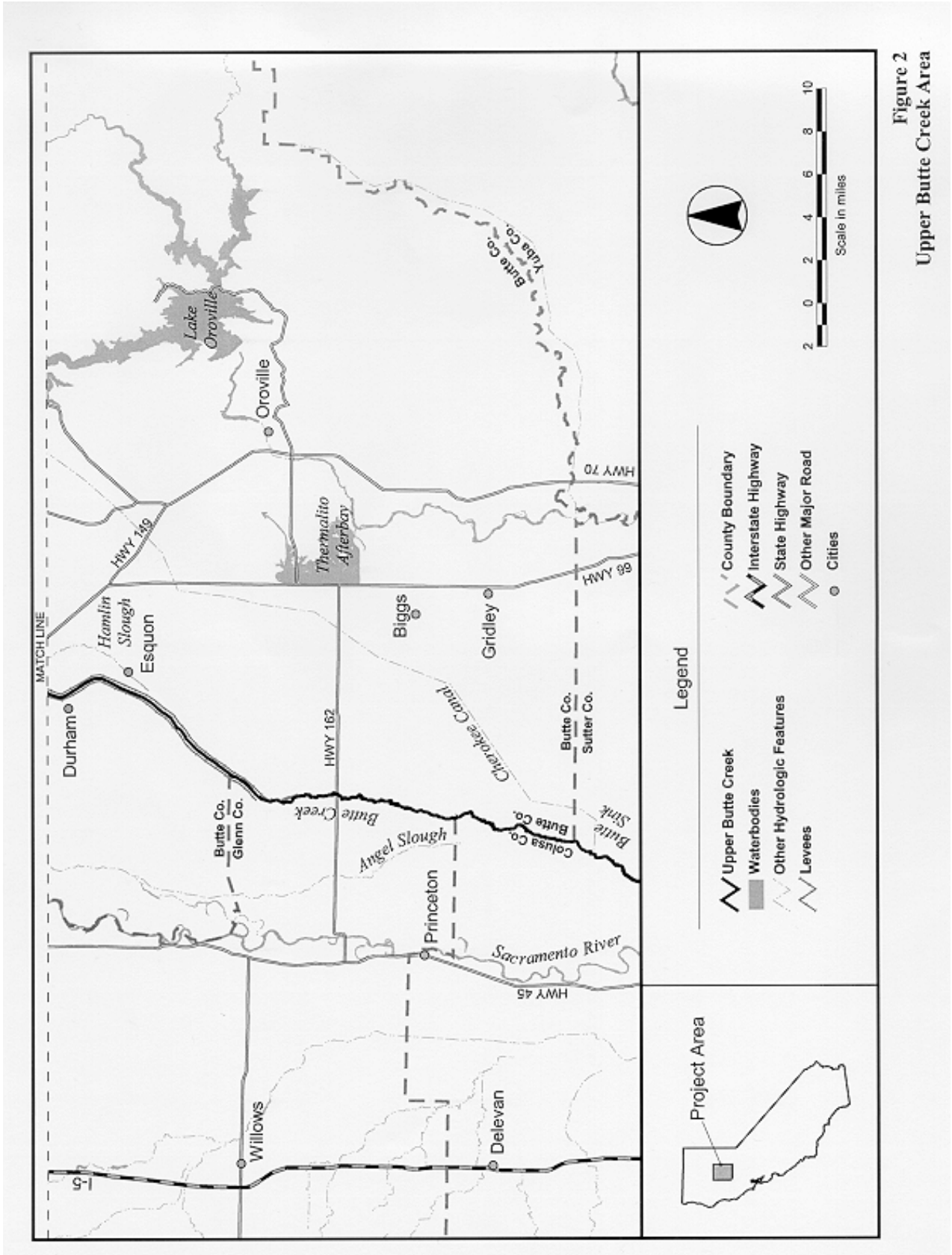


Figure 2
Upper Butte Creek Area

9. Flooding in the Butte Creek watershed is natural and unavoidable. Therefore any infrastructure, including housing and other structures on the floodplain, must be compatible with flooding in an environmentally conscious and sustainable manner.

10. There is a need for public education addressing appropriate management practices for the above 9 items.

The LBCP is another stakeholder-driven effort developing alternatives to improve fish passage along a reach of Butte Creek and related waterways extending approximately from Sanborn Slough downstream through the Sutter Bypass to Verona (Fig. 3). This area is made up of three geographic regions: Butte Sink; Butte Slough; and Sutter Bypass. The stated objectives of the LBCP are "to maintain the viability of commercial agriculture, managed private habitats, managed government lands, and other habitats while developing a set of mutually beneficial technical and operational alternatives for water users and fisheries."

Several site-specific actions have been proposed by the LBCP in the final project alternatives for the LBCP (JSA 1998), and fall under the generalized Proposed Actions described below. The actions were developed by the LBCP Steering Committee and stakeholder groups as a master list of actions that could be feasibly implemented to improve fish passage at each specific structure identified. The actions are grouped into 6 alternative configurations (Appendix A) with a system-wide perspective, as potential actions at each site are interdependent throughout the lower Butte Creek system. The alternatives focus on different fish passage routes and water delivery methods for the Butte Sink subarea (Alternatives 1-2) and Butte Slough/Sutter Bypass subarea (Alternatives 3-6) (Appendix A). All components of LBCP alternatives (Appendix A) are addressed by the generalized Proposed Actions, except for water system operations, which would need to be addressed in supplemental environmental compliance documents.

Proposed Actions could be implemented singly or in combination to accomplish a restoration goal (e.g., land conservation and agricultural management), because the entire watershed ecosystem must be considered when identifying restoration needs. The connectivity and interdependence of watershed systems necessitate this approach and, ideally, would result in watershed improvements that are sustainable through natural processes. Proposed Actions are applicable to Butte Creek, from the headwaters downstream to the historical confluence with the Sacramento River at the Butte Slough Outfall Gates, and from the mouth of Butte Slough on lower Butte Creek, through the Sutter Bypass, to the confluence with the Feather River (Fig. 2 and 3).

Most actions would require access to reach project sites. Construction of temporary roads could be required to transport equipment, materials, and workers. If a project would require regular maintenance, permanent roads may be necessary. Many actions would require use of heavy equipment that may include back-hoes, excavators, front-end loaders, bulldozers, large trucks loaded with construction materials, and other machinery. This equipment would be transported to the sites, and operated within a bounded area at the sites. Multiple load hauling may be necessary to deliver or remove materials from the sites. Although all potential actions are intended to be

environmentally beneficial, minor adverse effects during their implementation are possible. Therefore, mitigative measures are incorporated into all proposed actions to reduce adverse effects, thereby maximizing net benefits. Funding for operation and maintenance of constructed facilities generally would be the responsibility of facility owners.

Specific locations and acreage for many actions are not proposed, in order to provide the landowners and natural resource organizations flexibility in conserving and protecting riparian habitat. The acreage actually set aside for conservation would depend upon the willingness of landowners. Priority areas for conservation would be within 300 ft of streambanks where protection or enhancement of riparian habitat and the aquatic ecosystem is most needed. Lands with the greatest amount of stream corridor are also considered priorities. Lands outside of the 300-ft zone may be included for conservation as a contiguous part of the priority area, or when considered essential for enhancement and preservation measures.

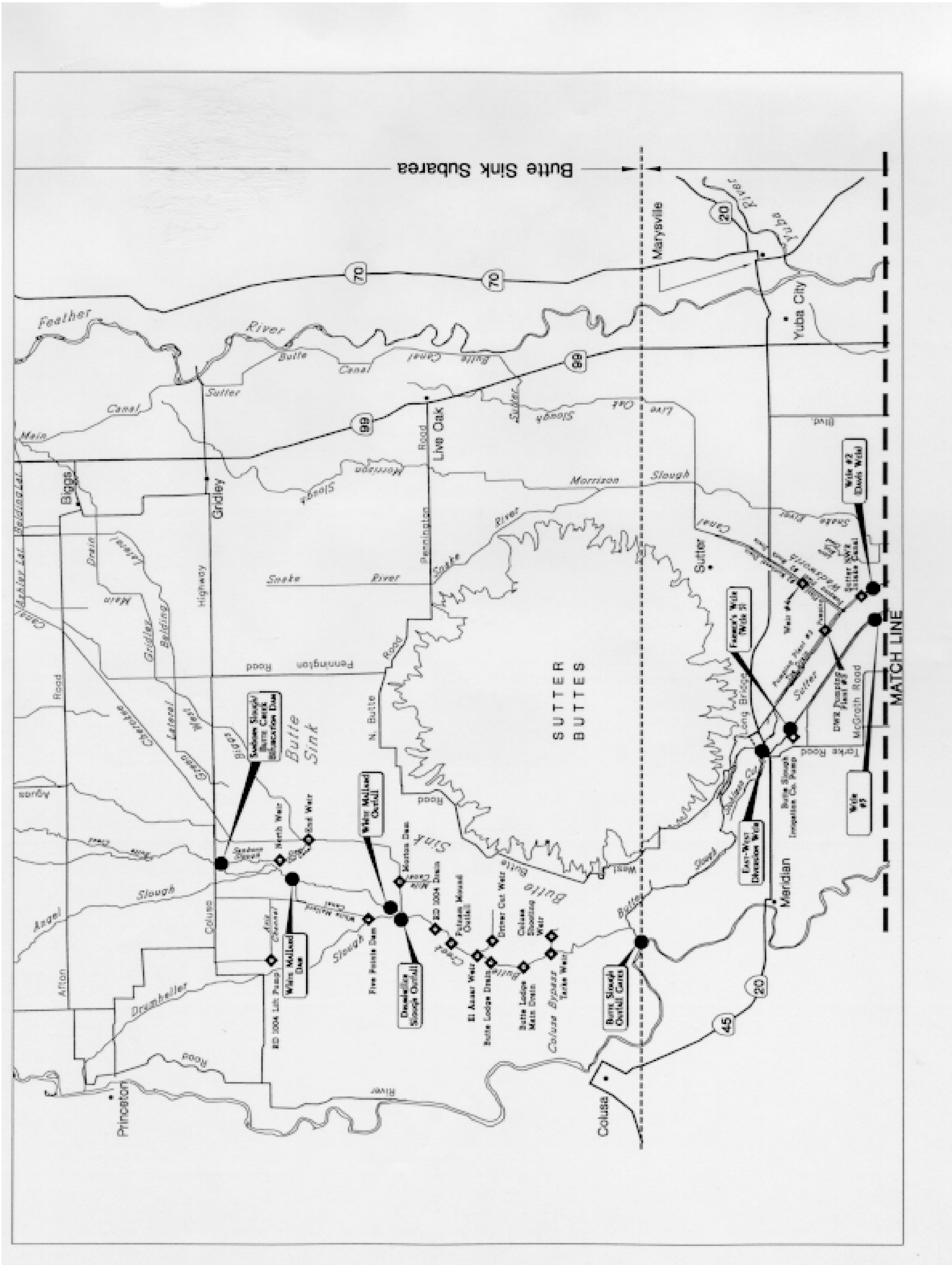
The 300-ft width is based on riparian corridor studies that concluded 300 feet on either side of a stream is the approximate minimum width to maintain vegetative structure for wetland-dependent wildlife (Castelle et al. 1992). This corridor, 300 feet on either side of the streams, serves the purpose of obtaining a representative sample of land types along Butte Creek, Butte Slough, and Sutter Bypass borrow canals that could be eligible for Proposed Actions (Table 1). It is not implied that the land area for any particular action must be 300 feet wide. Actual land dimensions involved in implementing actions would be determined and negotiated with landowners on a site-by-site basis.

ACTION DESCRIPTIONS

The Proposed Actions fall into categories of 1) land conservation, 2) fish passage, 3) fish screens, 4) spawning gravel replenishment, 5) riparian revegetation, 6) channel and instream habitat modification, 7) meander belt and floodplain management, 8) streambank modification, 9) agricultural management, 10) road management, and 11) monitoring.

Land Conservation

Conservation easements, fee title purchases, and other arrangements with willing providers are common and effective means to ensure land management practices are compatible with fish and wildlife habitat. A conservation easement is a nonpossessory interest in real property conveyed by a landowner to a nonprofit organization (land trust) or government agency for a specified period, often in perpetuity. It is a legal agreement for environmental conservation purposes that places limitations on the use of property, while allowing the landowner specific retained rights and uses that are compatible with conservation. Because vegetation types, management regimes,


Butte Sink Subarea
MATCH LINE
SUTTER BUTTES
Marysville
Yuba City
Live Oak
Gridley
Biggs
Sutter
Meridian
Colusa
Princeton
Feather River
Butte Sink
Morrison Slough
Snake River
Sutter Bypass
Colusa Bypass
Angel Slough
Drumheller
McGrath Road
Tarke Road
Long Bridge
N. Butte
Pennington Road
70
99
20
45

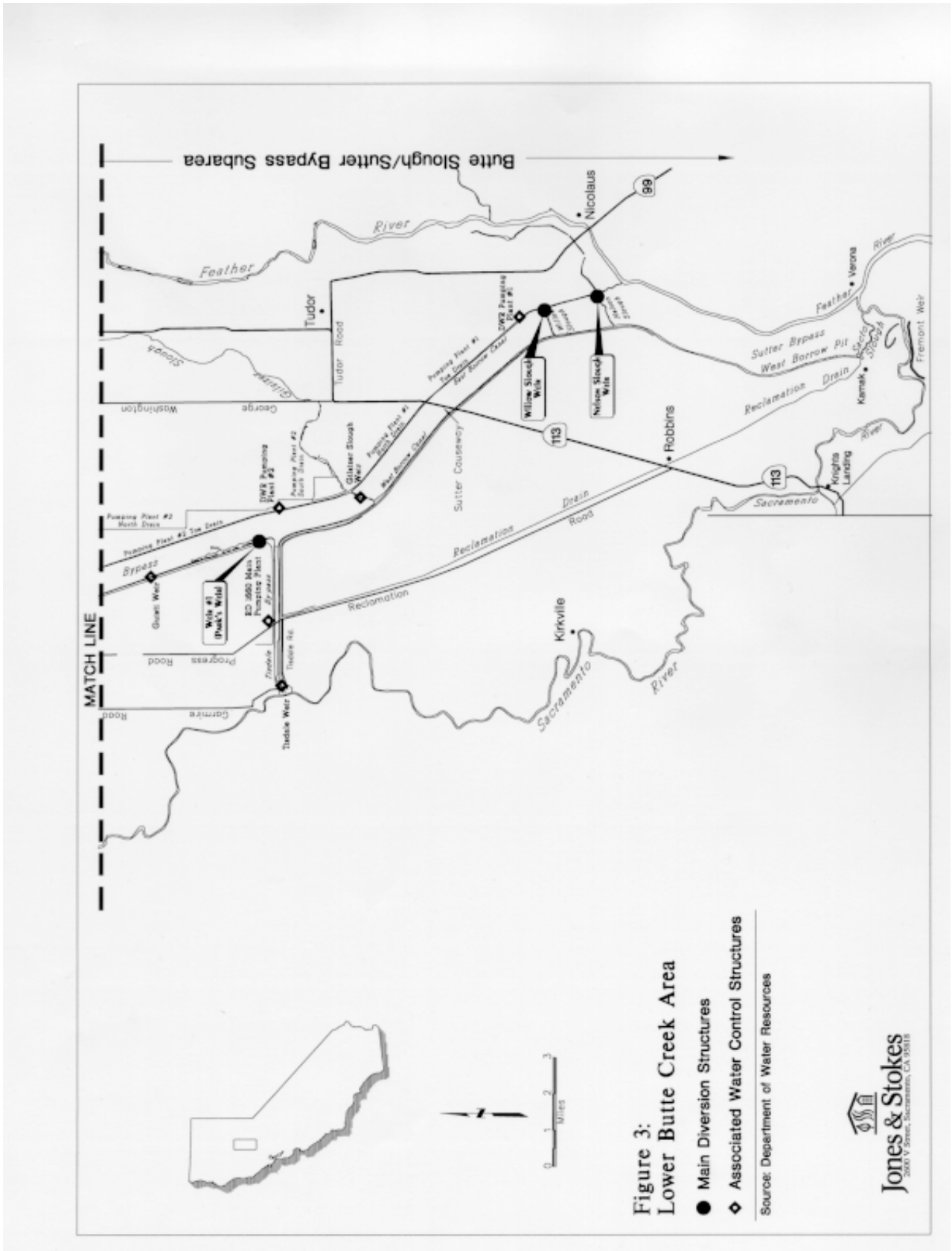

Butte Slough/Sutter Bypass Subarea
MATCH LINE
Feather River
Nicolaus
99
Tudor
Tudor Road
Sutter Bypass
West Borrow Pit
Reclamation Drain
Verona
Sacramento River
Fremont Weir
Willow Slough Weir
Nelson Slough Weir
DWR Pumping Plant #1
DWR Pumping Plant #2
Pumping Plant #1 Fish Screen
Pumping Plant #1 Main Drain
Pumping Plant #2 Fish Screen
Pumping Plant #2 Main Drain
Pumping Plant #2 Trash Drain
Gilsizer Slough
West Borrow Drain
Sutter Causeway
Robbins
113
Knights Landing
Sacramento
Reclamation Drain
Reclamation Road
Bypass
Gunn Weir
Wilk #1 (Puck's Weld)
ID 3000 Main Pumping Plant
Bypass
Tudor Rd
Progress Road
Tudor Weir
Garnier Road
Kirkville
Sacramento River
Kamek
Sacramento Slough
Miles
Figure 3:
Lower Butte Creek Area
Main Diversion Structures
Associated Water Control Structures
Source: Department of Water Resources
Jones & Stokes
2600 V Street, Sacramento, CA 95818

Table 1. Total estimated acres of land use types[1] within a 600-ft-wide corridor (300 feet from each bank) along Butte Creek in associated Counties[2] from the Lassen National Forest border downstream to the Sacramento river, and from Butte Slough through the Sutter bypass to Nelson Slough.

Land Use Type[3]	Butte County	Glenn County	Colusa County	Sutter County
Seasonally and Permanently Flooded Agriculture	380	252	191	507
Nonflooded Agriculture	494	124	19	161
Orchard/Vineyard	152	n/a	n/a	73
Grassland	144	37	11	207
Palustrine	77	41	206	329
Riparian Woody	177	74	133	442
Nonriparian Woody	167	n/a	n/a	245
Blue Oak/Foothill Pine	150	n/a	n/a	n/a
Mixed Chaparral	163	n/a	n/a	n/a
Ponderosa Pine	722	n/a	n/a	n/a
Sierra Mixed Conifer	748	n/a	n/a	n/a
Barren	47	n/a	14	148
Other	47	n/a	n/a	n/a

[1]Source: CDFG et al. 1997; California Gap Analysis 1998. Acreage for land use types was calculated from satellite imagery and should be considered approximate. Because classification of land use types from satellite imagery is approximate, some minor land use types may be missing, and acreage for others may be somewhat over or under represented.

[2]Where Butte Creek follows County lines, only one-half the corridor width (300 ft) is used to calculate acreage for the respective Counties.

[3]Seasonally and Permanently Flooded Agriculture is primarily Rice; Nonflooded Agriculture is primarily row crops and other nonflooded types; Orchard/Vineyard is primarily almonds, walnuts, and other types; Grassland is managed and natural grasslands; Riparian Woody is primarily riparian forest and scrub; Palustrine is primarily seasonally- and permanently flooded emergent wetland; Blue Oak Woodland and Blue Oak/Foothill Pine is primarily used for grazing and open space; Nonriparian Woody is primarily shrubs and trees not included in the Riparian Woody class, including significantly wooded residential areas; Barren is primarily exposed soil, including plowed fields at the time of satellite imagery; Other is primarily human developed areas and paved surfaces.

and conservation needs are particular to each parcel, conservation easements are customized for site specific needs and may affect all or part of a property.

Payments to landowners for easements would be determined from real estate appraisals of fair market value, and land use rights acquired, as provided by the Uniform Appraisal Standards for Federal Land Acquisition, 1973. Rights retained or forfeited largely depend on the site specific conservation needs and the land use needs of the landowner. Only those rights necessary for protection or restoration of habitat would be obtained by the easement. Generally, the more rights that are obtained in an easement, the greater the payment to the landowner. Examples of land uses for which restrictions could be negotiated are: 1) streambeds alteration; 2) public access (to prevent poaching); 3) use of specified pesticides and chemicals; 4) livestock grazing (e.g., offstream watering required); 5) crop type selection, vegetation management, and water application; 6) timber harvest, mining, and dredging; and 7) development rights. Conservation easements would target the approximately 600-ft riparian corridor, but may extend to adjacent upland areas as potential benefits warrant.

Title to the land remains in the landowner's name, and the landowner may continue to live on the land, sell it on the open market, and pass it on to heirs. If the land title changes hands, the new owner would be bound by terms of the easement. The land remains under landowner management, while the easement holder is responsible for habitat enhancement, monitoring, and enforcement of terms. Public access is not a requirement of an easement. Public use rights not acquired by the easement would be controlled by the landowner. Property taxes and assessments continue to be paid by the landowner. Easements generally would not affect active Williamson Act contracts if the land remains in agricultural production or other use consistent with the act (e.g., provide open space or essential habitat for wildlife). Long-term management and monitoring of habitat by land trust organizations could be funded with interest accrued in an endowment. If an easement holder cannot continue or chooses to discontinue holding an easement, holding rights would transfer to another non-profit organization or default to the Service. If defaulted to the Service, the Service would assume operations and maintenance or transfer them to a qualified nonprofit agency.

The conditions of an easement may include an interest in the water rights appurtenant to the lands under easement, or easement waters. The associated water rights could include riparian water rights, appropriative water rights, water rights secured under contract between the landowners and an irrigation or water district; and rights to any water from existing or future wells associated with the easement lands. The Service may acquire that portion of the water right reasonably required to meet habitat management or protection objectives.

Fee title purchase from willing sellers would provide the greatest habitat protection and maximum flexibility for habitat restoration and management, as all land use rights would be acquired. Changes in land use practices would be similar to those for conservation easements but could be more comprehensive. The landowner would receive payment based on fair market value. The purchased property would be held by a nonprofit organization (land trust) or government agency. The land holder would be responsible for planning and management of the property.

Similar to conservation easements are "set-aside agreements" with willing sellers that would include an annual payment based on a percentage of appraised fair market value of adjacent agricultural land. In general, landowners would not develop within the agreement area for a specified period. As with easements, landowners may retain certain noncommercial land use rights, and agreement provisions would carry over through changes in land ownership.

A "transfer of development rights" with local governments is another potential approach to land conservation. Land development potential in ecologically sensitive areas would be transferred to alternative sites where development is more innocuous. This method has been effective in California for addressing commercial and residential development (California Resources Agency 1989:42). Local governments could help relieve development pressure in riparian zones by assigning credits to owners of habitat that can be developed, and allowing the landowners to trade the credits for development rights on the alternative sites.

Once conservation lands are identified and any land use restrictions are determined, additional actions described under the Proposed Actions could be implemented per the land conservation agreement. All additional actions would be consistent with purposes of land conservation. Within a corridor of 300 feet from either side of the stream, it is estimated that about 6,505 acres of lands (includes all land use types) within four counties along Butte Creek, Butte Slough, and Sutter Bypass (Table 1) could be eligible for easements, set-aside agreements, transfer of development rights, or fee title purchase.

Fish Passage

Migrating salmonids need uninhibited instream passage to spawning habitat. Potential fish passage projects include consolidating diversions, removing unneeded dams, weirs, grade control structures, and other water control structures; modifying existing dams, weirs, control structures, outfalls, and fish ladders; and installing new fish ladders. Diversion canals may be modified to receive water from consolidated diversion points or alternative sources. Potential canal modifications include moving, extending, connecting, shortening, and widening. Alternatively, new canals may be constructed. Water may be transported across stream channels through suspended pipelines or flumes, or under stream channels through siphons.

New fish ladders may be installed or existing ladders may be modified at locations where fish passage is not possible or passage is impaired during certain flow conditions. Modified or new fish ladders may have wider flow ranges for passing fish. Locations for new fish ladders would be where construction, operation, and maintenance access are most efficient, usually at stream edges. Potential designs of fish ladders include pool and weir, vertical slot, and roughened channel types. All fish ladders would meet CDFG and NMFS specifications, and may include fish counting facilities. Poorly functioning fish ladders may be removed, capped, or continue to be used in combination with new adjacent ladders. Dam removal may require that replacement diversion facilities meet landowner diversion objectives and resource agency fish screen criteria.

Temporary gravel cofferdams may be necessary to de-water construction sites. Cofferdams would consist of washed, noncrushed river-run rock, generally between 0.25 to 4 inches in diameter, and may be spread evenly in the stream after construction is completed. Screened pumps may be required for dewatering prior to and during construction activities. Hydraulic and hydrologic modeling would be conducted during project design if hydraulics or hydrology would be significantly affected. The number of fish passage obstacles within the watershed is unknown and, consequently, the number of sites that may be involved in this action is undetermined

Fish Screens

The presence and operation of fish screens at diversions is an integral part of fish passage, protection, and restoration. Potential fish screening projects include installing new fish screens, expanding or relocating existing screens, and repairing damaged screens. Fish screens would have either squared or rounded openings $\leq$2.38 mm (3/32 inches) wide, or slotted openings $\leq$1.75mm (0.0689 inches) wide for protection of juvenile and adult steelhead and salmon (CDFG 1997, NMFS 1997). Screens for Sacramento splittail (*Pogonichthys macrolepidotus*) would need to meet with Service and CDFG approval. Screen panels would be checked before installation and regularly, thereafter, for nicks, burrs, damage, and deformities. Abnormalities would require repair or replacement. Other pertinent CDFG and NMFS requirements, such as approach velocities, sweeping velocities, and open areas, also would be met.

Potential screen expansions and construction would be limited to the size most appropriate to meet diversion flows. Fish screens may be relocated to allow consolidation of diversions, as well as provide better access for maintenance. Potential locations of screens would be at or downstream of diversion entrances. Screens at diversion entrances would be aligned parallel to the stream flow, and in a position that best minimizes eddies in front, upstream, and downstream of the screen. Screens placed downstream of diversion entrances would have an effective bypass system to collect and safely return fish to the stream. These bypass systems would have CDFG and NMFS approval. Automatic cleaning systems, such as air bursts, wipers, or paddle wheels would be installed for any new or modified fish screens, as necessary.

Temporary gravel cofferdams may be necessary to de-water construction sites. Cofferdams would consist of washed, noncrushed river-run rock, generally between 0.25 to 4 inches in diameter, and may be spread evenly in the stream after construction is completed. Screened pumps may be required for dewatering prior to and during construction activities. Hydraulic and hydrologic modeling would be conducted during project design if hydraulics or hydrology would be significantly affected. The number of fish screens needed within the watershed is unknown and, consequently, the number of screens that may be involved in this action is undetermined.

Spawning Gravel Replenishment

Salmon and steelhead trout require beds of clean loose gravel in the streambed for spawning; however, needs for spawning gravel in the watershed have not been determined. Suitable locations for gravel replenishment would depend on the history and potential for spawning use, the lack of quality or quantity of spawning gravel, the fluvial geomorphology, the accessability, and landowner participation. Candidate restoration sites also should have adequate instream and shoreline cover available, and should have flows available to provide suitable water temperatures for incubation. Potential actions include selective gravel placement in streambeds and measures to improve condition of existing gravel (restoration of fluvial processes to enable gravel recruitment are addressed under Channel and Instream Habitat Modification). Hydraulic and hydrologic modeling would be conducted during project design if hydraulics or hydrology would be significantly affected.

Suitable locations for gravel placement might include areas where added gravel would be transported downstream during high flows; such as the mouths of tributaries, on point bars, and near eroding streambanks. Engineering criteria for placement sites would include appropriate slopes, suitable water velocity and depth, and correct mixture of gravel sizes. Added gravel would generally be composed of about 80% 0.5- to 2.0-inch diameter and 20% 2.5- to 4.0-inch diameter river rock (Reynolds et al. 1993). Gravel would be sourced to ensure that migrating salmon are not attracted into the wrong spawning streams due to olfactory responses to gravel from other watersheds. Washed gravel would be transported in steam-cleaned truck beds and placed into streambeds during low flow periods. Old and new gravel may be mixed on-site, if necessary, by first mechanically ripping compacted material and then adding new gravel. Streambed contouring may be necessary and toe bars could be added to anchor gravel, provide proper hydrology and provide cover for fish.

Compacted or cemented gravel in streambeds could be improved by ripping with heavy equipment. Ripping would loosen the gravel and break up armoring from deposits of clays and other fines. This action would also take place during low flow periods, and could require repeated treatments from year to year. Ripping could also be used to mix existing gravel with new gravel at placement sites. Engineering considerations for ripping would be similar to those described for selective gravel placement.

Gravel treatments over multiple years may be necessary for optimal success. Temporary gravel cofferdams may be necessary to de-water work sites. Cofferdams would consist of washed, noncrushed river-run rock, generally between 0.25 to 4 inches in diameter, and may be spread evenly in the stream after construction is completed. Screened pumps may be required for dewatering prior to and during construction activities. After construction, streambanks would be resloped, revegetated with native species, and supplemented with appropriate sized gravel to prevent sloughing, as needed. If needs to replenish spawning gravel are identified, several thousand cubic yards may be placed over several years at specified locations, most likely from about the Western Siphon upstream to about Centerville.

Riparian Revegetation

Specific riparian enhancement actions on a site would depend on land ownership; floodplain elevation, contours, and soils; channel morphology; stream hydrology; site access; and other considerations. Natural maintenance of riparian vegetation requires flooding, erosion, and soil deposition. Therefore, the effectiveness of riparian restoration may depend on other complementary actions to provide these natural processes. Enhancement may or may not involve bank improvement. Riparian vegetation on natural floodplain soils is of higher quality and would be more desirable than revetted banks, but revetted banks also could be planted with riparian vegetation.

Riparian enhancement could be passive, active, or in combination, and could occur on existing degraded riparian habitat areas or on other land types acquired for riparian habitat restoration. Passive enhancement would provide opportunities for vegetation to recover naturally (e.g., protection of the vegetated areas), and allow vegetation to restore itself through natural processes such as sprouting and seed dispersal. This may be desirable if remnant stocks of desirable plant species exist and expected recovery time is acceptable.

Active restoration may be required on sites that are extremely degraded, or where passive recovery would not be successful or timely. Active restoration generally includes site preparation and planting, removal of exotic competing plant species, weed control, and irrigation. Planting would generally include trees, shrubs, and herbaceous species. Species selection and planting pattern would generally attempt to reproduce species composition and vegetational structure of similar natural sites. However, restoration practicalities such as immediate soil stabilization; flood tolerance; and expected vigor, growth, and survival of plants are additional considerations. Site preparation can involve tillage and discing (contouring is addressed under Streambank Modification). Depending on soil conditions, it may be necessary to add top soil, fertilizer, mulch, or other soil amendments. If planting is done on revetted streambanks, rock can be temporarily removed at sites of individual plants, and replaced after planting.

Potential plant sources are seeds, seedlings, cuttings, liners, tublings, and various size container stock. Weed control and removal of other exotic plant species may involve use of mulch, hand tools, “powered weed eaters”, and herbicides. Plant protectors could be installed to help protect new plants from weeds and browsing animals. Irrigation could be provided by natural flooding, managed flooding, or hand watering, drip line systems, or overhead sprinklers. Drip line and overhead sprinklers would be temporary until plants became established, and could require installation of pumps, filters, and distribution lines. If natural flooding of a site is not adequate and water rights attached to the site are not available, it may be necessary to purchase water from adjacent steams or canals until the vegetation can become independent of irrigation (generally about 3 years).

Within a corridor of 300 feet from either side of the stream, it is estimated that about 4,073 acres of land within four counties along Butte Creek, Butte Slough, and Sutter Bypass could be eligible for riparian revegetation (Table 1). This includes seasonally- and permanently flooded agriculture, nonflooded agriculture, nonriparian woody, orchard/vineyard, grassland, palustrine, barren, and other land use types. About 826 acres of existing riparian woody habitats are

estimated to be available for riparian vegetation enhancement. Acreage for revegetation and enhancement is not estimated for riparian areas within foothills and mountain areas as data were not available. In place of acreage, it is estimated that about 25 linear miles of riparian corridor within foothills and mountains would be eligible.

Channel and Instream Habitat Modification

Proposed channel and instream habitat modifications would depend on the existing fluvial geomorphology and the needs of anadromous fish in that area. Hydraulic and hydrologic modeling would be conducted during project design if hydraulics or hydrology would be significantly affected. Passive restoration could be effective when the source of disturbance to the stream channel can be removed or controlled, and the channel protected from further disturbance to allow recovery on its own. Natural fluvial processes would be relied upon to restore the channel to an ecologically healthy condition. An example is the elimination of a siltation source, followed by seasonal high flows to flush sediment from the streambed.

Active restoration actions could include relocation of channel pathways to better conform to flow regimes and modification of channel geometry, such as width, depth, and gradient to establish an equilibrium in fluvial processes. Creation of riffles, runs, and pools of appropriate size, proportion, and interspersion are potential channel design features that can improve fish cover, spawning areas, and invertebrate production sites. Channel features that attract fish into undesirable locations where they may be injured or stranded may need to be removed or modified. Channel modifications to remove habitat structures favored by predators of salmon and steelhead trout may be necessary to improve survival of smolts and young steelhead. Addition or removal of fluvial materials such as cobble and boulders could be required to improve channel substrates (gravel replenishment for spawning is addressed under Spawning Gravel Replenishment).

Other potential actions for improvement of instream habitat involve installation of structures in the stream channel. Riparian vegetation and natural channel morphology, such as undercut banks, provide very high quality cover for fish and other aquatic organisms. However, human-made structures can be effective for treating trouble spots, or supplementing natural forms of cover until fluvial processes can re-create adequate natural cover. Materials for instream structures include boulders, logs, root wads, gabions, wire fencing, and concrete. Some of the many possible structures include boulder clusters, log or boulder weirs, divide logs, digger logs, spider logs, upsurge weirs, culvert baffles, waterbars, check dams, or combinations of these structures.

Modification of channel morphology could require acquisition of fill material from borrow sites, or produce spoil material that would require disposal. Excavating, filling, and grading would occur within the stream channel to establish new configurations and geometry. Some situations could require removal of riparian vegetation to allow access of heavy equipment or accommodate new channel designs. Installation of instream structures could involve trenching in streambanks and streambeds and anchoring with rebar, fence posts, and steel cable. Temporary gravel cofferdams may be necessary to de-water construction sites. Cofferdams would consist of

washed, noncrushed river-run rock, generally between 0.25 to 4 inches in diameter, and may be spread evenly in the stream after construction is completed, as appropriate. Screened pumps may be required for dewatering prior to and during construction activities. The amount of channel and instream habitat modification that is needed in the watershed has not been identified. It is assumed, therefore, that the entire creek channel within the project area is eligible for this action.

Meander Belt and Floodplain Management

Opportunities for meander belt and floodplain restoration would depend on bank protection and flood control needs, land ownership and land uses, floodplain elevation and soils, channel morphology, stream hydrology, and other considerations. Hydraulic and hydrologic modeling would be conducted during project design if hydraulics or hydrology would be significantly affected. Meander belt and floodplain restoration would require removal of meander-inhibiting structures to allow streams to return to natural patterns of erosion and deposition. These actions could involve modification or relocation of bridge abutments or other fixed structures, riprap removal, removing or setting back levees, and other channel modifications. Setting back levees would require removing existing levees and rebuilding them farther back from the stream channel. The distance of levee set back would depend on conditions outside existing levees and the width of the historic floodplain. The new channel would be designed to accommodate the same or greater flow capacity as the existing channel and would be integrated into the overall channel system.

Once fixed structures are removed, natural process, such as erosion, deposition, and vegetation recovery, could be relied upon to restore the meander belt and floodplain ecosystem. Alternatively, additional restoration actions could be implemented, such as channel and instream habitat modification, streambank improvement, terracing, berm creation, riparian vegetation restoration, and gravel replenishment to supplement natural recovery. Meander belt and floodplain restoration may or may not require altering land uses. If existing land uses are compatible with stream meander and habitat restoration within the new meander zone, few adjustments would be needed. Otherwise, converting land uses to natural floodplain or other compatible uses would be necessary. This could be accomplished with flood easements, whereby land owners would be monetarily compensated for lost uses of land due to flooding. Other approaches are voluntary land owner conversion, conservation easements, or land purchase from willing sellers.

The approximately 15-mile section of Butte Creek between the Little Chico Creek Diversion Canal on Butte Creek to roughly the old Point Four Dam site probably has the most potential for setting back levees and widening the floodplain. This section abuts lands of Butte and Glenn Counties. Within the 15-mile long corridor and 300 feet from either side of the stream, it is estimated that about 1,005 acres of lands in Butte County, and 88 acres of lands in Glenn County, could be eligible for meander and floodplain management (Table 2). A limited number of other sites within the watershed may also have potential for meander and floodplain management.

Streambank Modification

The specific streambank improvements implemented on a site would depend on the nature of the problem, channel type, stream hydrology, availability of materials, site access, and other considerations. Hydraulic and hydrologic modeling would be conducted during project design if hydraulics or hydrology would be significantly affected. Potential streambank improvement activities include recontouring the topography of banks or adjacent slopes and creation of berms. Wing-deflectors made of boulders or logs may be constructed to deflect water away from banks. Stone riprap or bank cribbing made of boulders or logs could be installed to protect banks from erosion, although many bioengineered bank treatments are also available and can be environmentally and economically superior to rock riprap. These include revetment with combinations of trees, logs, root wads, boulders, and other native materials; application of geotextile fabrics; installation of willow walls, fascines, siltation baffles, and brush matting made from live plant material; and others. Metal posts, cables, and other reinforcement materials could be incorporated into many of the bank improvement designs, and toe trenches may be needed to resist undercutting by currents. Other possible bank improvement activities include the removal or replacement of existing bank structures if they are not functioning as desired, or are in poor condition. Any of these activities could be applied singly or in combination, and other environmentally compatible materials could be used in addition to those listed here. Improvement of streambanks may or may not include mulching or planting riparian vegetation.

Temporary gravel cofferdams may be necessary to de-water construction sites. Cofferdams would consist of washed, noncrushed river-run rock, generally between 0.25 to 4 inches in diameter, and may be spread evenly in the stream after construction is completed. Screened pumps may be required for dewatering prior to and during construction activities. The amount of streambank modification that is needed in the watershed is unknown, but the reach of Butte Creek between the canyon reach and the reach constrained by levees is a particular problem area for bank erosion and flooding (BCWP 1999). It is assumed that the entire creek channel is eligible for this action.

Table 2. Total estimated acres of land use types[1,2] within a 600-ft-wide corridor (300 feet from each bank) along Butte Creek in the approximately 15-mile section between the Little Chico Creek Diversion Canal on Butte Creek to roughly the old Point Four Dam site.

Land Use Type[3]	**Butte County**	**Glenn County**
Seasonally and Permanently Flooded Agriculture	220	16
Nonflooded Agriculture	387	69
Orchard/Vineyard	152	n/a
Grassland	61	n/a
Palustrine	2	n/a
Riparian Woody	52	3
Nonriparian Woody	66	n/a
Barren	37	n/a
Other	28	n/a

[1]Source: CDFG et al. 1997; California Gap Analysis 1998. Acreage for land use types was calculated from satellite imagery and should be considered approximate. Because classification of land use types from satellite imagery is approximate, some minor land use types may be missing, and acreage for others may be somewhat over or under represented.

[2]Where Butte Creek follows County lines, only one-half the corridor width (300 ft) is used to calculate acreage for the respective Counties.

[3]Seasonally and Permanently Flooded Agriculture is primarily Rice; Nonflooded Agriculture is primarily row crops and other nonflooded types; Orchard/Vineyard is primarily almonds, walnuts, and other types; Grassland is managed and natural grasslands; Riparian Woody is primarily riparian forest and scrub; Palustrine is primarily seasonally- and permanently flooded emergent wetland; Nonriparian Woody is primarily shrubs and trees not included in the Riparian Woody class, including significantly wooded residential areas; Barren is primarily exposed soil, including plowed fields at the time of satellite imagery; Other is primarily human developed areas and paved surfaces.

Agricultural Management

Land managers may restrict land uses that adversely affect fish and wildlife habitat, or that prevent or impair recovery of habitat through natural succession. Potential agricultural management techniques include elimination or management of discing, burning, mowing, alteration of natural topography, leveling of land, and other agricultural practices. Other options are to eliminate or manage wood cutting or clearing of woody vegetation. Agricultural land may be actively converted to riparian habitat or to land covers that would protect the riparian zone.

Managers may also eliminate or manage pesticide spraying and the application of chemical fertilizers that can degrade water quality or be toxic to wildlife. Storage of pesticides, fuels, and other hazardous materials that can be detrimental to fish and wildlife habitat can be eliminated or managed to prevent storage container leaks or spills.

Management practices for rangeland could include reduction of grazing intensity by modifying season of use, pasture rotations, stocking rates, and grazing duration. Distribution of livestock can be controlled by fencing, creation of stock trails, placement of off-stream water facilities, placement of salt and minerals, placement of supplemental feed, and manipulation of forage quality through fertilization or burning. Fencing livestock away from streambeds or creating livestock exclusion zones of a prescribed width, while providing off-stream water supplies, could protect riparian corridors. Fencing activities could include installation, repair, or replacement. Fencing protocols would be consistent with BLM's fencing guidelines (BLM 1989), or similar alternatives, to minimize restriction on wildlife movement. All fences would be installed manually unless heavy equipment becomes necessary.

Management of forested areas could include reduction of fuel wood loads and revision of timber management practices to decrease the potential for sedimentation of aquatic habitat from soil erosion. Fuel wood loads could be reduced by selective removal of woody material in areas where fuel wood has become excessively high due to fire suppression. Eliminating timber management practices that disturb forest soils could be revised or replaced by methods that minimize disturbance of the soil surface.

Within a corridor of 300 feet from either side of the stream, it is estimated that about 6,505 acres of lands (includes all land use types) within four counties along Butte Creek, Butte Slough, and Sutter Bypass (Table 1) could be eligible for agricultural management.

Road Management

Roads in the floodplains of rivers and streams have been built for purposes such as recreation access, gravel mining, wood cutting, and movement of agricultural equipment. These can increase the sedimentation of the streambed caused by accelerated erosion of exposed soil. On lands with conservation easements or purchased in fee title, the work done will seek to reduce erosion to levels more like those seen in natural floodplain habitats. Measures to control erosion

and sedimentation depend primarily on soil type, cause of the problem, and severeness of the problem. Areas with potential or current erosion problems may be revegetated as permitted by topography and soils. Where practical, moderate to highly unstable roads, parallel road systems, and temporary or nonsystem roads may be temporarily, seasonally, or permanently decommissioned. Permanently decommissioned roads would be revegetated with vegetation native to the area.

Where landslide potential exists, roads may be outsloped. Unstable fill along roads and landings could be pulled back. Stream crossings on in-service roads and trails may be repaired or upgraded, or may be completely removed on decommissioned roads. Worn or undersized culverts could be replaced with culverts sized for a specified capacity, such as 50- to 100-year storms. Rolling dips may be placed on roads at stream crossings that divert excess flows away from stream channels. Rolling dips also may be used to drain road surfaces and inside ditches or, alternatively, inside ditches may be permanently removed to provide long-term control of road surface drainage. Eliminating inside ditches may require that roadbeds be reshaped to slant outward. Other drainage improvements may consist of water bars, cross drain installations, revegetation of fill and cut slopes, sidecast removals, road prism shaping, or other related activities. The amount of road management that is needed in the watershed is unknown. It is assumed, therefore, that all roads are eligible for this action.

Monitoring

Monitoring will be performed in the watershed to collect baseline data and to evaluate implemented actions. All site-specific actions will require a monitoring plan. Monitoring is crucial to determine effectiveness of implemented actions relative to preestablished criteria and whether supplemental or remedial measures are necessary. For example, vegetation monitoring would determine success of planting relative to preestablished criteria and whether remedial measures are necessary. Project monitoring would generally include pre- and post-project sampling of proposed areas. Results of monitoring could help managers determine whether fish and wildlife are making use of restored habitat in anticipated numbers, provide information as to what restoration actions are most beneficial with the limited funding available, and identify needs for supplemental actions to achieve desired results.

Fishery monitoring could include measures of gravel permeability, intragravel dissolved oxygen, intragravel temperatures, instream flows, water quality, water surface elevations, stream gradients, pebble counts, redds counts, and erosion and deposition. Biological surveys may be conducted to determine abundance of aquatic invertebrates, fish migration patterns, fish ladder counts, spawner escapement, and effectiveness of ladders and screens. Depending on the component to be monitored, potential methods could include on-site inspection and sampling, data collection from topographic maps and automated monitoring stations, and mark-and-recapture studies.

Terrestrial monitoring could include survival and growth rates of vegetative plantings; height, density, and cover of vegetation; habitat use by wildlife; grazing by livestock; land use practices; and presence, absence, or abundance of animals. Potential methods include on-site inspections, field surveys, sampling on transects or in plots, and aerial photograph interpretation. A monitoring program is required for actions funded by the CVPIA. Monitoring information obtained will be incorporated into the Comprehensive Assessment and Monitoring Program (CAMP) database. The CAMP is an ecosystem-level monitoring program established by Section 3406(b)(16) of the CVPIA to assess effectiveness of restoration actions relative to the AFRP's anadromous fish production targets.

ASSOCIATED MITIGATIVE MEASURES

Mitigation and conservation measures were developed to mitigate a wide range of potential impacts from the proposed actions. A complete description of mitigation and conservation measures is provided in Appendix B. Each measure is preceded by an identity code that is referenced in an environmental effects and mitigation summary table in the Environmental Consequences section of the PEA. Mitigation and conservation measures were developed for Vegetation and Wildlife (VW), Fisheries and Water Quality (FWQ), Special Status Species (SS), Hydrology and Stream Channel (HSC), Air Quality and Noise (AQN), Recreation (R), Socioeconomic conditions (SC), Cultural Resources (CR), Hazardous Materials (HM), and Access, Roads and Traffic (ART). When incorporated into proposed actions, site-specific environmental compliance should be simplified and expedited. Incidental adverse effects of actions and corresponding mitigation measures will need to be determined during site-specific environmental compliance. Each action proposed at the site-specific level will also need to determine potential effects on special status species and identify appropriate conservation measures.

AFFECTED ENVIRONMENT

Butte Creek originates in the Jonesville Basin of Lassen National Forest on the western slope of the Sierra Nevada Mountains. The creek is a tributary to the Sacramento River through two points: Butte Slough at Sacramento River Mile 139, and the Sutter Bypass and Sacramento Slough at Sacramento River Mile 80. The watershed ranges from about 7,000 feet in elevation in the headwaters to approximately 150 feet at the Sacramento River points of entry. From Butte Meadows, the creek descends to the Sacramento Valley, passing through 25 miles of steep canyon. The creek then enters the Sacramento Valley southeast of Chico and continues downstream for about 45 miles to the point where it first enters the Sacramento River at the Butte Slough Outfall Gates. Depending on flow levels and operation of the Butte Slough Outfall Gates, Butte Creek also enters Butte Slough at this point and flows south through the Sutter Bypass via the East and West Borrow Canals. After paralleling the Sacramento River for about 40 miles, this system reaches the Sacramento River via Sacramento Slough and the Feather River. The Butte Creek watershed can be described in five reaches: Butte Meadows basin, the canyon reach, the valley reach, the Butte Sink area, and the Butte Slough/Sutter Bypass.

VEGETATION AND WILDLIFE

Due to a wide range of topographic features, soils, moisture regimes, and elevations, the Butte Creek watershed supports a great diversity of plant and animal communities. These communities are cursorily described here. Descriptions are largely adapted from the BCWP's Existing Conditions Report (BCWP 1999) and the Lower Butte Creek Project Final Project Report (JSA 1998). More detail on plant and animal communities can be found in these reports.

Butte Meadows Basin at the headwaters of the Butte Creek watershed, begins at an elevation of about 7,000 ft. Tributaries of Colby, two separate Willow Creeks, Jones, Scotts John, and Bolt Creeks unite together in an area of 12.5 square miles to form Butte Creek. Mixed conifer forest vegetation is characteristic, and Douglas fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), white fir (*Abies concolor*), red fir (*Abies magnifica*), chaparral, and oak woodland intergrade with montane meadows, ponds and swales. Riparian habitats line the tributaries. Plant communities in the Butte Meadows Basin are affected in some areas by grazing and trampling by livestock, invasion by exotic plant species, fire suppression, and logging.

The mixed coniferous forests of Butte Meadows basin support wildlife species such as Cooper's hawks (*Accipiter cooperi*) and northern goshawks (*Accipiter gentilis*), yellow warblers (*Dendroica petechia*), vaux's swift (*Chaetura vauxi*), bobcats (*Lynx rufus*), Pacific fishers (*Martes pennanti pacifica*), black bears (*Ursus americanus*), mountain lions (*Felis concolor*), and gray squirrels (*Sciurus griscus*). Wildlife in the Butte Meadows Basin are affected by logging, road construction, livestock grazing, residential development, and off-road vehicles, particularly in meadows, riparian areas, streams, and lakes (CDFG 1993b).

In the canyon reach, mixed riparian vegetation, oak woodland and mixed conifer forest provide a mosaic of habitats and ecotones. Early successional sand and gravel bars, white alder (*Alnus rhombifolia*), willow (*Salix* spp.), and Fremont cottonwood (*Populus fremontii*), riparian scrub, and an understory of California wild grape (*Vitis californica*), and blue elderberry (*Sambucus mexicana*) extend throughout the riparian zone. Blue oak-foothill pine, valley oak woodland, and mixed conifer forest occur in upland areas or riparian-upland transition zones. Like the Butte Meadows Basin, plant communities in some areas of the canyon reach are affected by grazing and trampling by livestock, invasion by exotic plant species, fire suppression, and logging.

Bird species occurring in the canyon reach include swallows, herons, waterfowl, bushtits (*Psaltriparus minimus*), western scrub jays (*Alphelocoma coerulescens*), winter wrens (*Troglodytes troglodytes*), Wilson's warbler (*Willsonia pusilla*), American dipper (*Cinclus mexicanus*), belted kingfisher (*Ceryl alcyon*). Western terrestrial garter snakes (*Thamnophis elegans*), opossums (*Didelphis virginiana*), California myotis (*Myotis californica*), mule deer (*Odocoileus hemionus*), black bears, mountain lions, and bobcats also occur in the canyon reach. Hydraulic mining in the early part of the century, timber harvest, recreational use, and human habitation have impacted wildlife in some parts of the canyon.

In the valley reach of Butte Creek, agriculture is the predominant land use adjacent to the channel. Only a few fragmented sections of mixed and valley oak riparian forests remain. Mixed riparian forests contain plant species such as Fremont cottonwood, Oregon ash (*Fraxinus latifolia*), and willows. The valley oak riparian forests typically contain (*Quercus lobata*), blue elderberry, and poison oak (*Toxicodendron diversilobum*). Avian species likely to use the small valley oak woodland and riparian habitats that remain include Swainson's hawks (*Buteo swainsoni*), ospreys (*Pandion haliaetus*), wood ducks (*Aix sponsa*), common mergansers (*Mergus merganser*), great blue herons (*Ardea herodius*), and several species of neotropical migrant birds. Other wildlife species likely to occur in these areas are striped skunks (*Mephitis mephitis*), racoons (*Procyon lotor*), opossums, ringtails (*Bassariscus astutus*), gray foxes (*Urocyon cenereoargenteus*), coyotes (*Canis latrans*), and mule deer. Conversion of natural grasslands, vernal pools, and woodlands to urban and agriculture lands is a major concern in this reach. Much of the valley reach is constricted by levees built for flood protection. Establishment and maintenance of riparian vegetation and natural floodplain functions are hindered in these areas.

Butte Sink is largely comprised of seasonally flooded wetlands (in part from rice drainwater), seasonally flooded agricultural lands (primarily rice fields), managed waterfowl habitat, vernal pools, riparian forests, and natural freshwater marshes. Butte Sink supports large concentrations of migratory and resident waterfowl. The Butte Sink east of Butte Creek contains one of the highest quality, contiguous blocks of remaining wetlands habitat in California. Its wildlife and waterfowl habitat values are particularly high because of associated riparian habitat. When flooded, adjacent wetlands and smaller sloughs also may provide winter and spring refugia and juvenile rearing habitat. These wetlands and riparian forests support a diversity of wildlife, including several threatened and endangered species, shore birds, and a set of riparian wildlife species similar in composition to that described for valley reach riparian areas. The USFWS's Butte Sink National Wildlife Refuge is located in this area.

Like the Butte Sink, the seasonal and permanent wetlands, managed waterfowl habitats, and other flooded lands of the Butte Slough and Sutter Bypass support large concentrations of migratory and resident waterfowl. The canals, sloughs, and flooded lands also provide wetland and riparian habitats for many other wildlife species as identified for Butte Sink and the valley reach. The Butte Slough/Sutter Bypass area contains the Sutter National Wildlife Refuge.

Riparian plant communities throughout the watershed, in association with their aquatic component, produces some of the highest quality habitats in terms of wildlife diversity and abundance. Riparian habitat is an important transition zone between aquatic and upland habitats, and strongly influences the health of the aquatic ecosystem. Riparian areas provide multiple layers of woody and herbaceous vegetation, moist soils, surface water, and a humid microclimate. Riparian vegetation provides temperature-reducing shade, nutrient cycling, input of invertebrates used for food, bank cohesion, woody debris used for instream cover, and a buffer zone to impacts from adjacent uplands. The vegetated near-shore zone (i.e., shaded riverine aquatic habitat), is important to a wide range of aquatic and terrestrial wildlife. Riparian corridors also provide dispersal and migration pathways for those wildlife species which, otherwise, could not traverse drier or more open adjacent areas. Other values of riparian vegetation include its function in reducing water velocities, bank shear stress, and soil erosion; its visual aesthetics and shade; and its buffering of human disturbance near streams. Much of the riparian habitat in the Butte Creek watershed has been fragmented, removed, and degraded due to human alterations for flood control, agriculture, and urbanization.

FISHERIES AND WATER QUALITY

Four native spawning runs of chinook salmon occur on Butte Creek: fall-, late-fall-, spring-, and winter-run. Native steelhead trout also occur on Butte Creek. Chinook salmon and steelhead trout are anadromous fishes, which means that juvenile fish migrate to the ocean early in life, grow to maturity in the ocean, and return to freshwater streams to spawn. Steelhead are the anadromous strain of the resident rainbow trout. Steelhead may spawn more than one year, whereas, mature chinook salmon die shortly after spawning. Over 30 species of other fish also inhabit Butte Creek, including trout, lamprey, bass, catfish, minnows, and sculpins (Appendix C).

Spring-run salmon are the most numerous run in Butte Creek (USFWS 1998). During the 10-year period of 1956 through 1965, annual spring-run escapement estimated by CDFG (1998) averaged about 2,800 fish, with 8,700 estimated in 1960. During the next three decades (1966-1975, 1976-1985, and 1986-1995), annual spring-run escapement estimated by CDFG (1998) averaged about 337, 162, and 1,354, respectively, with a low of 10 fish estimated for 1979. In 1998, spring-run salmon escapement hit a record 18,000-21,000, possibly due to favorable instream flows that may have aided the salmon in overcoming passage barriers. Between 1967 and 1991, the estimated average natural production of spring-run salmon in Butte Creek was 1,012 fish (USFWS 1995c).

Spring-run salmon migrate upstream into Butte Creek during March through June and hold over primarily in pools from the confluence of Little Butte Creek upstream to the Centerville Dam (USFWS 1998). Downstream of the Western Canal, spring-run adults generally have sufficient water to migrate upstream. Upstream of the Western Canal, these fish often encounter reduced flows and elevated water temperatures. These fish spawn from late September through early October (USFWS 1998, Hill and Webber 1999), mostly upstream from the Parrott-Phelan Dam (BCWP 1999). Most spring-run juveniles emigrate as fry beginning in mid-November and peaking between December and April (Hill and Webber 1999). A lesser number emigrate later in spring or early summer. Some spring-run salmon emigrate as yearlings during the following fall and winter.

During the CVPIA baseline period between 1967 and 1991, escapement of fall-run chinook salmon has ranged from as many as 1,000 fish in both 1975 and 1983, to as few as 5 fish in 1989 (USFWS 1995c). The average run size for this period was estimated to be 418 fish. Adjusted for harvest, the estimated natural fall-run production was about 760 fish. Fall-run salmon generally enter lower Butte Creek during late September through October (USFWS 1998). Downstream of the Western Canal, adult fall-run often encounter impassable barriers, dewatered reaches, siltation, a lack of suitable gravels, and inadequate cover and shade (USFWS 1998). Upstream of the Western Canal, several barriers have impeded the adult migration until high flows occurred. Most fall-run fish spawn in the area from Durham to the Parrot-Phelan Dam during October through December. Fall-run fry emigrate December through March, and older juveniles emigrate April through June (BCWP 1999). Emigrating juveniles are impacted by diversions and poor water quality (USFWS 1998).

Abundance of late-fall-run chinook salmon is unknown, but probably is low (USFWS 1998). Only a few fish are thought to use Butte Creek during favorable flow conditions. Late-fall-run salmon likely enter Butte Creek during December through February and spawn upstream of the Parrot-Phelan Dam during January through March. Instream barriers are not expected to impede upstream passage of late-fall-run salmon, except in extremely dry years. Juvenile fish likely emigrate during April through June and experience the same potential losses to diversions and poor water quality as spring and fall-run juvenile emigrants.

Steelhead population sizes also are unknown (USFWS 1998). Spawning steelhead currently are restricted to lower Butte Creek canyon and some tributaries such as Dry Creek and little Butte Creek. Steelhead enter Butte Creek during the late fall and winter and spawning occurs in the winter and spring. Steelhead trout fry and smolts in the upper Sacramento Valley tributaries generally emigrate March through June, whereas, juveniles one year or older generally emigrate September through March. Juvenile emigrants experience the same problems as do juvenile salmon.

The Butte Sink area of Butte Creek provides an important migratory pathway for chinook salmon and steelhead that spawn in the upper reaches of Butte Creek. These fish use this area primarily for passage. When flooded, adjacent wetlands and smaller sloughs also may provide winter and spring refugia and juvenile rearing habitat. The canals, sloughs, and flooded lands of Butte

Slough and Sutter Bypass also are an important migratory and nursery area for salmon and steelhead of Butte Creek and the upper Sacramento River and its tributaries, especially during high water years. Flooded lands of the Sutter Bypass are an important spawning and nursery area for Sacramento splittail, a fish species proposed for Federal listing as threatened. During high water years, many salmon and steelhead migrate to and from the upper Sacramento River and its tributaries through Butte Slough and the Sutter Bypass via overflows from the Tisdale, Colusa, Moulton, 3 Bs, and Goose Lake Weirs. Diversions within Butte Sink, Butte Slough, and Sutter Bypass are unscreened.

Declines in anadromous fish populations and degradation of associated aquatic and riparian habitat in the Butte Creek watershed are due primarily to inadequate instream flows, unscreened diversions, inadequate passage over diversion dams, entrainment and stranding of adult fish at agricultural return drains (outfalls), poor water quality, and poaching (CDFG 1993a; CALFED 1999b). Several diversion dams on Butte Creek above Butte Slough supply water for power generation, irrigation, gun clubs, and domestic use (CDFG 1993a). Some diversion dams have been recently removed or have been modified with new fish ladders to facilitate fish migration. Fish screens have been installed at several diversion structures. Other dams and diversions are still known to impair and delay migration of fish with impassable barriers and unscreened diversions. In Butte Slough, the outfall gates and culverts to the Sacramento River and the East-West Diversion Weir may produce problems for migrating fish. Within the Sutter Bypass, at least seven weirs and multiple unscreened diversions and outfalls entrap fish or impede fish passage. The nature and magnitude of fish passage problems within Butte Sink, Butte Slough, and Sutter Bypass at any given time are very much dependent on levels of flows and the current regime of agricultural operations.

The presence and operation of dams on streams also may reduce availability of spawning gravel by trapping mobilized gravel behind the dams and reducing instream flows. Adequate flows are needed to erode gravel deposits, transport the gravel downstream, and flush fine sediments from gravel beds. Riprap and other armoring on streambanks blocks natural gravel deposits from eroding into the stream. When gravel beds cannot be replenished and instream flows are inadequate for flushing fine sediments, existing gravel washes away, becomes covered with sediment, or is cemented with clays and other fines making it unusable for spawning.

Poor water quality and high water temperatures adversely impact adult and juvenile salmon and steelhead in Butte Creek. Water quality and temperature can vary seasonally and from year to year, depending on precipitation, hydropower operations, and agricultural activity. Potential agricultural contaminants enter the stream with irrigation return waters, but such contaminants largely are unmonitored. As flows decline during the diversion season, the contribution of agricultural return flows to the total flow increases, also increasing the potential effects of contaminants on the fish community. Water quality can also be degraded from urban runoff and outfalls. Inadequate riparian cover and reduced instream flows, have resulted in elevated water temperatures in Butte Creek during the summer and fall. Adverse temperatures occur during the upstream migration periods for spring and fall-run salmon, and during the emigration period for juvenile fish.

Degraded water quality also occurs through sedimentation of the stream channels. Erosion and sedimentation are natural processes of stream systems which can either improve or degrade habitat conditions. Bank erosion can provide beneficial gravel, cobble, boulders, and large woody debris to the stream channel; but fine sediment can produce negative effects by covering gravel and cobble, filling in pools, and causing high turbidity. Erosion of streambanks due to lack of stabilizing riparian vegetation, grazing by cattle, and road crossings can introduce fine sediments. Water runoff through upland areas that are overgrazed, that are damaged by logging and other land uses, or that have exposed soils due to road cuts or hot wildfires can also contribute sedimentation of the stream channel.

SPECIAL STATUS SPECIES

The Service has identified special status species that may occur in the action area (Appendix D). These include 21 species that are federally-listed as threatened or endangered or are proposed to be listed under ESA, and 8 species that are State-listed as threatened or endangered under CESA. Federal candidates for listing and Federal Species of Concern that may occur in the action area have also been identified (Appendix D). Distributions, habitats, and reasons for decline for special status species that may occur in the area of the Proposed Actions are provided in Appendix E.

HYDROLOGY AND STREAM CHANNEL

The hydrology of the Butte Creek watershed is complex. Much of the following description is taken from the BCWP's Final Existing Conditions Report (BCWP 1999). Water diverted from three adjacent watersheds co-mingles with the natural flows of Butte Creek and often comprises the major portion of the flow. Feather River water enters Butte Creek via the West Branch Feather River into DeSabla Reservoir. Flows from both Big and Little Chico creeks enter Butte Creek, including agricultural return flows that drain into Little Butte Creek. Flows from the Sacramento River reach Butte Creek from various diversion points from as far north as the mouth of Big Chico Creek to the Reclamation District 1004 pumps located near Princeton. Other agricultural return flows enter Butte Creek in many locations. The creek flows year-round and peaks during storms and spring runoff.

Butte Creek originates from snow and rainfall and gathers flow from many tributaries as it drops through the upper basin. The creek passes through a series of wide meadows in the Butte Meadows area, where it is characterized by a series of pools and riffles. This area is subject to flooding during high, warm precipitation events when snowpack is present. Butte Creek flows from the Butte Meadows area for about 25 miles through a steep canyon, where it enters the Sacramento Valley floor southeast of Chico. Numerous small tributaries and springs enter the creek in the canyon area. Within the canyon section, flows from the west branch of the Feather River are diverted into Butte Creek through the Hendricks and Toadtown Canals for power generation. As part of the canyon hydropower system, three dams divert water from Butte Creek and three powerhouses generate power. The lower dam, Centerville Diversion Dam, is generally

considered the uppermost limit of anadromous fish migration. Little Butte Creek, which enters Butte Creek near the end of the canyon, makes a minimal contribution to Butte Creek flows.

After leaving the canyon, Butte Creek flows through its valley reach between Chico and Butte Sink. Much of the creek in this reach is bordered by levees. Four dams and numerous diversions take water from Butte Creek for agricultural purposes. The first of these dams is the Parrott-Phelan Dam, which diverts water into the Comanche Creek delivery system. Farther downstream, the creek passes the Durham Mutual Dam, Adams Dam, and Gorrill Dam. All of these dams have recently had new fish screens and fish ladders installed. Recently removed dams include the Western Canal Dams (1997), McGowan Dam (1998), and McPherrin Dam (1998). The Point Four Dam was removed in 1993. The Parrott-Phelan Dam diverts water all year, but most others divert in April through September. Just downstream of the Durham Mutual Dam, the Little Chico Creek diversion carries excess flood waters from Little Chico Creek into Butte Creek. A levee system on Butte Creek begins at this point and continues downstream for about 14.5 miles. Other major water conveyance channels entering Butte Creek within the valley reach are Hamlin Slough and 1048 Slough just above the old Western Canal Dams site, Western Canal Water District Main Drain just above the old McGowan Dam site, and Howard Slough just above the old McPherrin Dam site.

Below the McPherrin Dam site, Butte Creek is joined by Little Dry Creek before reaching Butte Sink. At the Sanborn Slough Bifurcation in the upper end of Butte Sink, part of Butte Creek's flows are divided east into Sanborn Slough to the North Weir where it is either diverted to the northern portion of the Butte Sink, or into the Crosscut Canal to the Reclamation District 833 Main Drain. Remaining Butte Creek water flows west along the western side of Butte Sink. Angel Slough enters Butte Creek below the bifurcation. White Mallard Dam is located approximately two miles downstream of the Bifurcation Dam and sets stage for diversion of water through the White Mallard Canal to the White Mallard Gun Club and Reclamation District 1004. Return flows, including Sacramento River water, re-enter Butte Creek through the Drumheller Slough Outfall.

Just below this point, water from the Cherokee Canal/Biggs-West Gridley Main Drain reenters the creek after flowing through Butte Sink. Additional weirs and outfalls occur on Butte Creek before it reaches the Colusa Bypass, where Sacramento River overflows enter the creek. Additional Sacramento River flood flows are diverted into the Butte system from the river's Moulton Weir south of Princeton. Below the last Butte Creek outfall at Tarke Weir, Butte Creek extends downstream unobstructed to its mouth, where it enters Butte Slough about 0.75 miles east of the Butte Slough Outfall Gates to the Sacramento River at Ward's Landing.

Butte Slough, another branch of the Butte Creek hydrological system, begins at the Butte Slough Outfall Gates on the Sacramento River and extends east and south along the west side of the southern end of Butte Sink and the Sutter Buttes for 8 miles where it ends at the East-West Diversion Weir at the head-end of the Sutter Bypass. The East and West Borrow Canals extend from the downstream end of Butte Slough southeast along both sides of the Sutter Bypass for

approximately 30 miles. The East Borrow Canal ends at Nelson Slough, a small slough of the Feather River floodplain.

In addition to water diverted to the head of the West Borrow Canal through the Stohlman Cut, Willow, Gilsizer, and Nelson Sloughs carry water from the East Borrow Canal approximately 1 mile to the southwest to the West Borrow Canal. From the mouth of Nelson Slough, the West Borrow Canal flows south for an additional 10 miles before ending at Sacramento Slough. Sacramento Slough flows eastward for 1 mile before entering the Sacramento River just upstream of the mouth of the Feather River. The Feather River flows south 7 miles along the east side of this lower portion of the Sutter Bypass, essentially replacing the East Borrow Canal as the water conveyance structure of the Sutter Bypass.

The mean annual impaired hydrograph for Butte Creek near Chico (USGS Gauge 11390000) indicates that for the water years 1931-1994, annual flows in Butte Creek as it enters the Sacramento Valley average 288,700 acre-feet, equivalent to a mean annual flow of 398 cubic feet per second (cfs). The median monthly flow was 205 cfs. The highest daily flows occur December through March. Flows in this location are supplemented by imported water from the Feather River diverted into Butte Creek at the Centerville Powerhouse. The variance in these flows is determined by precipitation within the watershed, and is characteristic of a Mediterranean climate. Downstream of the gauge, the flow regime varies significantly from this hydrograph. In the lower 30 miles of the stream, flows are seasonally influenced by the diversion dams that divert water for agriculture and waterfowl habitat management.

The hydrology of the lower Butte Creek system varies substantially on an annual, seasonal, and daily basis. In winter and spring of wet years, the Butte Sink and Sutter Bypass is flooded most of the time. During dry periods, water flows are low or even absent from some channels. Water imported from the Sacramento and Feather Rivers substantially augments natural flows during dry years. At times, the Sacramento River rises and spills water at the Colusa and Moulton Weirs with flows that reach the Butte Sink. The Sacramento River also spills at the Tisdale Weir, through the Tisdale Bypass, and into the Sutter Bypass below the Sutter National Wildlife Refuge. These conditions occur before the Sacramento River is considered to be at flood stage; however, Butte Creek can already be at flood stage at the same time as a result of upstream inflow conditions.

The hydraulic capacity of existing waterways in the lower Butte Creek system is small in relation to the runoff associated with significant rainfall or seasonal return flow from agricultural operations. An unmanageable or uncontrollable condition exists when surface flow is so large that structures are inundated and or operational decisions cannot be made and implemented to affect the stage, rate, or direction of water flow in the system. From fall through spring, when the most significant fish migration is occurring, hydraulic conditions can change several times in a season from manageable to unmanageable. The efficiency of fish screens and ladders can be impaired during unmanageable conditions.

As Butte Creek flows from its headwaters to the Sacramento River, it becomes progressively wider, less steep, and travels over softer bed material. Butte Creek's channel in the upper canyon area is characterized by steep rocky walls and streambeds. Between Helltown and Centerville, the streambed ranges from fine cobble to siltstone. Deep pools are interspersed throughout the steep upper canyon above Centerville, whereas, the area below has a shallower gradient. The channel between Centerville and Highway 99 is composed of cobble, gravel, and sand with areas of dredge tailings. Between Highway 99 and the Sacramento River, gravels and sands are the primary streambed materials.

Meandering of Butte Creek is constrained by rocky walls in the canyon reach and by levees in the lower reaches. The section of Butte Creek below the canyon and above the levees has the greatest potential for meandering due to softer streambed materials, mining tailings, and lack of mature riparian vegetation. Average channel migration rates in this section range from about 8-11 ft per year. This section of Butte Creek, particularly between the Steel Bridge to near Durham, has had numerous flooding problems and has received considerable bank stabilization work. The National Resources Conservation Service (NRCS) installed over 3,800 ft of riprap on Butte Creek near the Parrott-Phelan Dam in 1997 and conducted two additional bank stabilization projects upstream. Several private projects were undertaken as well.

SOCIOECONOMIC CONDITIONS AND LAND USE

A diversity of topography and soils in the Butte Creek watershed has resulted in a diversity of land uses. The predominant land use in the watershed is agriculture, especially rice production, with other major land uses consisting of upland forest and residential. Current land uses and their acreage in the watershed above Butte Slough and the Sutter Bypass are estimated in Table 3. Land uses within Butte Slough and Sutter bypass are Predominantly agricultural crops and managed wetlands for waterfowl.

Land in the upper watershed is owned primarily by the U.S. Forest Service (USFS), U.S. Bureau of Land Management (BLM), and Sierra Pacific Industries (BCWP 1999). Land in the canyon reach of the watershed is primarily privately owned, with a few parcels owned by BLM and CDFG. The valley portion of the watershed is made up of primarily of private agricultural lands, with a few parcels of State and Federal ownership. Most of the residential ownership is located within, or adjacent to, the urban areas of Chico and Paradise, and the lower section of the canyon (BCWP 1999).

Table 3. Current land uses in the Butte Creek watershed (adapted from BCWP 1999). Does not include the Butte Slough or Sutter Bypass areas.

Land Use Category	Estimated Acreage	Percent of Watershed
Commercial	3,519	<1
Dry farming	2,581	<1
Field and row crops	24,168	5
Grazing	84,871	17
Irrigated pasture	1,667	<1
Industrial	1,690	<1
Miscellaneous Agriculture	27,894	5
Orchards	31,255	6
Residential	62,362	12
Rice	158,916	31
Riparian forest	2,034	<1
Upland forest	65,708	13
Unknown	59	<1
Total	509,904	100

The potential action area in the Butte Creek watershed overlaps parts of four counties: Butte County, Glenn County, Colusa County, and Sutter County. Part of the Butte Creek watershed, outside of the potential action area, overlaps a portion of Tehama County. Each county has a General Plan under which local agencies review proposals for developing their resources. Implementation measures most commonly used by the counties and incorporated cities are zoning regulations, subdivision regulations, specific plans, capital improvements, building and housing codes, environmental impact procedures, and citizen participation. All discretionary decisions regarding land use, resource management, development approvals, and environmental impact assessment must be considered by the County Board of Supervisors or City Councils in the context of their current General Plan.

The Central Valley is an important agricultural region for both California and the United States. In 1993, the 19 Central Valley counties contributed more than 60%, by value, of California's agricultural production. Agriculture is also an important employer and affects the regional economy through the expenses of farmers and transportation and processing or crops (USBR 1997c). Estimates of income from agricultural production is not available specifically for the area within the Butte Creek watershed boundary, but county estimates are useful for putting agricultural production in the four-county region into perspective (Table 4). Values of crop production can range from $200 to $1,500 or more per acre (USBR 1997c).

Table 4. Total value of crop production in Butte, Glenn, Colusa, and Sutter Counties in 1993 (adapted from USBR 1997c).

1993 County Rank	County	1993 Production ($1,000)	Percent of Total CA Value	Leading Crops
18	Sutter	292,108	1.3	Rice and seed, walnuts, peaches, prunes, tomatoes and seed
19	Butte	278,030	1.2	Almonds, rice, walnuts, prunes, kiwifruit
20	Colusa	273,518	1.2	Rice, almonds, tomato processing, wheat, rice seed
21	Glenn	249,134	1.1	Rice, almonds, dairy products, prunes, cattle and calves

AIR QUALITY AND NOISE

The Butte Creek watershed is located in the Sacramento Valley Air Basin, as designated by the California Air Resources Board. Air quality throughout the watershed is affected by a combination of air contaminants, meteorological conditions, and the topographical configuration of the valley. Atmospheric conditions such as wind speed, wind direction, and air temperature gradients interact with the physical features of the landscape to determine the movement and dispersal of air pollutants. Overall air quality in the watershed is relatively good. Air Quality problems in the valley area are primarily related to burning of rice stubble, mostly occurring in spring and fall. Burn Days and no-burn days are designated for the counties by the Air Pollution Control District in Sacramento, depending on regional weather patterns and pollutant levels, to maintain acceptable conditions. Dust from agricultural operations, such as rice driers and plowing, also contribute to air pollutants. Wildfires in the Sierra Nevada also can effect air quality, particularly during dry summers. A primary factor leading to the increases of air pollution is population growth with its associated smog produced by vehicle operation and industrial processes.

Based on noise studies in the United States and California's Central Valley, planners generally accept that a direct relationship exists between population density and associated noise levels, with less populated areas typically having a lower noise level (Table 5) (CALFED 1999c). Noise planning standards and noise control ordinances within California's Central Valley are fairly uniform, typically ranging within 5 dBA for a similar land use category. Land use categories throughout the watershed range from undeveloped rural to densely developed urban (BCWP 1999) and, therefore, associated noise levels in the watershed can be assumed to approximate those in Table 5. Most of the potential action area is rural and has relatively few noise receptors such as residences, schools, hospitals, and businesses. Potentially noisier land uses, such as industrial and commercial, and areas adjacent to transportation corridors and airports are possible.

Table 5. Noise levels correlated with land use categories ranging from undeveloped rural to urban (CALFED 1999c).

Location	Persons/km^2	L_{dn} (dBA)*
Rural		
Undeveloped	8	35
Partially developed	23	40
Suburban		
Quiet	77	45
Normal	230	50
Urban		
Normal	770	55
Noisy	2,300	60
Very noisy	7,700	65

*Average sound level for a 24-hr period expressed in decibel units on a human perception scale

CULTURAL RESOURCES

The Butte Creek watershed is located within the original territory of the Northwestern Maidu or Konkow (Ridell 1978 cited in BCWP 1999). They lived mainly in family units in small villages located along streams. Gathering and hunting occurred in nearby foothills and higher elevations. Use of salmon as food was highly significant. The arrival of Euro-Americans in the 1800s brought great changes to the area. Gold mining, ranching, logging, and crop production were the initial major industries. Hydropower was developed in the area at the turn of the century. A detailed history of these events has been documented by the BCWP (1999). These land use activities produced an abundance of roads, railroads, bridges, dams, canals, flumes, mills, levees, debris piles, residential and industrial buildings, and other infrastructure, many of which are now cultural artifacts.

RECREATION

Recreational opportunities and facilities within the Butte Creek watershed are many and vary depending on the reach of the creek. A detailed profile of these recreational resources has been prepared by the BCWP (BCWP 1999). A majority of the land within the Butte Meadows area is managed for public use. Located adjacent to the Lassen National Forest, much of this area is located in or near the Almanor Ranger District and receives Ranger District oversight. This area offers year-round recreational opportunities, including camping, hunting, fishing, hiking, horseback-riding, sightseeing, picnicking, and cross-country skiing. The Butte Creek Trail

follows the creek from Jonesville to Butte Creek House. Public campgrounds and privately developed areas provide camping sites.

In the upper canyon area, the BLM's Forks of Butte Creek Recreation Area is the only public access site for recreation. This area provides hiking, fishing, tubing, kayaking, picnicking and camping, among other activities. Farther downstream, the foothill section of the Butte Creek canyon is predominantly private land and there is little developed recreational access. The Steel Bridge and Honey Run Covered Bridge areas provide a variety of recreational opportunities.

Recreational opportunities along the valley reach of Butte Creek are also limited. A few public access sites are located here, but the predominance of private land precludes high levels of use. This reach of the creek contains several parks and wildlife areas, including Butte Creek Canyon Ecological Reserve, the Llano Seco Unit of the Sacramento National Wildlife Refuge, CDFG's Butte Basin and Gray Lodge Wildlife Areas, and park sites of the Durham Recreational Park District. The lower valley and Butte Sink contains more than 45 private hunting clubs. Like most upstream areas of the Butte Creek system, recreational access along the Butte Slough and Sutter Bypass is limited. Existing recreational opportunities include fishing, picnicking, birding, canoeing, and swimming.

Issues and concerns regarding recreational access exist for both recreationists and residents along the Butte Creek system. Resident's concerns center around disturbance, overuse, and private property trespass. Recreationists concerns include lack of access, parking, and related facilities, and conflicts with motor vehicles and incompatible recreation activities.

ENVIRONMENTAL CONSEQUENCES

VEGETATION AND WILDLIFE

NO-ACTION ALTERNATIVE

Without the Proposed Actions, vegetation and wildlife conditions for the defined assessment area would continue to decline as human populations increase. The level of habitat decline is dependent on many local land planning actions and landowner decisions. Remnant riparian areas and special habitats would continue to decline where they are under cultivation, development, or grazed. Continued encroachment into remnant riparian zones is anticipated without implementation of protection and enhancement actions. Habitat improvement actions also would be dependent on local land management decisions, and there are active local stakeholders in the area. Private actions by local stakeholders to enhance and maintain riparian areas have occurred primarily through easements. This would be expected to continue in the future, but take considerably longer than with the Proposed Actions.

PROPOSED ACTIONS

All proposed actions are designed to benefit the stream and riparian ecosystem, including vegetation and wildlife. Many of the proposed actions have potential for short-term, incidental adverse effects on vegetation and wildlife. Streambank modification, riparian revegetation, fish screen and ladder installation, fish barrier removal, and road management, would involve construction or earth disturbing activities. Implementing these actions could temporarily damage vegetation and soil substrates at construction sites, staging areas, and points of access. Changes in stream hydrology due to removal or modification of water control structures could isolate riparian vegetation from surface or groundwater supplies. Work on or near streambanks could result in temporary disturbance of streambank structure and vegetation loss. Some native vegetation could be inadvertently damaged during removal of exotic vegetation. Noise and human activity at work sites could temporarily disturb wildlife. In some cases, wildlife could be subject to injury or mortality. If fuel, pesticides, or hazardous materials are stored at construction sites, detrimental leaks or spills are possible. With implementation of the mitigative measures (Appendix B, Code VW) to minimize and compensate for adverse effects, unavoidable adverse effects should be minor and short term. Moreover, these incidental adverse effects would be outweighed by expected benefits to vegetation and wildlife.

Land conservation through easements, fee title acquisitions, set-aside agreements, and transfer of development rights would benefit vegetation and wildlife by maintaining existing biological values and protecting habitats from development and detrimental land practices. Modification or elimination of land use practices that have adverse effects on upland and riparian habitats could protect and enhance ecological values by eliminating causes of habitat degradation, preventing

future adverse effects, and enabling recovery of natural ecological processes. Land conservation could reduce further fragmentation of riparian vegetation and discourage urban encroachment into ecologically sensitive areas. Establishment of conservation lands also would provide opportunities for other proposed actions that would enhance and restore habitat values.

Revegetation with riparian species would increase riparian habitat area and improve riparian habitat values. Enhanced riparian vegetation would provide temperature-reducing shade, nutrient cycling, production of invertebrates, bank cohesion, woody debris used for ground cover, and a buffer zone to impacts from adjacent uplands, such as human disturbance and polluting urban runoff. The near-shore zone is especially important for wildlife that frequent the stream. Improved and reconnected riparian corridors would provide dispersal and migration pathways for wildlife species that cannot traverse drier or more open adjacent areas. Enhanced riparian vegetation also may improve visual aesthetics and shade, and reduce water velocities, bank shear stress, and soil erosion.

Meander belt and floodplain management could convert upland habitats to riparian habitats, but it would be a net benefit because riparian habitats are relatively scarce and provide high wildlife values. Reestablishing meander belts and widening floodplains would produce a wider corridor and greater diversity of terrestrial habitats, encourage natural regeneration of riparian vegetation and woody downfall, and help create oxbows, sloughs, and side channels. A wider floodplain also should provide greater flood management capacity and flexibility without damaging habitat. Removing structures or discouraging new structures from being built in the floodplain should provide better wildlife habitat and reduce future habitat losses.

Effects of agricultural management on adjacent wildlife habitats may be beneficial or adverse depending on its type, intensity, and duration. Modifying or eliminating land use practices that have adverse effects on aquatic and riparian habitats could protect existing ecological values, eliminate risks to habitats or continuing causes of habitat degradation, and enable recovery of natural processes. All practices proposed under agricultural management would be designed to benefit wildlife by protecting and enhancing their habitats. Proposed grazing practices would benefit riparian wildlife by reducing the crushing and trampling of vegetation, overgrazing, compaction of soils, erosion of streambanks, widening and aggrading of channels, and introduction of sediment and animal wastes into streams. Reducing excessive fuel loads would decrease the potential for unusually hot wildfires and removal of soil-stabilizing vegetation and litter. Eliminating timber management practices that disturb forest soils would similarly help maintain a stable soil surface and reduce potential for soil erosion. Potential disturbance of vegetation and soils from fence installation and provision of alternative water sources for livestock would be minor and temporary, and should be outweighed by expected benefits from fencing livestock out of riparian habitat areas.

Monitoring is designed to evaluate biological conditions and not alter them. Most adverse effects would stem from disturbance of habitat or wildlife by human activities. However, mitigation measures for monitoring vegetation and wildlife would be applied, and any remaining adverse effects from monitoring should be minor and temporary. Potential environmental effects and

mitigation measures for vegetation and wildlife are summarized in Appendix F at the end of the Environmental Consequences section.

FISHERIES AND WATER QUALITY

NO-ACTION ALTERNATIVE

Without the proposed actions, human activities such as dams, streamflow diversions, organic pollution from livestock and sewage, and siltation could result in deterioration of aquatic and riparian environments, creating conditions adverse to anadromous fish populations. Anadromous populations could decline due to migration difficulties within the watershed. Without the proposed actions, impacts to water quality may gradually worsen as human population, construction, and industry in the watershed increases.

PROPOSED ACTIONS

All proposed actions are designed to benefit the stream and riparian ecosystem, including fisheries and water quality. Mitigation measures incorporated into the actions (Appendix B, Code FWQ) would largely avoid incidental adverse effects. Nevertheless, many of the proposed actions have potential for short-term, incidental adverse effects on fisheries and water quality. Temporary adverse effects may result from actions involving instream work, including streambank modification, fish screen and ladder installation, fish barrier removal, and spawning gravel replenishment, or actions near the stream channel, such as riparian revegetation. Instream construction activities, including cofferdam construction, streambed alteration, heavy equipment movements in the streambed, and dewatering and rewatering of work sites would disturb soils and sediment and temporarily degrade water quality through turbidity and sedimentation. Changes in stream hydrology due to removal or modification of water control structures may induce altered sediment transport and deposition. Fish in all life stages would be subject to these effects, which could include siltation of salmonid spawning habitat downstream. Instream habitat structure, such as pools, riffles, and spawning gravel also may be disturbed or altered in construction areas or from changes in stream hydrology due to removal or modification of water control structures. Risks also exist for oil and grease discharges into the creek from heavy equipment within the streambed. With implementation of the mitigative measures (Appendix B, Code FWQ) to minimize and compensate for adverse effects, unavoidable adverse effects should be minor and short term. Moreover, these adverse effects should be outweighed by expected benefits to aquatic habitat.

No adverse effects would result from land conservation. Easements, fee title acquisition, set-aside agreements, and transfer of development rights would benefit fisheries and water quality by maintaining existing biological values and protecting habitats from development and detrimental land practices. Modifying or eliminating land use practices that have adverse effects on stream corridors would protect and enhance aquatic habitat by eliminating causes of aquatic habitat

degradation, preventing future adverse effects, and enabling recovery of natural ecological processes. Land conservation could reduce further fragmentation of riparian vegetation important to fish at stream edges and discourage urban encroachment into these ecologically sensitive areas. Establishment of conservation lands also would provide opportunities for other proposed actions, such as riparian revegetation, that may enhance and restore aquatic habitat values.

Removing or modifying water control structures and installing fish ladders would enable greater numbers of adult salmonids to avoid entrainment and stranding hazards and reach spawning habitats more easily. Salmonids also would be less susceptible to injuries during migration and mortality from warm water temperatures and poaching at stranding sites. New or upgraded fish screens would reduce straying and entrainment of juvenile salmonids and other fish species into water diversions during downstream migration. Spawning gravel replenishment would increase the availability and quality of spawning habitat and should improve egg hatching success. High quality spawning gravel also should improve production of aquatic invertebrates.

Modification of streambanks would improve substrates for growth of riparian vegetation, prevent excessive erosion to improve water quality, and further stabilize streambanks. Modified streambanks also could enhance near-shore cover for anadromous fish and other aquatic species. Channel and instream habitat modification may further benefit fisheries by establishing riffles, pools, and runs, and restoring the fluvial processes that maintain them. Modifications of stream channel morphology could reduce erosion and sedimentation and establish flow velocities and depths beneficial to fisheries. Instream cover created by cut banks and additions of boulders, logs, root wads and other materials would enhance cover for fish and other aquatic species.

Riparian revegetation should benefit fisheries and water quality with reduced sedimentation of streams, and increased shaded riverine aquatic habitat that would provide temperature-reducing shade, nutrient cycling, input of invertebrates used for food, woody debris used for instream cover. Improved near-shore shaded riverine aquatic habitat is especially important for young anadromous fish. Enhanced streamside vegetation would also buffer impacts from adjacent uplands, such as human disturbance and polluting urban runoff.

Reestablishing meander belts and widening floodplains would produce a wider stream corridor and greater quality and diversity of aquatic habitats to benefit fisheries and other aquatic species. A wider floodplain would encourage natural regeneration of riparian vegetation, produce more woody material for instream cover, create sources of spawning gravel, and enhance stream channel complexity, such as riffles, pools, oxbows, sloughs, and side channels. Over time, erosion and deposition on inside bends and point-bars, respectively, would result in channel migration with stream meanders gradually moving downstream. These natural processes would promote and help maintain stream channel complexity for the benefit of fisheries and the aquatic ecosystem.

Effects of agricultural management on adjacent aquatic habitats can be beneficial or adverse depending on its type, intensity, and duration. Modifying or eliminating land use practices that have adverse effects on aquatic and riparian habitats could protect existing ecological values,

remove known risks, prevent future risks, eliminate continuing causes of habitat degradation, and enable recovery of natural processes. All practices proposed under agricultural management would be designed to benefit fisheries and water quality by protecting and enhancing the aquatic ecosystem through reductions in pesticide, herbicide, and chemical use, and restrictions on discing, burning, mowing, and other manipulations where they have adverse effects. Proposed grazing practices would benefit fisheries and water quality by reducing damage to riparian zones, erosion of streambanks, widening and aggrading of channels, and introduction of sediment and animal wastes into streams. Reducing excessive fuel loads would decrease the potential for sedimentation of aquatic habitat from unusually hot wildfires that remove soil-stabilizing vegetation and litter. Eliminating timber management practices that disturb forest soils would similarly help maintain a stable soil surface and reduce potential for soil erosion and sedimentation. Potential adverse effects from fencing, such as steam sedimentation, would be minor and temporary, and should be outweighed by expected benefits from fencing livestock out of sensitive habitat areas.

Monitoring is designed to evaluate biological conditions and not alter them. Most adverse effects would stem from disturbance by human activities. However, mitigation measures for monitoring fisheries and water quality would be applied, and any remaining adverse effects due to monitoring should be minor and temporary. Potential environmental effects and mitigation and conservation measures for fisheries and water quality are summarized in Appendix F at the end of the Environmental Consequences section. Adverse effects from monitoring would be negligible.

SPECIAL STATUS SPECIES

NO-ACTION ALTERNATIVE

Attempts by Federal and State programs to increase the natural production of anadromous salmonids in the Butte Creek watershed and Central Valley would be hindered by the No-Action Alternative. The existing conditions of spawning gravel, riparian habitat, and fish passage would continue to degrade and adversely affect populations of spring- and fall-run chinook salmon and Central Valley steelhead trout. In addition, this alternative would not provide any short- or long-term benefits to other special status species associated with the aquatic/riparian ecosystem.

PROPOSED ACTIONS

Measures have been incorporated in the proposed actions to avoid and minimize adverse effects on each species (Appendix B, Code SS). Potential effects on special status species are described below and summarized in Appendix F at the end of the Environmental Consequences section. Conditions under which site-specific actions would likely have no adverse affect on the species, and under which consultation with the Service would be required are identified. Each action proposed at the site-specific level will review potential effects on federally-listed species. When

an action proponent proposes that an action is not likely to adversely affect listed species, the action proponent will request concurrence from the Service and NMFS.

Aleutian Canada goose. Impacts to Aleutian Canada geese will be avoided by restricting construction activities that could disturb the birds during their normal wintering and migration period (October 1 to May 14). Some actions may benefit this species by implementing land use practices that would protect resting and foraging habitat. Therefore, Aleutian Canada geese are not likely to be adversely affected by the proposed actions.

Bald eagle. Resting sites for migrating bald eagles will not be impacted because mature trees will not be removed or altered. Construction near nesting sites will be avoided from January 15 to July 31 and provide 0.5 mile buffer protection. The new trees and increased prey base that are expected on enhanced and protected habitats should benefit bald eagles and other birds of prey, especially during the migration periods. Therefore, bald eagles are not likely to be adversely affected by the proposed actions.

American peregrine falcon. On August 25, 1999, the Service removed the American peregrine falcon from the Federal list of endangered species. However, continued recovery of the peregrine falcon is partially dependent upon Federal agencies continuing to carry out actions that benefit the species. In addition, the American peregrine falcon must be monitored for a five-year period, from the date of delisting, to ensure that it does not decline appreciably, necessitating our need to relist the species under the Act. Proposed actions will treat the peregrine falcon as a listed species with respect to applying conservation measures during implementation of actions. Resting sites for migrating American peregrine falcons will not be impacted because mature trees will not be removed or altered. Construction near nesting sites will be avoided from January 15 to July 31 and provide 0.5 mile buffer protection. The new trees and enhanced prey base that are expected on enhanced and protected habitat should benefit peregrine falcons and other birds of prey, especially during the migration periods. Therefore, peregrine falcons are not likely to be adversely affected by the proposed actions.

California red-legged frog. Suitable habitats, such as emergent aquatic vegetation, will be avoided to the extent possible, as described by avoidance measures incorporated into proposed actions. Avoidance of these habitats should protect red-legged frogs from movements and operation of construction equipment, construction activities, and loss of habitat. If suitable habitat of red-legged frogs cannot be avoided at a specific site, the Service will be consulted. Because avoidance measures will be applied to each project site, no cumulative effects on red-legged frogs should occur. Increases in stream and riparian habitat quality, such as overhanging willows and emergent aquatic vegetation, are expected to benefit red-legged frogs and other special-status species using these habitats, such as the tiger salamander, northwestern pond turtle, foothill yellow-legged frog, and spadefoot toad. Proposed actions that implement all avoidance measures are not likely to adversely affect red-legged frogs.

Giant garter snake. Suitable habitats of giant garter snakes will be avoided to the extent possible, as described by avoidance measures incorporated into proposed actions. Avoidance of these

habitats, such as limiting earthwork activities between May 1 and October 1, should protect giant garter snakes from movements and operation of construction equipment, construction activities, and loss of habitat. If giant garter snake habitat cannot be avoided at a specific site, the Service will be consulted. Because avoidance measures will be applied to each project site, no cumulative effects on giant garter snakes should occur. Enhancements to the riparian zone and increased riparian habitat protection are expected to benefit VELB and other special-status species using these habitats, such as the tiger salamander, northwestern pond turtle, foothill yellow-legged frog, and spadefoot toad. Proposed actions that implement all avoidance measures are not likely to adversely affect giant garter snakes.

Valley elderberry longhorn beetle (VELB). Impacts to elderberry plants will be avoided to the extent possible, as described by avoidance measures incorporated into proposed actions. Avoidance of these habitats should protect elderberry plants from movements and operation of construction equipment, construction activities, and loss of habitat. If elderberry plants may be impacted at a specific site, the Service will be consulted. Because avoidance measures will be applied to each project site, no cumulative effects on VELB should occur. Enhancements to the riparian zone and increased riparian habitat protection are expected to benefit VELB and other special-status species using these habitats, such as the tiger salamander, northwestern pond turtle, foothill yellow-legged frog, and spadefoot toad. Proposed actions that implement all avoidance measures are not likely to adversely affect VELB.

Vernal pool shrimp. Impacts to Conservancy fairy shrimp, vernal pool fairy shrimp, and vernal pool tadpole shrimp will be avoided to the extent possible, as described by avoidance measures incorporated into proposed actions. Avoidance of vernal pools should protect the shrimp from movements and operation of construction equipment, construction activities, and loss of habitat. If vernal pools may be impacted at a specific site, the Service will be consulted. Because avoidance measures will be applied to each project site, no cumulative effects on vernal pool shrimp should occur. Some actions may benefit vernal pool shrimp by implementing land use practices that would protect vernal pool habitat. Proposed actions that implement all avoidance measures are not likely to adversely affect vernal pool shrimp.

Vernal pool plants. Impacts to Green's tuctoria, Hoover's spurge, hairy orcutt grass, and slender orcutt grass will be avoided to the extent possible, as described by avoidance measures incorporated into proposed actions. Avoidance of vernal pool plants should protect the plants from movements and operation of construction equipment, construction activities, and loss of habitat. If vernal pool plants may be impacted at a specific site, the Service will be consulted. Because avoidance measures will be applied to each project site, no cumulative effects on vernal pool plants should occur. Some actions may benefit vernal pool plants by implementing land use practices that would protect vernal pool habitat. Proposed actions that implement all avoidance measures are not likely to adversely affect vernal pool plants.

Chinook salmon (all runs) and Central Valley steelhead trout. Impacts to spring-, fall-, and late fall-run chinook salmon and Central Valley steelhead trout will be largely avoided by limiting construction affecting the stream channels to periods when the fish are at their lowest abundance

(June 15-October 15), and by other conservation measures incorporated into proposed actions. Winter-run chinook salmon that may be present in Butte Sink, Butte Slough, and Sutter Bypass would also be largely avoided with the June 15-October 15 construction window. Some construction activities could cause incidental adverse effects , but these should be temporary and minimal due to incorporated mitigation and conservation measures. For example, instream habitat, such as pools, riffles, and spawning gravel could be disturbed or altered in the construction areas. Other construction activities, such as cofferdam construction and associated streambed alteration, would result in soil disturbance leading to temporary water quality degradation from sedimentation and increased turbidity at, and downstream of, the construction sites. However, spawning and incubation for fall- and late-fall-run chinook salmon and steelhead trout occurs outside of the June 15-October 15 construction window and, therefore, spawning and incubation should not be affected. Spring-run holding, spawning, and incubation generally occurs in the canyon upstream of the Parrott-Phelan Dam, above the portions of Butte Creek where most potential instream work would occur. Most spring-run will have passed upstream of construction areas prior to the construction window. Winter-run chinook salmon are not known to spawn in the Butte Creek watershed. Any new diversions will be screened per CDFG and NMFS criteria. Additional adverse effects on fisheries, that may apply to special status salmonids, are described under Fisheries and Water Quality.

The potential benefits to chinook salmon and steelhead trout should outweigh any incidental, short-term adverse effects. Expected benefits include, but are not limited to, improved fish passage, enhanced spawning and rearing habitats, and increased juvenile survival. A discussion of additional fisheries benefits that may apply to special status salmonids is provided under Fisheries and Water Quality. Proposed actions that implement all avoidance measures are not likely to adversely affect listed salmonids.

Delta smelt. Delta smelt do not occur in the watershed and will not be directly affected by the proposed actions. Potential indirect effects, such as changes in flows to the Delta, also will not occur because proposed actions will not noticeably alter hydrology of the Sacramento River. Therefore, Delta smelt are not likely to be adversely affected by the proposed actions.

Sacramento splittail.
Impacts to Sacramento splittail will be avoided to the extent possible, as described by avoidance measures incorporated into proposed actions, including avoidance of shallow water with submerged vegetation during the March through May spawning period. Passage at construction sites will be provided at all times in areas where splittail occur. Changes in timing and quantity of watershed flows into the Sacramento River will be insignificant. Other potential adverse effects on splittail and associated conservation measures are described under Fisheries and Water Quality. Because avoidance measures will be applied to each project site, no cumulative effects on the Sacramento splittail should occur. Enhancements to the riparian zone and increased riparian habitat protection are expected to benefit splittail and other special-status species using these habitats. Proposed actions that implement all avoidance measures are not likely to adversely affect Sacramento splittail.

Western yellow-billed cuckoo. Impacts to riparian forest habitat will be avoided to the extent possible, as described by avoidance measures incorporated into proposed actions. Avoidance of these habitats should protect yellow-billed cuckoos from construction activities and loss of habitat. If habitat suitable for yellow-billed cuckoos cannot be avoided at a specific site, CDFG will be consulted. Because avoidance measures will be applied to each project site, no cumulative effects on yellow-billed cuckoos should occur. Enhancements to the riparian zone and increased riparian habitat protection may benefit yellow-billed cuckoos and other special-status species using riparian habitats.

Bank swallow. Impacts to soil banks suitable for bank swallow nesting will be avoided to the extent possible, as described by avoidance measures incorporated into proposed actions. Avoidance of these habitats should protect bank swallows from construction activities and loss of habitat. If habitat suitable for bank swallows cannot be avoided at a specific site, CDFG will be consulted. Because avoidance measures will be applied to each project site, no cumulative effects on bank swallows should occur. Enhancements to the riparian zone and increased riparian habitat protection may benefit bank swallows and other special-status species using soil banks, such as belted kingfishers and barn owls.

Swainson's hawk Nesting and resting sites for Swainson's hawks will not be impacted because mature trees will not be removed or altered. Construction near nesting sites will be avoided from March 1 to July 31 and provide 0.5 mile buffer protection. New riparian habitat created by implemented actions may enhance the prey base to the benefit Swainson's hawks and other birds of prey.

HYDROLOGY AND STREAM CHANNEL

NO-ACTION ALTERNATIVE

Without the proposed actions the hydrology of the area may continue relatively unchanged. Additional diversions of water from the system may be necessary to supply water to a growing human population in the watershed. The stream channel would likely continue to be degraded by additions of riprap, maintenance of levees, and use disturbance by livestock and other agricultural practices.

PROPOSED ACTIONS

Many of the proposed actions, such as fish passage, fish screens, spawning gravel replenishment, channel and instream habitat modification, meander belt and floodplain management, and streambank modification, would directly alter the stream channel and affect stream hydrology.

However, all such modifications would be designed to enhance hydrological and fluvial processes. Mitigative measures incorporated into proposed actions for hydrology and stream channel (Appendix B, Code HSC) would help ensure that any adverse effects are avoided or minimized. Minimal and temporary effects on hydrology would occur during instream construction for installation or repair of fish screens and ladders, and for removal or modification of fish barriers. Actions would be designed and implemented to preserve or enhance groundwater hydrology and flood capacity, but instream flow would be temporarily redirected if cofferdams are needed. Placement of spawning gravel could increase the wetted area of streams due to displacement of water, but should not adversely affect hydrology or streambanks. Distribution of instream flows, water elevations, and fluvial processes could be permanently altered by adding, modifying, or removing water control structures, reconfiguring the channel, adding materials for fish cover, or modifying streambanks; however, by design, effects on fluvial functions should be beneficial.

Removing or setting back levees could alter hydrology and fluvial processes by widening constricted channels, but should create a more natural and stable state. The widened floodplain would be designed to benefit the stream channel by decreasing the speed of flood waters and increasing flood flow and storage capacity. Another benefit would be an increased wetted area and time period in which to recharge groundwater. Revegetation associated with stream channels would not be allowed to interfere with passage or storage of flood waters. Agricultural management, road management, and monitoring are not expected to produce adverse effects. Potential environmental effects and corresponding mitigation measures for hydrology and stream channel are summarized in Appendix F at the end of the Environmental Consequences section.

AIR QUALITY AND NOISE

NO-ACTION ALTERNATIVE

Without the proposed actions the air quality for the area would not be affected except for actions which take place under existing permits. Air quality and noise may gradually worsen as population, construction, and industry in the watershed increase.

PROPOSED ACTIONS

The proposed actions may cause short-term impacts on air quality. Impacts on air quality would include dust/particulate generation from hauling supplies (fill, topsoil, and gravel), earthwork activities, and combustion emissions (nitrogen oxide, carbon monoxide, and ozone) resulting from operating construction equipment and hauling trucks. However, mitigative measures for air quality have been incorporated into proposed actions (Appendix B, Code AQN). With these measures, air emissions are anticipated to fall within the levels existing in the project zone. Most proposed actions would occur within rural areas with few noise receptors. Noise levels would be expected to increase from construction activities and construction equipment operation, such as trucks on haul roads and earth-moving equipment and electrical generators at construction sites.

Given mitigation measures for noise incorporated into proposed actions (Appendix B, Code AQN), adverse effects from noise are not anticipated. Potential environmental effects and corresponding mitigation measures for air quality and noise are summarized in Appendix F at the end of the Environmental Consequences section.

CULTURAL RESOURCES

NO-ACTION ALTERNATIVE

With the No-Action Alternative no cultural resources would be impacted.

PROPOSED ACTIONS

The diversity and scope of the proposed actions have the potential to disturb both exposed and buried cultural resources. Mitigative measures incorporated into proposed actions (Appendix B, Code CR) for cultural resources, including compliance with the Programmatic Agreement between the Service, the Advisory Council on Historic Preservation, and the California State Historic Preservation Officer (SHPO), will be exercised at site-specific project levels to avoid adverse effects. Activities that have negligible potential to affect historic properties include Planting, pruning, vegetative removals without surface disturbances, herbicide application, mowing, discing within plow zones, and fencing. After review of proposals by a Service Historic Preservation Specialist (Specialist), these actions may not require further compliance to protect cultural resources.

Projects that have potential to affect historic properties, such as recontouring, excavations, and culvert modifications would require review by a Specialist, and may require on-site surveys. These projects would be deemed to have no adverse effects and could proceed without further need for formal cultural resource consultation if the Specialist does not find any major cultural resources. If the Specialist determined that a project was outside the scope of the Agreement, a proposed action would follow the standard process for Section 106 of the National Historic Preservation Act, with review by SHPO, before proceeding to ensure that cultural resources are protected. Appropriate consultations would be conducted for any significant cultural resource sites to ensure proper mitigation, as needed. If human remains are found, the county coroner, the California Native American Heritage Commission, and the Service's Regional Archaeologist will be contacted. Because projects would go forward only upon compliance with these protocols, adverse effects to cultural resources are not expected for any proposed action. Potential environmental effects and corresponding mitigation measures for cultural resources are summarized in Appendix F at the end of the Environmental Consequences section.

SOCIOECONOMIC CONDITIONS AND LAND USE

NO-ACTION ALTERNATIVE

Land use in the watershed would probably see some shift from agricultural uses to more intensive urban uses as a result of human population increases. The socioeconomic base would consequently shift a small degree from agriculture toward the municipal and industrial side. Land uses may face greater development restrictions in some areas due to conflicts with fish and wildlife habitats, including threatened and endangered species.

PROPOSED ACTIONS

Land conservation, meander belt and floodplain management, riparian revegetation, and agricultural management actions could adversely affect agricultural production and tax revenue in Butte, Glenn, Colusa, and Sutter Counties. Land types and acreage eligible for land conservation, meander belt and floodplain management, riparian revegetation, and agricultural management actions in Butte, Glenn, Colusa, and Sutter Counties are estimated in Tables 6-9, respectively. Eligible acreage of different land types is relatively small. For agricultural land types, estimated eligible acreage is less than 1.0 percent of the total area of the land types within the respective counties (Tables 6-9). These estimates only represent land eligibility as described under the Action Descriptions section of this document, and do not imply that all of the acreage would be proposed for site-specific actions. Amounts proposed for actions would likely be less.

In affected areas, agricultural productivity and income to the local economy could be reduced by restricting agricultural practices or replacing agricultural land with riparian or upland habitat types. Values of associated lands could decline due to lessened agricultural potential, which would reduce county property tax revenue. Restrictions on land development could preclude future increased tax valuations of the land. However, County tax revenue on fee title lands acquired by the Service or with Service funding could be reduced if the annual payments to counties under the Refuge Revenue Sharing Act were insufficient and Congress does not appropriate supplemental payments. The authorized revenue sharing rate paid to local jurisdictions during Federal fiscal years 1972 to 1997 averaged 80.6%.

Reduced tax revenue may be partially offset for lands acquired by the Service if the lands are enroled in Williamson Act contracts, as tax rates under these contracts are based on agricultural use rather than market value, and would no longer apply. Costs to counties and landowners for

Table 6. Total estimated acres of land use types[1] within a 600-ft-wide corridor (300 feet from each bank) along Butte Creek in Butte County[2] from the Lassen National Forest border downstream to the border of Sutter County, compared to total estimated acres within Butte County.

Land Use Type[3]	Corridor Total	Butte County Total	Percent of County Total
Seasonally and Permanently Flooded Agriculture	380	107,723	0.35
Nonflooded Agriculture	494	54,359	0.91
Orchard/Vineyard	152	61,903	0.25
Grassland	144	82,582	0.17
Palustrine	77	11,090	0.69
Riparian Woody	177	7,390	2.40
Nonriparian Woody	167	9,972	1.68
Blue Oak/Foothill Pine	150	132,837	0.11
Mixed Chaparral	163	10,225	1.60
Ponderosa Pine	722	128,052	0.56
Sierra Mixed Conifer	748	224,565	0.33
Barren	47	17,983	0.26
Other	47	10,144	0.46

[1]Source: CDFG et al. 1997; California Gap Analysis 1998. Acreage for land use types was calculated from satellite imagery and should be considered approximate. Because classification of land use types from satellite imagery is approximate, some minor land use types may be missing, and acreage for others may be somewhat over or under represented.

[2]Where Butte Creek separates Butte County from Glenn and Colusa Counties, only the Butte County side of the creek is included.

[3]Seasonally and Permanently Flooded Agriculture is primarily Rice; Nonflooded Agriculture is primarily row crops and other nonflooded types; Orchard/Vineyard is primarily almonds, walnuts, and other types; Grassland is managed and natural grasslands; Riparian Woody is primarily riparian forest and scrub; Palustrine is primarily seasonally- and permanently flooded emergent wetland; Blue Oak Woodland and Blue Oak/Foothill Pine is primarily used for grazing and open space; Nonriparian Woody is primarily shrubs and trees not included in the Riparian Woody class, including significantly wooded residential areas; Barren is primarily exposed soil, including plowed fields at the time of satellite imagery; Other is primarily human developed areas and paved surfaces.

Table 7. Total estimated acres of land use types[1] within a 300-ft-wide corridor[2] along Butte Creek in Glenn County from the Glenn County border downstream to the border of Colusa County, compared to total estimated acres within Glenn County.

Land Use Type[3]	Corridor Total	Glenn County Total	Percent of County Total
Seasonally and Permanently Flooded Agriculture	252	77,869	0.32
Nonflooded Agriculture	124	107,039	0.12
Grassland	37	62,711	0.06
Palustrine	41	5,675	0.72
Riparian Woody	74	3,640	2.00

[1]Source: CDFG et al. 1997; California Gap Analysis 1998. Acreage for land use types was calculated from satellite imagery and should be considered approximate. Because classification of land use types from satellite imagery is approximate, some minor land use types may be missing, and acreage for others may be somewhat over or under represented.

[2]Because Butte Creek separates Glenn County from Butte County, only the Glenn County side of the creek is included.

[3]Seasonally and Permanently Flooded Agriculture is primarily Rice; Nonflooded Agriculture is primarily row crops and other nonflooded types; Grassland is managed and natural grasslands; Riparian Woody is primarily riparian forest and scrub; Palustrine is primarily seasonally- and permanently flooded emergent wetland.

Table 8. Total estimated acres of land use types[1] within a 300-ft-wide corridor[2] along Butte Creek in Colusa County from the Colusa County border downstream to the confluence with the Sacramento River, compared to total estimated acres within Colusa County.

Land Use Type[3]	Corridor Total	Colusa County Total	Percent of County Total
Seasonally and Permanently Flooded Agriculture	191	139,714	0.14
Nonflooded Agriculture	19	89,588	0.02
Grassland	11	59,520	0.02
Palustrine	206	16,716	1.23
Riparian Woody	133	3,144	4.23
Barren	14	73,035	0.02

[1]Source: CDFG et al. 1997; California Gap Analysis 1998. Acreage for land use types was calculated from satellite imagery and should be considered approximate. Because classification of land use types from satellite imagery is approximate, some minor land use types may be missing, and acreage for others may be somewhat over or under represented.

[2]Because Butte Creek separates Colusa County from Butte and Sutter Counties, only the Colusa County side of the creek is included.

[3]Seasonally and Permanently Flooded Agriculture is primarily Rice; Nonflooded Agriculture is primarily row crops and other nonflooded types; Grassland is managed and natural grasslands; Riparian Woody is primarily riparian forest and scrub; Palustrine is primarily seasonally- and permanently flooded emergent wetland; Barren is primarily exposed soil, including plowed fields at the time of satellite imagery.

Table 9. Total estimated acres of land use types[1] within a 300-ft-wide corridor[2] along Butte Creek in Sutter County from the Sutter County border downstream to the confluence with the Sacramento River, and a 600-ft-wide corridor[3] along Butte Slough downstream through the East and West Borrow Canals to Nelson Slough, compared to total estimated acres within Sutter County.

Land Use Type[4]	Corridor Total	Sutter County Total	Percent of County Total
Seasonally and Permanently Flooded Agriculture	507	145,280	0.35
Nonflooded Agriculture	161	82,748	0.20
Orchard/Vineyard	73	29,291	0.25
Grassland	207	54,743	0.38
Palustrine	329	8,703	3.78
Riparian Woody	442	3,431	12.88
Nonriparian Woody	245	11,206	2.19
Barren	148	40,712	0.36

[1]Source: CDFG et al. 1997; California Gap Analysis 1998. Acreage for land use types was calculated from satellite imagery and should be considered approximate. Because classification of land use types from satellite imagery is approximate, some minor land use types may be missing, and acreage for others may be somewhat over or under represented.

[2]Because Butte Creek separates Sutter County from Colusa County, only the Sutter County side of the creek is included.

[3]Where Butte Slough divides into the East and West Borrow Canals, only one side the canals, the sides toward the center of the Sutter Bypass, were included, as the other sides are obstructed by levees.

[4]Seasonally and Permanently Flooded Agriculture is primarily Rice; Nonflooded Agriculture is primarily row crops and other nonflooded types; Grassland is managed and natural grasslands; Riparian Woody is primarily riparian forest and scrub; Palustrine is primarily seasonally- and permanently flooded emergent wetland; Nonriparian Woody is primarily shrubs and trees not included in the Riparian Woody class, including significantly wooded residential areas; Barren is primarily exposed soil, including plowed fields at the time of satellite imagery.

flood control maintenance and damage from floods could be reduced by restoring meander belts and widening the floodplain to more easily accommodate flood waters.

Landowners would not be adversely affected, as land conservation and floodplain management would be implemented on a willing seller basis, and landowners would be paid fair market value for land, restricted land uses, or agricultural productivity due to flooding. However, operation and maintenance expenses for constructed facilities generally would be the responsibility of facility owners. Because property taxes and assessments on lands under conservation and flood easements would continue to be paid by landowners, reduced land values could benefit land owners by reducing the taxes and assessments. Other possible tax benefits to landowners include reduced income and capital gains taxes. Easements also can reduce estate taxes when land is passed on to heirs, as restrictions on property development would continue to reduce the property's market value. Gift easements may qualify for tax deductions if the easements meet Federal tax code requirements.

The proposed actions would benefit salmonid survival and recovery and the increased salmon and steelhead production should have economic and community benefits in terms of recreation and aesthetics. Benefits to the riparian ecosystem are further described under the effects of other actions that may be implemented in conjunction with the Land Conservation action. Construction activities for proposed actions would have a beneficial effect on the local economy, as local contractors would be hired to the extent practicable. Removing structures or discouraging new structures from being built in the floodplain should reduce flood damage and associated costs. Reducing the potential for wildfires through fuel wood reduction could help prevent loss of existing structures and harvestable timber. Potential environmental effects and corresponding mitigation measures for socioeconomic conditions are summarized in Appendix F at the end of the Environmental Consequences section.

RECREATION

NO-ACTION ALTERNATIVE

Without the proposed actions the recreational opportunities would not change.

PROPOSED ACTIONS

Much of the area that may be affected is privately owned, and recreational activities on privately-owned lands are limited. Short-term effects on recreational opportunities at public access sites are possible due to construction activities. Construction sites may create short-term public safety concerns for recreationists such as kayakers, canoeists, hikers, and anglers. Fish ladders can pose a danger to swimmers who may get caught in the underwater ports when surfing down the ladders. Mitigative measures for recreation incorporated into proposed actions (Appendix B, Code R) should avoid or minimize adverse effects. The Proposed Actions will contribute to the

long-term goal of restoring and enhancing the watershed environment. Long-term effects of these actions would improve salmonid populations and riparian vegetation, which would increase recreational opportunities and enjoyment. Increased tourism and recreation would have a positive impact on the associated retail sales and service industries. However, because public access to the creek is limited by private property, these benefits would be limited. Potential environmental effects and corresponding mitigation measures for recreation are summarized in Appendix F at the end of the Environmental Consequences section.

CUMULATIVE EFFECTS

Cumulative effects are the effects on the environment that result from the incremental accumulation of past, present and reasonably foreseeable future actions undertaken by the same or other agencies or persons. Cumulative effects can result if an action's effects, together with the effects of other similar actions, are cumulatively substantial. In the case of a multi-action program, cumulative effects can occur from both the sum of action effects within the program (i.e., the Proposed Actions), and from the sum of the program's effects with the effects of other related programs.

PROPOSED ACTIONS

The Proposed Actions constitute an ecosystem-level approach that considers the physical environment, biological environment, and human environment. Development of the Proposed Actions evaluated the watershed as a whole, recognizing the interdependencies of stream hydrology, sedimentation, riparian vegetation, aquatic and terrestrial wildlife (including rare and sensitive species), and human-induced influences. Therefore, other aspects of the human environment, in addition to anadromous fish, would benefit from restoration actions.

Proposed actions would generally be implemented in a phased approach as site-specific needs are identified, designs are completed, funding is acquired, and site-specific environmental compliance is completed. The use of adaptive management would also tend to spread implementation of approved actions over time as results of previously implemented actions are monitored and additional needs for action are determined. Because only a few of the actions would likely be implemented in any one year and all actions would incorporate mitigation and conservation measures, the temporary and minor adverse effects that may occur at construction sites would not be expected to substantially accumulate throughout the watershed.

Cumulative actions to improve stream corridor habitats throughout the watershed are expected to provide long-term benefits to associated vegetation and wildlife. These improvements, such as restoration of habitat continuity in the riparian corridor, would contribute to the goals of several plans and programs for restoration of the watershed ecosystem. However, because vegetation communities and wildlife habitats within the Butte Creek watershed have been substantially modified to suit human land uses, and will likely continue to be modified as human populations increase, cumulative benefits from proposed actions would not be substantial relative to the No-Action Alternative. Habitat enhancements within the Butte Creek watershed would contribute towards the goals of several Central Valley-wide programs for protecting, enhancing, and restoring riparian habitats within the overall Central Valley, but relative to the magnitude of restoration needs in the Central Valley, effects of Butte Creek actions over the 10-year implementation period would not be substantial.

The proposed actions considered together would be expected to improve fish passage and instream habitat and contribute toward AFRP and State goals (USFWS 1995c and California Resources Agency 1989, respectively) for doubling populations of salmon and steelhead trout. However the magnitude of fisheries restoration actions needed throughout the Central Valley is substantial and the effects of Butte Creek actions would be relatively minor. Anadromous fish are migratory and many factors outside of the watershed (e.g., environmental conditions in the Sacramento River, Delta, and San Francisco Bay; and ocean harvests) affect their numbers. In addition, habitat needs within the watershed that are outside the scope of the Proposed Actions (e.g., water acquisition for instream flows and water temperature management) may continue to impact anadromous fish, and activities in the watershed that degrade fisheries habitat likely will continue as human populations increase. Therefore, cumulative net benefits in the watershed due to Proposed Actions implemented over a 10-year implementation period may not be substantial relative to the No-Action Alternative. Because multiple factors determine population levels and populations are naturally cyclic, monitoring and adaptive management over time would be required to estimate the magnitude of benefits from the Proposed Actions.

Agricultural land conversions to riparian and other native habitats could accumulate and reduce County tax revenue. However land conversion acreage would be small relative to the total acreage of the land types in Butte, Glenn, Colusa, and Sutter Counties (less than 1.0 percent) (Tables 6-9, respectively). No accumulation of adverse effects to landowners is anticipated.

RELATED ACTIVITIES

The following programs would have effects similar to the Proposed Actions. However, because the objectives and probable actions of these programs are similar to those of the Proposed Actions, their effects would overlap with those identified for the Proposed Actions. The combination of these activities with the Proposed Actions would not be expected to substantially increase the overall cumulative effects beyond those identified for the Proposed Actions.

Stakeholder Watershed Management Plans

The BCWC/BCWP is developing a watershed management strategy plan to identify and resolve watershed management problems. Similarly, the LBCP is developing alternatives to improve fish passage and maintain the viability of commercial agriculture, managed private habitats, managed government lands, and other habitats. Like the other programs, these programs share a concern for protecting, enhancing, and restoring aquatic and riparian habitats, while maintaining landowner rights and multiple use of land and water. Actions proposed for implementation would likely be consistent with CALFED's Ecosystem Restoration Program Plan, the Service's AFRP Plan, and other Federal and State restoration programs.

CVPIA Anadromous Fish Restoration Program

Section 3406(b)(1) of the Central Valley Project Improvement Act (CVPIA) (P.L. 101-575) requires the Secretary of the Interior; in consultation with other State and Federal agencies, Indian tribes, and affected interests; to "develop within three years of enactment and implement a program which makes all reasonable efforts to ensure that, by the year 2002, natural production of anadromous fish in Central Valley rivers and streams will be sustainable, on a long-term basis, at levels not less than twice the average levels attained during the period of 1967-1991..." Section 3406(b)(1)(A) requires that the program "give first priority to measures which protect and restore natural channel and riparian habitat values through habitat restoration actions ..." This program, called the Anadromous Fish Restoration Program (AFRP), produced a draft Restoration Plan in 1995, which was revised in 1997. The Proposed Actions in this PEA are consistent with the AFRP Plan's recommendations for Butte Creek (USFWS 1997a). As of 1998, AFRP actions on Butte Creek have included two land acquisitions for riparian habitat restoration; construction of fish screens and ladders at two diversion dams; monitoring studies for instream flows and temperatures; studies on fish habitat availability and use; initiation of a fluvial geomorphology study; life history and monitoring studies for spring-run chinook salmon; studies for fish passage in the Lower Butte Creek, Butte Slough, and Sutter Bypass areas; and initiation of a Watershed Management Study. The AFRP will likely fund additional projects on Butte Creek in the future.

CVPIA Anadromous Fish Screen Program

The CVPIA [Section 3406(b)(21)] Anadromous Fish screen Program is targeted at anadromous fish entrainment reductions through screening unscreened diversions and upgrading inadequate fish screens throughout the State. This activity is designed to reduce anadromous fish losses at water diversion sites. Reducing entrainment losses has the potential to increase populations by reducing juvenile fish take. As of 1998, actions of Anadromous Fish screen Program on Butte Creek include removal of 4 diversion dams at three sites, construction of fish screens and ladders at 2 diversion dams, acquisition of water rights to supplement instream flows for fish, and consolidation of 12 unscreened diversions and construction of a siphon to improve fish passage.

CVPIA and CDFG Anadromous Fish Spawning Gravel Programs

The CVPIA [Section 3406(b)(13)] and CDFG anadromous fish gravel replacement efforts are designed to improve and expand potential spawning and rearing habitats to increase population levels. The CVPIA program is focused on spawning habitats on the Sacramento River below Keswick Dam, American River below Nimbus Dam, and Stanislaus River below Goodwin Dam.

DOI Water Acquisition Program

The Department of the Interior Water Acquisition Program under CVPIA sections 3406(b)(3) and 3406(d)(2) is targeted at providing level 4 refuge water supplies and supplementing instream flows. The program acquires water from willing sellers to augment instream flows and provide level 4 supplies to refuges throughout the State. Additionally, the AFRP is implementing actions in the Delta designed to improve anadromous salmonid habitat and survival as fish leave the tributaries and migrate through the mainstem San Joaquin River and the Delta. The water acquisition program has studied the hydrology and water rights of the Butte Creek and other Central Valley watersheds, and may take action to acquire, on a willing-seller basis, short-term, long-term, or permanent water to supplement instream flows for fish in Butte Creek and other Central Valley streams.

CVPIA Dedication and Management of 800 TAF of CVP Yield

The CVPIA [Section 3406(b)(2)] directive to dedicate and manage 800,000 Acre-feet of CVP yield has the primary purpose of implementing the fish, wildlife, and habitat restoration measures identified in the CVPIA. It is unlikely that actions taken under this directive would directly affect the Butte Creek watershed.

CALFED Bay-Delta Ecosystem Restoration Program Plan

The mission of the CALFED Bay-Delta Program is to develop a long-term comprehensive plan that will restore ecosystem health and improve water management for beneficial uses of the Bay-Delta system. CALFED's goal for ecosystem quality is to improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species. The CALFED Ecosystem Restoration Program Plan (ERPP) addresses this goal. The foundation of the program is restoration of ecological processes that are associated with streamflow, stream channels, watersheds, and floodplains. Additionally, the program aims to reduce the effects of stressors that inhibit ecological processes, habitats, and species. ERPP actions on Butte Creek would likely address fish passage in lower Butte Creek, Butte Slough, and Sutter Bypass, acquisition of supplemental water from willing sellers to facilitate fish migration, development of substitute water supplies to reduce Butte Creek diversions, improvement of water quality and temperature, and preservation and restoration of riparian habitat.

Upper Sacramento River Fisheries and Riparian Habitat Management Plan

To help reverse trends of declining salmon runs and loss of riparian habitat in the upper Sacramento River system, Senate Bill 1086 was passed into law in 1986. This law established an advisory Council representing a wide range of Federal, State, and local agencies and private interests, and required the Council to develop a plan to establish a series of priority actions for the upper Sacramento River and its tributaries between the Feather River and Keswick Dam. The

plan, completed in 1989, describes specific actions to help restore the Sacramento River fishery to its optimum state and protect and restore riparian habitat. The plan is consistent with and complementary to Senate Bill 2261; the Salmon, Steelhead Trout, and Anadromous Fisheries Program Act of 1988; which has the goal of doubling "... the current natural production of salmon and steelhead trout resources..." by the end of the century.

Restoring Central Valley Streams: A Plan For Action

The specific goals of this plan developed by CDFG in 1993 are to restore and protect California's aquatic ecosystems that support fish and wildlife, and to protect threatened and endangered species. These goals were presented in Governor Pete Wilson's April 1992 water policy statement, and incorporate the State-legislated mandate and policy to double populations of anadromous fish in California (Senate Bill 2261: Salmon, Steelhead Trout and Anadromous Fisheries Program Act of 1988). The plan encompasses all Central Valley waters accessible to anadromous fish outside of the Sacramento-San Joaquin Delta, including Butte Creek.

Lassen Land and Resource Management Plan (LRMP)

The LRMP is required by the Forest Rangeland Renewable Resources Planning Act of 1974, and was adopted in 1993. The purpose of the LRMP is to define the resources in the different parts of the Forest, establish Forest goals and objectives for commodities and services to be provided, and prescribe standards, guidelines, and practices to achieve the goal and objectives. Among the standards and guidelines are measures to protect habitat for anadromous and resident fisheries along Butte Creek and its tributaries, pursue the opportunity with private landowners to improve stream conditions through management of livestock, protect riparian habitat and riparian management zones, and protect sensitive plants animals and habitats (USDA 1992).

Interim Strategies for Managing Anadromous Fish-Producing Watersheds on Federal Lands in Eastern Oregon and Washington, Idaho, and Portions of California (PACFISH)

The USFS and BLM developed an interim strategy to manage for the decline of anadromous fish in watersheds of Federal lands, including Butte Creek. The interim management strategy was designed to prevent further endangerment to sensitive anadromous fish, and included an establishment of riparian goals and management objectives, delineating riparian habitat conservation areas, and establishing standards and guidelines for managing timber, roads, grazing, recreation, minerals, fire/fuels, fisheries and wildlife restoration, and the general watershed.

The Redding Resource Management Plan (RMP)

The Bureau of Land Management (BLM) has included Butte Creek canyon in the Ishi Management Area of its RMP. Under this plan, the canyon would be managed to maintain fisheries habitat, improve riparian vegetation, regulate timber harvest, and maintain semi-primitive recreational opportunities.

NRCS Emergency Watershed Protection Project

In 1997, following the January floods on Butte Creek, the Natural Resource Conservation Service (NRCS) implemented the Parrott-Phelan Irrigation Diversion/Butte Creek Emergency Watershed Protection Project. The project returned Butte Creek flows to its pre-flood channel and installed about 3,800 linear feet of riprap along streambanks for stabilization. Three smaller NRCS projects were conducted upstream on Butte Creek and two others on Little Butte Creek for a watershed total of 7,681 linear feet of bank stabilization.

Environmental Quality Incentives Program (EQIP)

Established in 1996, EQIP is a voluntary conservation program with the Natural Resource Conservation Service (NRCS) for farmers and ranchers. NRCS provides technical and financial assistance to participants to address resource concerns. Cost-sharing may be up to 75 % NRCS and will require a minimum of 5 years commitment to a conservation plan.

Wildlife Habitat Incentives Program (WHIP)

WHIP is also a voluntary conservation program with the NRCS and has similar goals to the EQIP program. However, this program is not restrictive to only farmers and ranchers. NRCS will provide technical and financial assistance to participants who want to help establish and improve fish and wildlife habitat. Cost-sharing may be up to 75 % NRCS and will require a minimum of 5 years commitment to a conservation plan.

ENVIRONMENTAL COMPLIANCE

The PEA was prepared in accordance with applicable laws and executive orders, and provides programmatic coverage for environmental compliance in the Butte Creek watershed. Prior to implementation of site-specific projects under this PEA, site-specific environmental assessments (EAs), permits, and other authorizations may be required, and project proponents will need to comply with applicable executive orders and legislative acts. The PEA has been prepared in a manner to maximize the ability of future environmental documents to incorporate significant amounts of information by reference. These actions could adopt the PEA as a base document and extend from its coverage to avoid duplication (a process termed "tiering" under NEPA guidelines). Future documents that could tier from the PEA include site-specific EAs, documents required under the California Environmental Quality Act (CEQA), and applications for permits.

FEDERAL LAWS, EXECUTIVE ORDERS, AND REGULATIONS

NATIONAL ENVIRONMENTAL POLICY ACT

The PEA was prepared pursuant to regulations implementing the National Environmental Policy Act (NEPA) (42 USC 4321 *et seq*.). NEPA provides a commitment that Federal agencies will consider the environmental effects of their actions. The PEA provides information regarding the No-Action Alternative and Proposed Actions, environmental impacts, and associated mitigation measures to be incorporated into the actions. The PEA addresses the basic elements of specific and generalized habitat restoration actions and provides a framework under which actions can be analyzed for potential environmental effects using sets of diagnostic criteria. When project sites have been identified, lead agencies will consider project-specific actions prior to their implementation to determine if the specific impacts were fully analyzed in the PEA. If the actions would have no greater impacts than those analyzed in the PEA or would not require additional mitigation measures, the actions could be authorized under the PEA's coverage. In such cases, an administrative decision could be made that no further NEPA documentation is necessary. Other actions would require supplemental site-specific environmental documentation prior to decisions on their implementation.

ENDANGERED SPECIES ACT

The Endangered Species Act of 1973, as amended (ESA) (16 USC 1531 *et seq.*), establishes a national program for the conservation of threatened and endangered species of fish, wildlife, and plants and the preservation of the ecosystems upon which they depend. Section 7(a) of the ESA requires Federal agencies to consult with the Service and NMFS on any activities that may affect any species listed as threatened or endangered under their jurisdiction. The PEA has described the potential effects of Proposed Actions on special status species and, through informal

consultation with the Service and NMFS, has defined associated conservation measures to bring adverse effects to a level of "not likely to adversely effect." Ideally, specific actions proposed in the future would rely on information in the PEA to cover most ESA compliance needs. Projects meeting conditions identified in the PEA for special-status species should receive timely concurrence from the Service or NMFS. Additional informal or formal consultation on listed species would occur in situations where programmatic conservation measures would not be adequate for expected effects of a proposed action.

NATIONAL HISTORIC PRESERVATION ACT

Compliance with the National Historic Preservation Act (16 USC 470 *et seq*.) would be necessary for all Proposed Actions in areas listed, or that are eligible for listing, on the National Register for Historic Places. The Service, the Advisory Council on Historic Preservation, and the California State Historic Preservation Officer (SHPO), pursuant to section 800.13 of the regulations (36 CFR 800.13) implementing Section 106 of the NHPA, have entered into a Programmatic Agreement (Agreement) to streamline the cultural resource compliance process for low impact projects. Preliminary identification of cultural resource sites has not been requested at this time. The PEA has described the potential effects of Proposed Actions on cultural resources and has defined mitigative measures and compliance procedures that would be exercised at the site-specific level. Compliance for qualifying actions would be achieved through the Agreement. Proposed Actions outside the scope of the agreement would follow the standard process for Section 106 of the National Historic Preservation Act, with review by SHPO, before proceeding to ensure that cultural resources are protected.

FARMLAND PRESERVATION AND FARMLAND PROTECTION POLICY ACT OF 1981

The U.S. Council on Environmental Quality Memoranda on Farmland Preservation and Farmland Protection Act of 1981 (7 USC 4201, 7 CFR 658) require Federal agencies preparing Environmental Impact Statements to include farmland assessments designed to minimize adverse effects on prime and unique farmlands. Although an EA need not address this administrative policy, effects of the Proposed Actions on agricultural lands are assessed in the Environmental Consequences section of this PEA.

FISH AND WILDLIFE COORDINATION ACT

The Fish and Wildlife Coordination Act (FWCA) (16, USC 661 *et seq*.) provides for the equal consideration and coordination of wildlife conservation with other project features of federally funded or permitted water resource development projects. The Proposed Actions were developed under the authority of the CVPIA's AFRP. The purposes of the CVPIA include "to protect, restore, and enhance fish, wildlife, and associated habitats..." and "to achieve a reasonable balance among competing demands for use of Central Valley Project water, including the requirements of

fish and wildlife"; hence, the implementing authority fulfills the intent of the FWCA. A FWCA report on the proposed actions is not needed for the purpose of this PEA.

CLEAN WATER ACT AND RIVERS AND HARBORS ACT

Section 404 of the Clean Water Act (33 USC 1344) requires that a Department of the Army permit be obtained from the U.S. Army Corps of Engineers (Corps) for the discharge of dredged or fill material into the "waters of the United States," including wetlands. Section 10 of the Rivers and Harbors Act of 1899 (33 USC 403) prohibits the unauthorized obstruction or alteration of any navigable waters of the United States without a permit from the Corps. Compliance with these Acts would occur at the site-specific level. The PEA has described the potential effects of Proposed Actions on wetlands and other waters, and has defined mitigative measures that would be exercised at the site-specific level in order to facilitate compliance.

PROTECTION OF WETLANDS--EXECUTIVE ORDER 11990

Executive Order 11990 requires Federal agencies to follow avoidance, mitigation, and preservation procedures with public input before proposing new construction in wetlands. The PEA has identified mitigation measures that would be incorporated into Proposed Actions to avoid or minimize adverse effects on wetlands. Implementation of certain Proposed Actions could enhance wetlands or increase their area. Compliance with Executive Order 11990 would occur at the site-specific level, and would likely be coordinated with compliance for section 404 of the Clean Water Act, as appropriate.

FLOODPLAIN MANAGEMENT--EXECUTIVE ORDER 11988

Executive Order 11988 requires that all Federal agencies take action to reduce the risk of flood loss; to restore and preserve the natural and beneficial values served by floodplains; and to minimize the impact of floods on human safety, health and welfare. The PEA has described the potential effects of Proposed Actions on floodplains, and has defined mitigative measures that would be exercised at the site-specific level in order to facilitate compliance. The Proposed Actions support the preservation and enhancement of the natural and beneficial values of floodplains. Final compliance with this Executive Order would occur at the site-specific level.

ENVIRONMENTAL JUSTICE IN MINORITY AND LOW INCOME POPULATIONS--EXECUTIVE ORDER 12898

Executive Order 12898 requires Federal agencies to identify and address disproportionately high and adverse human health and environmental effects of Federal programs, policies, and activities on minority and low-income populations. The assessment of Proposed Actions has considered the environmental, social, and economic impacts on minority and low-income populations. Final compliance with this Executive Order would occur at the site-specific level.

INDIAN TRUST ASSETS, INDIAN SACRED SITES ON FEDERAL LAND–EXECUTIVE ORDER 13007, AND AMERICAN INDIAN RELIGIOUS FREEDOM ACT OF 1978

These laws are designed to protect Indian Trust Assets; accommodate access and ceremonial use of Indian sacred sites by Indian religious practitioners, and avoid adversely affecting the physical integrity of such sacred sites; and protect and preserve the observance of traditional Native American religions, respectively. The Proposed Actions and their associated mitigation measures would not violate these protections. Preliminary identification of Indian Trust Assets has not been requested at this time. Final compliance with these laws would occur at the site-specific level.

STATE LAWS, EXECUTIVE ORDERS, AND REGULATIONS

THE CALIFORNIA ENVIRONMENTAL QUALITY ACT

The California Environmental Quality Act (CEQA) is a process similar to that required by NEPA, whereby State, regional, or local agencies would assess the environmental effects of proposed actions and circulate these assessments to other agencies and the public for comment before making decisions. Compliance with CEQA would be required when a State or local agency is solely or partially a sponsor for an action, or when State, regional, or local agency approval or discretion is required to implement an action. The PEA has provided programmatic information on the purpose and need for actions in the watershed, the affected environment, the Proposed Actions and associated mitigation and conservation measures, and the potential effects of Proposed Actions. Actions that would require CEQA compliance could adopt the PEA as a base document and extend from its coverage to expedite meeting CEQA requirements.

THE CALIFORNIA ENDANGERED SPECIES ACT

The California Endangered Species Act (CESA) protects plant and animal species designated by the California Fish and Game Commission as either endangered or threatened. Compliance with section 2090 of CESA would be required for actions having a State lead agency. Section 2081 compliance may be required for actions implemented by local governments or private entities. The PEA has described the potential effects of Proposed Actions on State special status species and has defined associated conservation measures that could be incorporated into proposed actions to avoid or minimize adverse effects on these species. Specific proposed actions could

reference information in the PEA to help achieve timely CESA compliance. Compliance with CESA would require consultation with CDFG.

CLEAN WATER ACT

Section 401 of the Clean Water Act (33 USC 1344) requires that State water quality standards not be violated by the discharge of dredged or fill material into the "waters of the United States." The California State Water Resources Control Board (SWRCB) and Regional Water Quality Control Board (RWQCB) must issue a certification, or waiver of certification, of compliance before the Corps will issue a section 404 permit. Compliance with these regulations would occur at the site-specific level. To facilitate compliance the PEA has described the potential effects of Proposed Actions on wetlands and other waters, and has defined mitigative measures that could be exercised at the action site.

OTHER WATER QUALITY REGULATIONS

The SWRCB and RWQCBs are responsible for issuing permits under the National Pollutant Discharge Elimination System for industrial stormwater runoff, stormwater runoff from general construction activities, municipal stormwater runoff, and point-source discharges. Waste discharge permits are issued by the RWQCBs to regulate actions that may affect groundwater quality or that may discharge waste in a diffused manner. Compliance with these regulations would occur at the site-specific level. To facilitate compliance the PEA has described the potential pollution effects of Proposed Actions, and has defined mitigative measures that could be exercised at the action site.

LAKE OR STREAMBED ALTERATION AGREEMENT

Authorization is required from CDFG under section 1601 for public actions and section 1603 for nonpublic actions prior to any action that substantially diverts, obstructs, or changes the natural flow of the river, stream, or lake, or uses material from the streambed. The PEA has defined general actions and associated mitigation measures that may affect streambeds. Specific information on these activities required for compliance would be addressed at the site-specific level.

STATE HISTORIC PRESERVATION OFFICER CONSULTATION

Consultation with California's SHPO under Section 106 of the National Historic Preservation Act would be necessary for all Proposed Actions in areas listed, or that are eligible for listing, on the National Register for Historic Places. Compliance for section 106 would be achieved through the

Programmatic Agreement between the Service, the Advisory Council on Historic Preservation, and SHPO, as described under Federal compliance needs.

STATE LANDS COMMISSION LAND USE LEASE

Actions occurring on State sovereign lands, such as ungranted tidelands and submerged lands and beds of navigable Rivers streams, lakes, bays, estuaries, inlets, and straits, may require authorization from the State Lands Commission. The PEA has described the potential effects of Proposed Actions that may occur on State sovereign lands and has defined associated mitigation measures that could be incorporated to avoid or minimize adverse effects. Specific proposed actions could reference information in the PEA to help achieve timely compliance.

RECLAMATION BOARD ENCROACHMENT PERMIT

The Reclamation Board issues permits to maintain the integrity and safety of flood control project levees and floodways that were constructed according to the flood control plans adopted by the Board or the California Legislature. Actions that would affect existing State flood control project facilities, including levees, dams, reservoirs, floodways, and flood control plans would require permits. The PEA has described the potential effects of Proposed Actions on flood control and has defined associated mitigation measures that could be incorporated to avoid or minimize adverse effects. Specific proposed actions could reference information in the PEA to help achieve timely compliance.

REGULATIONS FOR DAMS AND RESERVOIRS

Any proposal to construct or enlarge a dam or reservoir must obtain written approval from the California Department of Water Resources (CDWR) Division of Safety of Dams for the plans and specifications. Actions that may require this approval include construction and modification of dams, levees, artificial ponds, or other structures that are under this jurisdiction. Plans and specifications for such actions would be submitted to DWR at the site-specific level.

ENCROACHMENT PERMIT/RIGHT-OF-WAY

The California Department of Transportation issues permits to encroach on land within its jurisdiction to ensure that the proposed encroachment is compatible with the primary uses of the State highway system. Actions occurring within a right-of-way would require this permit, which would be obtained at the site-specific level.

AIR DISTRICT PERMITS

Actions using facilities or equipment that emit air pollutants or that generate dust emissions must obtain permits to ensure that emissions from such sources will not interfere with the attainment or maintenance of ambient air quality standards adopted by the California Air Resources Board and U.S. Environmental Protection Agency. The PEA has described the potential effects of Proposed Actions on air quality and has defined associated mitigation measures that could be incorporated to avoid or minimize adverse effects. Specific proposed actions could reference information in the PEA to help achieve timely compliance.

LOCAL REGULATORY COMPLIANCE

Cities and counties in California have adopted local zoning ordinances and general plans that set policy on how land development will occur within their respective jurisdictions. Approvals and entitlements at the city or county level, such as conservation easements, grading permits, building permits, special or conditional use permits, subdivision map approvals, specific plans, zoning ordinance amendments, and local general plan amendments may be required for certain actions. CEQA compliance may be required for grading and building permits if they are discretionary and is normally required for approvals and entitlements. Specific proposed actions could reference information in the PEA to help achieve timely compliance.

PUBLIC INVOLVEMENT

The purpose of public involvement is to inform the public of proposed actions, exchange information with all potentially affected stakeholders in the planning process, and identify practical alternatives. Public participation has played an important role in development of the AFRP Plan. After release of the plan in December 1995, the AFRP and cooperating agencies engaged in a substantial public outreach effort. This included a public scoping workshop held by the AFRP in Chico during February 1996 to address public issues and concerns and obtain public input.

Additional written comments were received by the AFRP on the 1995 Draft Anadromous Fish Restoration Plan (USFWS 1995d) during the designated December 1995 through March 1996 comment period (public comments and the Service's responses are documented in Appendices H and I of the Revised Draft Restoration Plan; USFWS 1997a). In 1995, two public meetings were held by the BCWC in Centerville (September 19 and December 11), which addressed Butte Creek fisheries issues and the AFRP. Additional meetings were held with the LBCP Steering Committee (November 1998) and the BCWC Board of Directors (December 1998) to present plans for preparation of the PEA.

A Notice of Availability for this Draft PEA and Draft Finding of No Significant Impact (FONSI) for public review has been provided to the local media. All comments will be considered in preparation of the final PEA.

COORDINATION AND CONSULTATION

Coordination and consultation in preparing the PEA included the following:

U.S. Fish and Wildlife Service (Lead Agency)
- Sacramento Fish and Wildlife Office, Sacramento, CA
- Sacramento-San Joaquin Estuary Fishery Resources Office, Stockton, CA
- Sacramento Realty Field Office, Sacramento, CA
- Region I Cultural Resources Team, Sherwood, Oregon

National Marine Fisheries Service, Santa Rosa, CA
U.S. Forest Service, Lassen National Forest, Susanville, CA
U.S. Bureau of Land Management, Redding Resource Area, Redding, CA
U.S. Bureau of Reclamation, Mid-Pacific Region, Sacramento, CA
California Department of Fish and Game
- Region II, Rancho Cordova, CA
- Inland Fisheries Division, Red Bluff, CA

Butte Creek Watershed Conservancy, Chico, CA
Butte Creek Watershed Project, Chico, CA
Lower Butte Creek Project, Chico, CA
Ducks Unlimited, Sacramento, CA
Jones and Stokes Associates, Inc., Sacramento, CA
The Nature Conservancy, Sacramento, CA

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REFERENCES

BCWP (Butte Creek Watershed Project). 1999. Final Existing Conditions Report. California State University, Chico.

CALFED (CALFED Bay-Delta Program). 1999a. Ecosystem Restoration Program Plan. Vol I. Ecological Attributes of the San Francisco Bay-Delta Watershed.

CALFED (CALFED Bay-Delta Program). 1999b. Ecosystem Restoration Program Plan. Vol. II. Ecological Management Zone Visions.

CALFED (CALFED Bay-Delta Program). 1999c. Draft programmatic environmental impact statement/environmental impact report.

California Resources Agency. 1989. Upper Sacramento River fisheries and riparian habitat management plan. Sacramento, Calif. 158 pp.

Castelle, A. J., C. Conolly, M. Emers, E. D. Metz, S. Meyer, M. Whitter, S. Mauermann, T. Erickson, and S. S. Cook. 1992. Wetland buffers: use and effectiveness. Adolfson Associates, Inc., Shorelands and Coastal Zone Management Program, Washington Dept. Ecology, Olympia. Pub. No. 92-10.

CDFG (California Department of Fish and Game). 1993a. Restoring Central Valley streams: a plan for action. Inland Fisheries Div., Sacramento.

CDFG (California Department of Fish and Game). 1993b. Butte Creek House Ecological Reserve, Butte County.

CDFG (California Department of Fish and Game). 1997. Fish Screening Criteria. Sacramento.

CDFG (California Department of Fish and Game). 1998. A status review of the spring-run chinook salmon in the Sacramento River drainage. Candidate species status report 98-01.

CNDDB (California Natural Diversity Database). 1999. Database reports generated for Butte Meadows, Onion Butte, Jonesville, Humboldt Peak, Paradise East, Paradise West, Cohasset, Stirling City, Nelson, Llano Seco, Ord Ferry, Chico, Oroville, Shippee, Hamlin Canyon, Cherokee, Moulton Weir, Pennington, Sanborn Slough, Butte City, West of Biggs, Gridley, Biggs, Tisdale Weir, Grimes, Meridian, Sutter Buttes, Gilsizer Slough, Eldorado Bend, Kirkville, Verona, Knights Landing, Sutter Causeway, Nicolaus quadrangles. March 24, 1999. CDFG, Sacramento, CA.

CDFG (California Department of Fish and Game), California Wildlife Conservation Board, and U.S. Bureau of Reclamation. 1997. California wetland and riparian geographic information project. Final report, January 17, 1997. Calif. Dept. Fish and Game, Natural Heritage Div., Sacramento, Calif.

Hill, Katherine A. and J. D. Webber. 1999. Butte Creek spring-run chinook salmon (Onchorhynchus tshawytscha) juvenile emigration and life history study 1995-1998. Calif. Dep. Fish and Game, Inland Fisheries. Administrative Rep. No. 99-5.

JSA (Jones and Stokes Associates, Inc). 1998. Lower Butte Creek Project final project report. June 30, 1998. (JSA 97-248). Sacramento, Calif. Prepared for the Nature Conservancy, Sacramento, Calif.

Mills, T. J. and F. Fisher. 1993. Central Valley anadromous sport fish annual run-size, harvest estimates, and population trends, 1967 through 1991. Preliminary draft: June. Inland Fisheries Tech. Rep. Calif. Dep. Fish and Game, Sacramento.

National Marine Fisheries Service (NMFS). 1997. Fish Screening Criteria for Anadromous Salmonids. Santa Rosa, CA.

Reynolds, F. L., R. L. Reavis, and J. Schuler. 1990. Central Valley salmon and steelhead restoration and enhancement plan: Calif. Dep. Fish and Game, Inland Fish. Div., Sacramento.

Reynolds, F., T. J. Mills, R. Benthin, and A. Low (Compilers). 1993. Restoring Central Valley streams: A plan for action. California Department of Fish and Game, Sacramento, CA.

USBR (U.S. Bureau of Reclamation). 1997a. Central Valley Project Improvement Act draft environmental impact statement. Tech. App., Vol. 3 (Fisheries). Sacramento, Calif.

USBR (U.S. Bureau of Reclamation). 1997b. Central Valley Project Improvement Act draft environmental impact statement. Tech. App., Vol. 4. Vegetation and Wildlife. Sacramento, Calif.

USBR (U.S. Bureau of Reclamation). 1997c. Central Valley Project Improvement Act draft environmental impact statement. Tech. App., Vol. 5. Agricultural Economics and Land Use. Sacramento, Calif.

USDA (U. S. Department of Agriculture). 1992. Lassen National Forest. Final Environmental Impact Statement for the Land and Resource Management Plan.

USFWS (U.S. Fish and Wildlife Service). 1995a. Working paper on restoration needs: Habitat restoration actions to double natural production of anadromous fish in the Central Valley

of California. Volume I. Prepared for the U.S. Fish and Wildl. Serv. under the direction of the Anadromous Fish Restoration Program Core Group. Stockton, Calif.

USFWS (U.S. Fish and Wildlife Service). 1995b. Working paper on restoration needs: Habitat restoration actions to double natural production of anadromous fish in the Central Valley of California. Volume II. Prepared for the U.S. Fish and Wildl. Serv. under the direction of the Anadromous Fish Restoration Program Core Group. Stockton, Calif.

USFWS (U.S. Fish and Wildlife Service). 1995c. Working paper on restoration needs: Habitat restoration actions to double natural production of anadromous fish in the Central Valley of California. Volume III. Prepared for the U.S. Fish and Wildl. Serv. under the direction of the Anadromous Fish Restoration Program Core Group. Stockton, Calif.

USFWS (U.S. Fish and Wildlife Service). 1995d. Draft restoration plan for the anadromous fish restoration program. December 6, 1995. Prepared for the Secretary of the Interior by the U.S. Fish and Wildlife Service with assistance from the Anadromous Fish Restoration Program Core Group. Stockton, CA.

USFWS (U.S. Fish and Wildlife Service). 1997a. Revised draft restoration plan for the anadromous fish restoration program. May 30, 1997. Prepared for the Secretary of the Interior by the U.S. Fish and Wildlife Service with assistance from the Anadromous Fish Restoration Program Core Group. Stockton, CA.

USFWS (U.S. Fish and Wildlife Service). 1997b. Endangered and threatened wildlife and plants; determination of endangered species status for three plant and threatened status for five plants from vernal pools in the Central Valley of California. Final Rule. Federal Register. Wednesday, March 26, 1997. Vol. 62, No. 58. Page 14338.

USFWS (U.S. Fish and Wildlife Service). 1998. Central Valley Project Improvement Act Tributary Production Enhancement Report. Central Valley Fish and Wildlife Restoration Program Office. Sacramento, CA.

Lower Butte Creek Project Alternatives 1 and 2 (Butte Sink Subarea) (From JSA 1998).

Site	Action	Alt. 1	Alt. 2	Generalized Actions*
Sanborn Slough Bifurcation	Upgrade the bifurcation structure with a new automated/remotely controlled structure to control water levels and flow split between Sanborn Slough and Butte Creek. The new structure will be evaluated to determine whether a fish screen at the head of Sanborn Slough is appropriate. The screen would be remotely operated so that it could be pulled or opened during uncontrolled-flow conditions. The screen would have a maximum design capacity of 200 cfs and would not contribute to flood conditions. The new water control structure would also include a fish ladder with a minimum design capacity of 40 cfs on Butte Creek. Flow capacity of the structure would be established to accommodate existing maximum controlled flows into Butte Creek (approximately 200 cfs) and Sanborn Slough (approximately 200-300 cfs). However, hydraulic analysis of the channels and structure is required to identify how the new structure could minimize sediment deposition at and near the structure and how it could improve downstream Butte Creek channel capacity through improved hydraulics.	X		Fish Passage; Fish Screen; Stream Channel Modification; Operations
	Upgrade the bifurcation structure with a new automated or remotely controlled structure to control water levels and flow split between Sanborn Slough and Butte Creek. The new structure would include a provision to pass adult fish through Butte Creek and Sanborn Slough for the full range of controlled flows. Flow capacity of the structure would be established so that existing maximum controlled flows (estimated at 200 cfs) could be accommodated. However, hydraulic analysis of the channels and structure will be required to identify how the new structure could minimize sediment deposition at and near the structure as well as how it could improve downstream channel capacity through improved hydraulics.		X	Fish Passage; Stream Channel Modification; Operations
White Mallard Dam	Upgrade the existing dam on Butte Creek with a new water control structure with a design capacity of 400 cfs and a fish ladder with a minimum design capacity of 40 cfs. Screen the entrance to the White Mallard Canal to keep juvenile fish from entering the west side of Butte Sink under controlled flows in Butte Creek (<400 cfs). The screen would have a design capacity of 160 cfs and would be designed to minimize potential obstruction to flood flows. **-OR-** Construct a diversion structure at, or upstream of, the Butte Creek/Sanborn Slough Bifurcation Structure with a conveyance system flowing westerly to the East Levee Canal.	X	X	Fish Passage; Fish Screen; Operations

Site	Action	Alt. 1	Alt. 2	Generalized Actions*
White Mallard Outfall	Maintain existing structure. Enhance operations.	X	X	Operations
Drumheller Slough Outfall	Maintain existing structure. Enhance operations.	X	X	Operations
North Weir -Wild Goose Club	Maintain existing structure. Enhance operations.	X	X	Operations
End Weir	Maintain existing structure. Enhance operations.	X		Operations
	Operate the existing structure to provide unimpeded fish passage in at least one of the four culverts when passing small flow volumes through the Cross Cut Canal into Cherokee Canal.		X	Operations
Morton Weir	Maintain existing structure. Enhance operations.	X		Operations
	Upgrade Morton Weir with a new water control structure that would allow greater operational flexibility and unimpeded fish passage. The existing crest elevation of this weir would be lowered by approximately 1 ft. Evaluate the need for a fish ladder (minimum design capacity of 40 cfs) during controlled-flow conditions, to allow for unimpeded fish passage through Butte Sink.		X	Fish Passage; Operations
Mile Canal Weir	Maintain existing structure. Enhance operations.	X		Operations
	Upgrade water control structures at the entrances to Mile Canal and Field and Tule Canal from Cherokee Canal to provide unimpeded fish passage. The upgraded structures will allow passage of boats to access privately managed waterfowl habitat areas.		X	Fish Passage; Operations

Site	Action	Alt. 1	Alt. 2	Generalized Actions*
Cherokee Canal Outfall	Construct a permanent, fixed, adult fish barrier on Cherokee Canal to prevent adult fish passage upstream into Butte Sink under controlled-flow conditions (<200 cfs). The structure would be constructed to facilitate return of juvenile fish to the preferred Butte Creek channel after uncontrolled-flow events. The structure would be designed to withstand high flows and heavy debris loads.	X		Fish Passage; Operations
	Construct a permanent, fixed, adult fish barrier on Cherokee Canal upstream of the confluence of Cherokee Canal and the Cross Cut Canal to prevent adult fish passage upstream under controlled-flow conditions (<200 cfs). The structure would be constructed to facilitate return of juvenile fish to lower Cherokee Canal after uncontrolled-flow events. The structure would be designed to withstand high flows and heavy debris loads.		X	Fish Passage; Operations
Drivers Cut Outfall	Evaluate the need for a permanent, fixed, adult fish barrier at the Drivers Cut Outfall to prevent adult fish passage upstream into Butte Sink under controlled-flow conditions (<200 cfs). The structure would be constructed to facilitate return of juvenile fish to the preferred Butte Creek channel after uncontrolled-flow events.	X		Fish Passage; Operations
	Evaluate the need for a fish ladder (minimum design capacity of 40 cfs) during controlled-flow conditions, to allow for unimpeded fish passage into Butte Sink.		X	Fish Passage; Operations
Colusa Shooting Weir	Evaluate need for a fish ladder (minimum design capacity of 40 cfs) during controlled-flow conditions, to allow for unimpeded fish passage into Butte Sink.		X	Fish Passage; Operations
Tarke Outfall	Evaluate the need for a permanent, fixed, adult fish barrier at the Tarke Outfall to prevent adult fish passage upstream into Butte Sink under controlled-flow conditions (<200 cfs). The structure would be constructed to facilitate return of juvenile fish to the preferred Butte Creek channel after uncontrolled-flow events.	X		Fish Passage; Operations
	Evaluate the need for a fish ladder (minimum design capacity of 40 cfs) during controlled-flow conditions, to allow for unimpeded fish passage into Butte Sink.		X	Fish Passage; Operations

*Operations are not included in the PEA and would require supplemental environmental compliance documentation.

Lower Butte Creek Project Alternatives 3, 4, 5, and 6 (Butte Slough/Sutter Bypass Subarea) (From JSA 1998).

Site	Action	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Generalized Actions*
Butte Slough Outfall Gates	Maintain existing outfall structure. Enhance operations. Evaluate land management options adjacent to the slough. Evaluate potential seepage onto adjacent agricultural lands from increased flows through slough. Develop operational guidelines for gate management.	X	X	X	X	Operations; Floodplain Management
East-West Diversion Weir	Upgrade the existing structure with a new automated or remotely controlled water control structure located at the head of the East Borrow Canal near Long Bridge. The new structure would accommodate 0–100% of controlled flows in each channel (800 - 1,200 cfs/channel), and would include a fish ladder with a minimum design capacity of 40 cfs and a remotely controlled screen at the entrance to the East Borrow Canal. The screen would be put in place during controlled-flow conditions (design screen to function up to 200 cfs) to prevent juvenile fish passage into the East Borrow Canal. The screen would be pulled or opened during uncontrolled-flow conditions.	X				Fish Passage; Fish Screen; Operations
	Upgrade the existing structure by removing the East-West Diversion Weir and combining its functions with those of Weir 5 at Weir 5. The new structure would include a fish ladder with a minimum design capacity of 40 cfs to facilitate adult fish passage. Plug the East Borrow Canal at the confluence of the East and West Borrow Canals. Construct a cross canal from Weir 5 across to the East Borrow Canal. Install a remotely controlled screen at the entrance to the cross canal. The screen would be put in place during controlled-flow conditions (design screen to function up to an amount equal to water use demand in the East Borrow Canal) to prevent juvenile fish passage into the East Borrow Canal. The screen would be pulled or opened during uncontrolled-flow conditions. Construct a levee along the inside of the south and east banks of Stohlman Cut and the West Borrow Canal from the East Borrow Canal plug to Weir 5 to prevent nuisance flooding inside the bypass. Remove Butte Slough Irrigation Company diversion upstream of the weir and provide alternative water from the Sacramento River.		X			Fish Passage; Fish Screen; Floodplain Management; Operations
	Upgrade the existing structure with a new automated or remotely controlled water control structure located at the head of the East Borrow			X		Fish Passage; Fish Screen;

Site	Action	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Generalized Actions*
	Canal near Long Bridge. The new structure would accommodate 0–100% of controlled flows in each channel (800 - 1,200 cfs/channel) and would include a fish ladder with a minimum design capacity of 40 cfs at the entrance to the East Borrow Canal, and a remotely controlled screen at the entrance to the West Borrow Canal. The screen would be put in place during controlled-flow conditions (design screen to function up to 200 cfs) to prevent juvenile fish passage into the West Borrow Canal. The screen would be pulled or opened during uncontrolled-flow conditions.					Operations
	Upgrade the existing structure with a new automated or remotely controlled water control structure located at the head of the East Borrow Canal near Long Bridge. The new structure would accommodate 0–100% of controlled flows in each channel (800 - 1,200 cfs/channel), and would include a fish ladder with a minimum design capacity of 40 cfs and a remotely controlled screen at the entrance to the East Borrow Canal. The screen would be put in place during controlled-flow conditions (design screen to function up to 200 cfs) to prevent juvenile fish passage into the East Borrow Canal.				X	Fish Passage; Fish Screen; Operations
Farmers Weir (Weir 5)	Upgrade the existing structure with a new water control structure that would include a fish ladder with a minimum design capacity of 40 cfs. The design capacity of the new water control structure would be relative to the appropriate flow and stage anticipated for fish passage periods and water use periods.	X		X	X	Fish Passage; Operations
	(See 2nd option, East-West Diversion Weir).		X			Fish Passage; Fish Screen; Floodplain Management; Operations

Site	Action	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Generalized Actions*
Weir 3	Remove weir and abutment.	X			X	Fish Passage
	Remove weir and abutment. Remove all upstream diversions and provide alternative water from Weir 5.		X			Fish Passage
	Upgrade Weir 3 with a new water control structure that would allow greater operational flexibility. The new structure would include an upgraded fish ladder with a minimum design capacity of 40 cfs to facilitate passage of adult fish up the West Borrow Canal.			X		Fish Passage; Operations
Giusti Weir and Intake	Raise the level of the existing structure (6 inches) to hold stage at a level to provide water to diverters and subirrigators upstream of Weir 3. Evaluate length of run and flow velocity through the opening on the east side of weir to ensure compliance with DFG and NMFS fish passage criteria. Evaluate need for roughened chute grade modification on east side of weir.	X	X		X	Fish Passage; Operations
	Maintain existing structure. Enhance operations.			X		Operations
Weir 2 (Davis Weir)	Maintain existing structure. Enhance operations.	X	X			Operations
	Upgrade Weir 2 with a new water control structure that would allow greater operational flexibility. The new structure would include an upgraded fish ladder with a minimum design capacity of 40 cfs to facilitate passage of adult fish up the East Borrow Canal.			X	X	Fish Passage; Operations
Weir 1 (Paks Weir)	Remove weir. Provide alternative water source for the southwest corner of the Sutter National Wildlife Refuge and other small, dependent diverters.	X	X	X	X	Fish Passage
Willow Slough Weir	Maintain existing structure. Enhance operations.	X	X			Operations
	Upgrade Willow Slough Weir with a new water control structure that would allow greater operational flexibility. The new structure would include an upgraded fish ladder with a minimum design capacity of 40 cfs to facilitate passage of adult fish into the East Borrow Canal.			X	X	Fish Passage

Site	Action	Alt. 3	Alt. 4	Alt. 5	Alt. 6	Generalized Actions*
Willow Slough Outfall	Install a permanent, fixed, adult fish passage barrier across Willow Slough at the confluence with the West Borrow Canal.	X	X			Fish Passage
	Install a permanent, fixed, adult fish passage barrier across the West Borrow Canal at the confluence with Willow Slough.			X		Fish Passage
Nelson Slough Weir	Maintain existing structure. Enhance operations.	X	X	X	X	Operations
Nelson Slough Outfall	Install a permanent, fixed, adult fish passage barrier across Nelson Slough at the confluence with the West Borrow Canal.	X	X			Fish Passage
Wadsworth Canal Outfall	Install a permanent, fixed, adult fish barrier across Wadsworth Canal at the confluence with the East Borrow Canal.			X	X	Fish Passage
DWR Pumping Plants 1, 2, and 3	Screen all gravity diversions.	X	X	X	X	Fish Screen

*Operations are not included in the PEA and would require supplemental environmental compliance documentation.

APPENDIX B

Code	Mitigation and Conservation Measures
	Vegetation and Wildlife
VW1	All activities will be implemented in coordination with protection of existing habitat.
VW2	All activities will be implemented during the least detrimental time of year; e.g., low streamflow periods.
VW3	All activities will be completed in a timely manner.
VW4	All contractors and equipment operators will be given written and oral instructions to avoid impacts and be made aware of ecological values of the site.
VW5	Pre-construction field surveys will be conducted during suitable seasons by qualified personnel to identify any sensitive plants or sensitive areas (such as wetlands, riparian zones, native habitat, vernal pools, and special status species habitat) at or near the project site.
VW6	Pre-construction field surveys will be conducted by qualified personnel to confirm that no sensitive terrestrial wildlife occur within one-half mile of the project site.
VW7	If pre-construction surveys should identify sensitive habitats, those areas will be flagged, isolated, and avoided during the construction process.
VW8	A biological monitor will be on site during construction when listed species or other sensitive fish, wildlife, or vegetation require protection. The monitor will check the site before construction each day for sensitive species; assist in avoiding impacts; determine the least damaging options for removal or transplantation of vegetation according to established protocols; and provide technical information.
VW9	Existing access points will be used whenever possible in order to avoid sensitive locations.
VW10	Least sensitive areas will be used for parking, construction activities, stockpiling, and staging areas, and these areas will be clearly marked and restored following construction.
VW11	Unavoidable damage to wildlife habitat will be mitigated according to the Service's Mitigation Policy.

Code	Mitigation and Conservation Measures
VW12	Disturbed sites will be revegetated. All planted vegetation will be with species native to, and collected in, the area, as appropriate.
VW13	When feasible, native vegetation will be salvaged from areas where ground disturbances occur, and replanted.
VW14	Vegetative planting techniques will not cause major disturbances to soils and slopes.
VW15	Fast growing willows, alders, and others species will be planted at stream edges, as appropriate, to minimize recovery time and provide shade to near-shore portions of the stream.
VW16	Excavating, filling, and other earth moving will be done in a gradual manner to allow wildlife species to escape in advance of machinery and moving materials.
VW17	Topsoil removed for excavations will be retained, stockpiled, and re-spread.
VW18	Surveying and monitoring activities will be designed and conducted to minimize disturbance of wildlife and their habitat.
VW19	Environmental protections at borrow sites will be the same as at project construction sites.
VW20	Riparian vegetation or wetlands isolated from water supplies by altered hydrology will be provided with replacement water supplies.
	Fisheries and Water Quality
	Fish passage on a stream will not be obstructed at any time.
FWQ1	Fish remaining in dewatered areas will be returned to the creek.
FWQ2	If cofferdams are used, only screened pumps will be used to de-water the construction area. The channel will be rewatered incrementally to minimize turbidity and sedimentation.
FWQ3	Instream construction activities must be minimized to reduce sedimentation.
FWQ4	Avoid construction during the rainy season or high flows to the degree possible.

Code	Mitigation and Conservation Measures
FWQ5	Construction should occur during the late summer low-flow season when sediment will settle out quickly.
FWQ6	Silt curtains, silt fences, settling basins, sandbags, check-dams, straw bales, and other erosion control devices to will be used as necessary to minimize sediment impacts to waters. Turbidity will be monitored to meet exceedence thresholds established by project's water quality waiver agreement with the Regional Water Quality Control Board, as applicable.
FWQ7	Any machinery that enters the river during work will be steam-cleaned and properly maintained to avoid water quality contamination from the release of grease, oil, petroleum products, or other nonnative materials.
FWQ8	Only clean gravel, washed of silt and fines will be placed into streams. Rewatering the stream channel after construction will be done incrementally to avoid mobilization of sediments and increases in turbidity.
FWQ9	Surveying and monitoring activities will be designed and conducted to minimize disturbance of fish habitat. Should the collection of data on redds require surveyor boats, monitors will travel only downstream to minimize disturbance of salmon redds.
FWQ10	Sedimentation due to alterations in water control structures will be managed to minimize adverse effects on fish habitat.
	Special Status Species
SS1	Aleutian Canada goose (*Branta canadensis leucopareia*) Aleutian Canada geese winter in wetlands and cropland on the Central Valley floor. Where project sites are located on or within 1/4 mile of active resting and foraging sites, work activities above ambient noise levels will not occur during the bird's normal wintering and migration period, from October 1 to May 14.
SS2	Bald eagle (*Haliaeetus leucocephalus*) Bald eagles usually nest in uneven-age (multi-storied) stands of mixed conifers near bodies of water. Nest trees in California are typically mature, large ponderosa or sugar pines between 41 to 46 inches in diameter. Surveys should be conducted in any suitable nesting habitat. If there are any bald eagle nests within 0.5 miles with a direct line of sight to the

Code	Mitigation and Conservation Measures
	activity, implement a seasonal restriction on project activities that could disturb nesting birds from January 15 through July 31.
SS3	American peregrine falcon (*Falco peregrinus anatum*) American peregrine falcons nest almost exclusively on cliffs usually near water. Preferred cliffs are typically 150 feet or more in height with a small cave or overhung ledge. Peregrines have nested from near sea level to over 11,000 feet. Survey any suitable cliff habitat within 0.5 miles of the project area. If there are peregrine nests within 0.5 miles with a direct line of sight to the activity, implement seasonal restriction on project activities that could disturb nesting birds from February 1 through August 1.
SS4	California red-legged frog (*Rana aurora draytonii*) Red-legged frogs may occur in creeks, ponds and marshes, often with cattails, tules, and willows. If habitat is present, a red-legged frog survey will be conducted at least six months before construction begins. If red-legged frogs are found and habitat may be affected, consultation with the service will be required. Before construction, work crews will review one-page guidance on identifying red-legged frogs and bullfrogs, and will be instructed to be observant for frogs at project sites. All ponds or reaches of creeks where cattails or tules grow will be avoided. All stands of willows will be fenced to prevent intrusion by workers or machinery. Placement of gravel or other materials into red-legged frog habitat will be done gradually from the water's edge out into the stream or pond to allow frogs to escape. If red-legged frogs are observed during construction activities, the area where frogs were seen completely avoid until a Service biologist has been notified.
SS5	Giant garter snake (*Thamnophis gigas*) Giant garter snake may occur in permanently aquatic habitat or habitats seasonally flooded during the snakes active season (early-spring through mid-fall), such as marshes, sloughs, ponds, low gradient streams, irrigation and drainage canals, and rice fields. If habitat is present, a giant garter snake survey will be conducted at least six months before construction begins. If giant garter snakes are found or their habitat may be affected, consultation with the service will be required. Construction activity within giant garter snake habitat will be limited to May 1 through October 1, when the snakes are usually active. Other construction times would require additional guidance from the Service to determine if additional measures are necessary, as giant garter snakes are more susceptible to take when occupying underground burrows or crevices. The project will be surveyed for the snake 24-hours prior to construction activities, and any sightings reported to the Service. Survey of the project area will be repeated if a lapse in construction activity of two weeks or greater has occurred. Construction personnel will receive Service-approved worker awareness training to instruct workers to recognize the

Code	Mitigation and Conservation Measures
	snake and its habitat. Giant garter snake habitat within and adjacent to construction sites will be flagged as environmentally sensitive areas. Movement of heavy equipment to and from project sites, staging areas, or borrow sites will be confined to existing roadways to minimize habitat disturbance. Equipment and construction activities will keep at least 200 feet from giant garter snake aquatic habitat to avoid impacts. If construction activities must occur less than 200 feet from habitat, the effected area will be confined to the minimum necessary for construction activities. A Service-approved biologist will be on site during clearing and grubbing of wetland vegetation. Any dewatered habitat will remain dry for at least 15 consecutive days after April 15 and prior to excavating or filling of the dewatered habitat. If a snake is encountered during construction, activities will stop until it successfully escapes the project area or until capture and relocation have been completed by a Service-approved biologist. Disturbed areas will be returned to pre-project conditions following construction.
SS6	Valley elderberry longhorn beetle (*Desmocerus californicus dimorphus*) The beetles primarily occur with elderberry plants (*Sambucus* spp.) in riparian habitats, although any elderberry plant with one or more stems measuring 1.0 inch or greater in diameter at ground level are considered habitat. Surveys will be conducted on project sites at least six months before construction activities to locate elderberry plants. Elderberry plants will be avoided if possible. If elderberry plants cannot be avoided consultation with the Service will be required. An incidental take permit from the Service will be necessary to remove or transplant elderberry plants. Transplanting of elderberry plants will follow current Service protocols and will be included in the revegetation plan. Sixty days before construction, a pre-construction survey will be conducted to flag remaining elderberries. During construction bright orange construction fencing or similar material will temporarily fence plants so they are not disturbed. The fence will run $\geq$20 feet from the dripline of any elderberry plant with one or more stems measuring 1.0 inch or greater in diameter at ground level.
SS7	Conservancy fairy shrimp (*Branchinecta conservatio*); vernal pool fairy shrimp (*Branchinecta lynchi*); vernal pool tadpole shrimp (*Lepidurus packardi*) Listed vernal pool crustaceans may occur in vernal pools, vernal swales, and other seasonal wetlands that pond water for three weeks or more. Once identified in the pre-construction survey, vernal pools will be surrounded with bright orange fencing

Code	Mitigation and Conservation Measures
	to prevent disturbance. Construction activities will be avoided within 250 feet of pool margins and swale edges. Activities beyond 250 feet will be avoided if they could eventually result in adverse effects to the pools and swales through changes in hydrology, sedimentation, or contamination of the habitat. If pools or swales cannot be avoided, the Service will be notified in writing as soon as possible, and information provided to the Service as requested. A biological monitor will be on site at all times during construction to assist in avoidance of impacts to sensitive species and provide technical information. Following construction, uplands will be restored to their previous condition whenever possible. Revegetation plant species will include only those that do not compete with native vernal pool plant species.
SS8	Butte County meadowfoam (*Limnanthus floccosa californica*); Greene's tuctoria (*Tuctoria greenei*); Hoover's spurge (*Chamaesyce hooveri*); hairy Orcutt grass (*Orcuttia pilosa*); slender Orcutt grass (*Orcuttia tenuis*): Habitats and conservation measures for vernal pool plant species are the same as for vernal pool crustaceans described above. Butte County meadowfoam may occur in vernal swales in Butte County. Proposed actions within the Chico Urban Development Boundary will contact the Service for specific avoidance areas to protect Butte County meadowfoam.
SS9	Winter-run chinook salmon (*O. tshawytscha*); Winter-run chinook salmon critical habitat; Fall-run/late fall-run chinook salmon (*O. tshawytscha*); Fall-run/late fall run chinook salmon critical habitat; Spring-run chinook salmon (*O. tshawytscha*); Steelhead trout (*Oncorhynchus mykiss*): Construction activities will be timed to occur when juvenile and adult life stages are most scarce, in-migration and out-migration are at their lowest points, and spawning and incubation are not occurring. Construction occurring between June 15 and October 15 is likely to avoid direct effects to the greatest extent possible. Passage around construction sites would be provided at all times. Any new diversions will be screened per CDFG and NMFS criteria. General measures listed for Fisheries and Water Quality and Hydrology and Stream Channel will also contribute to avoidance and minimization of adverse. Riparian vegetation providing shaded riverine aquatic habitat will be protected during construction and will be mitigated if damage is unavoidable.
SS10	Delta smelt (*Hypomesus transpacificus*): Delta smelt do not occur within the watershed, however water quality can be affected by significant changes in

Code	Mitigation and Conservation Measures
	watershed hydrology, as the smelt's habitat occurs downstream. Any proposed structural or operational action will be designed to keep changes in timing and quantity of watershed flows into the Sacramento River nil or minimal.
SS11	Sacramento splittail (*Pogonichthys macrolepidotus*): Sacramento splittail occur in the lower Sacramento River and may occur in the Sutter Bypass when flooded. Any new diversion structures constructed within the Sutter Bypass will be screened per CDFG and NMFS criteria or operated to minimize entrainment if entrainment of splittail would be likely. Changes in hydrology within the Sutter Bypass will be designed to not exacerbate adverse effects on spawning and rearing splittail. Any proposed structural action will be designed to keep changes in timing and quantity of watershed flows into the Sacramento River nil or minimal. Passage at construction sites will be provided at all times where splittail are present. During the March through May spawning period, shallow waters with submerged vegetation, such as backwaters, sloughs, ponds connected to the stream channel will be avoided to the extent possible during construction. Riparian vegetation providing shaded riverine aquatic habitat will be avoided to the extent possible and will be repaired if damage is unavoidable. General measures listed for Fisheries and Water Quality and Hydrology and Stream Channel will also contribute to avoidance and minimization of adverse effects.
SS12	Western yellow-billed cuckoo (*Coccyzus americanus occidentalis*): The western yellow-billed cuckoo forages and breeds in dense riparian forest with a thick understory of blackberry and willows. They may breed from June through early September. Site surveys will be conducted to identify nesting activity in suitable habitat. If nests are located within 0.5 miles of the project site with a direct line of sight to the activity, consultation with CDFG will be required to establish appropriate mitigation. Seasonal restrictions on project activities may be appropriate.
SS13	Bank swallow (*Riparia riparia*): Bank swallows prefer soft-textured vertical river banks to make burrows for their colonies. They breed from early May though July. Site surveys will be conducted to identify colonies in appropriate habitat. If colonies are located within 0.5 miles of the project site they will be flagged and avoided during construction. CDFG will be consulted to establish appropriate conservation. Seasonal restrictions on project activities may be appropriate.
SS14	Swainson's hawk (*Buteo swainsoni*): Swainson's hawks nest in the large trees of the lowlands of the Central Valley such as oaks, cottonwoods and walnuts. The nesting areas are in association with hunting grounds of open native grassland. Swainson's hawks arrive to breed from about March to April and chicks generally fledge around early July. If nests are located within 0.5 mile of the project site with

Code	Mitigation and Conservation Measures
	a direct line of sight to the activity, CDFG will be consulted to establish appropriate mitigation. Seasonal restrictions on project activities may be appropriate.
	Hydrology and Stream Channel
HSC1	Projects will be planned and designed based on geomorphological analysis.
HSC2	Work within stream channels will be minimized, to the extent possible.
HSC3	If stream flows are accelerated due to riprap or other bank protection, wing-deflectors or other measures will be considered on opposite and down streambanks; ends of riprapped areas will be stabilized to prevent erosion.
HSC4	Streambanks will be contoured appropriately to provide stability.
HSC5	Plantings of riparian vegetation will be designed to not adversely affect groundwater hydrology or flood storage space or hinder flood flows that must be maintained to prevent flood damage.
HSC6	Proposed actions will be designed to be compatible with existing flood control systems and be coordinated with local flood control entities.
HSC7	Proposed actions will comply with established local flood control regulations.
HSC8	Erosion and sedimentation due to alterations in water control structures will be managed to minimize adverse effects on irrigation system hydrology and beneficial uses of water.
HSC	Installation, removal, or modification of water control structures will be designed to maintain or enhance hydrological conditions and preserve beneficial uses of water among water users, with specific attention to interdependencies of structures throughout the system.
	Socioeconomic Conditions
SC1	Under all land use agreements, landowners would be monetarily compensated based on real estate appraisals of fair market value and land use rights acquired, as

Code	Mitigation and Conservation Measures
	provided by the Uniform Appraisal Standards for Federal Land Acquisition, 1973. The more rights that are obtained in an easement, the greater the payment to the landowner. Potential arrangements include conservation and flood easements, land set-aside agreements, transfers of development rights, and other agreements.
SC2	Land use rights acquired from landowners would consider the site-specific conservation needs and the land use needs of the landowner. Only those rights necessary for protection or restoration of habitat would be acquired by the easement.
SC3	Conserving habitat through fee titles may reduce county tax revenue because of potential decreases in market value of conserved land. However, if fee titles are acquired by the Service, the Service would annually reimburse the associated counties to offset revenue lost through the Refuge Revenue Sharing Act (Public Law 95-469). This law states that the Secretary of the Interior shall pay out to the counties the greater of the following amounts: a. An amount equal to the product of 75 cents multiplied by the total acreage of that portion of the fee area which is located within such county; or b. An amount equal to three-fourths of one percent of the fair market value, as determined by the Secretary, for that portion of the fee area which is located within such county; or c. An amount equal to 25 percent of the net receipts collected by the Secretary in connection with the operation and management of such fee area during such fiscal year. However, if a fee area is located in two or more counties, the amount for each county shall be proportioned in relationship to the acreage in that county. Congress may appropriate, through the budget process, supplemental funds to compensate local governments for any shortfall in revenue sharing payments. The Act also requires that the Service land be reappraised every 5 years to ensure that payments to local governments remain equitable. Payments under the Refuge Revenue Sharing Act would be made only on lands which the Service acquires through fee purchase, transfer, or donation fee title. On lands where the Service might acquire partial interest through easement, all taxes will remain the responsibility of the individual landowner.
SC4	Local contractors would be hired for the construction activities to the extent practicable to benefit local economies.

Code	Mitigation and Conservation Measures
SC5	Revegetation plans will incorporate measures to minimize the potential for establishment and spread of noxious weeds. Noxious weeds that may become established will be controlled as necessary.
	Air Quality and Noise
AQN1	Construction sites will be watered to control dust. Fume-emitting equipment will not be operated excessively near developed areas.
AQN2	Construction machinery will be equipped for noise suppression using modern mufflers and proper operating conditions. Nearby residents will be contacted prior to project construction. Noisy machinery will be placed as far away from developed areas as possible. Hours of construction will be limited to regular work hours when near developed areas. Machinery will be shut off when not in use.
	Cultural Resources
CR1	As necessary, surveys for archaeological resources will be conducted by a cultural resource specialist.
CR2	Proposed projects will comply with applicable cultural resources regulations and acquire appropriate permits or clearance.
CR3	If cultural sites or artifacts are discovered during construction, work will be stopped and a qualified archeologist will be consulted. The Native American Heritage Commission will be consulted if Native American artifacts are found.
	Recreation
R1	Project activities will be limited to weekdays whenever possible and will be completed as soon as possible to minimize temporary impairment of recreational opportunities during construction.
R2	Appropriate signs will be used to warn recreationists of construction activities and potentially hazardous conditions.
R3	Actions involving grading, terracing, or creating structures will be designed to blend into the landscape to every extent possible, and to appear as natural or visually pleasing as possible. Construction sites will be kept clean and orderly.

Code	Mitigation and Conservation Measures
	Hazardous Materials
HM1	The project site will be surveyed and tested for existing hazardous substances by qualified persons and, if present, cleaned up prior to construction. All fill material used will be checked for contaminants, and discarded material and any accidental spills will be removed and disposed of at an approved site.
HM2	Chemical pesticide and fertilizer use will be consistent with environmentally beneficial objectives of the actions.
HM3	A written contingency plan will be developed for all project sites where hazardous materials (e.g., pesticides, herbicides, and petroleum products) will be used or stored. Appropriate materials and supplies (e.g., shovel, disposal containers, absorbent materials, first aid supplies, and clean water) will be available on site to cleanup any small scale accidental hazardous spill. Hazardous spills will be reported to State and Federal authorities.
HM4	Treatments for the control or removal of invasive plants in riparian/wetland areas must be limited to hand or wick applications by qualified personnel.
HM5	Apply chemicals during calm, dry weather and maintain unsprayed buffer areas near aquatic habitats and other sensitive areas.
HM6	Chemical applications must be avoided where seasonal precipitation or excess irrigation water is likely to wash residual toxic substances into waterways.
	Access, Roads, and Traffic
ART1	Whenever possible, existing roads will be used to access project sites . Access agreements will be established with landowners as needed. Access to project sites will be clearly marked to avoid accidental trespass or damage to land cover.
ART2	Limitations will be placed on frequency and total amount of construction traffic, and appropriate speed limits will be set to reduce dust hazards and potential for accidents. Vehicle and heavy equipment speed within construction area will be safely limited.
	Unless maintenance or monitoring access is required, only temporary roads will be constructed. Temporary roads will be built with as little damage as possible to the

Code	Mitigation and Conservation Measures
ART3	land cover using careful routing and proper surface materials, such as wood chips. Sensitive root zones and vegetated areas will be fenced-off from roaded areas.
ART4	Temporary roads will be removed upon completion of the project and vegetation and habitats restored.
ART5	Temporary roads that have been severely compacted will be tilled to promote vegetation establishment and growth.
ART6	Access roads will be improved or built suitably for heavy equipment, multiple haul loads, and materials being transported. Loads will be covered, as needed, for trucks transporting material off-site.

APPENDIX C

FISHES OF BUTTE CREEK

COMMON NAME	SCIENTIFIC NAME
Pacific lamprey	*Lamper. tridentata*
Pacific brook lamprey	*Lamper pacifica*
Chinook salmon	*Oncorhynchus tshawytscha*
Steelhead rainbow trout	*Oncorhynchus mykiss*
Brown trout*	*Salmo, trutta*
Brook trout*	*Salvelinus foritinalis*
Hitch	*Lavinia exilicauda*
California roach	*Hesperoleucus symmetricus*
Hardhead	*Mylopharodon conocephalus*
Sacramento pikeminnow	*Ptychocheilus grandis*
Speckled dace	*Rhinichthys osculus*
Golden shiner*	*Noternigonus crysoleucas*
Goldfish*	*Carassius auratus*
Common Carp*	*Cyprinus carpio*
Sacramento sucker	*Catostomus occidentalis*
Black bullhead*	*Ictalurus melas*
Brown bullhead*	*Ictalurus nebulosus*
Channel catfish*	*Ictalurus punctatus*
Mosquitofish*	*Gambusia affinis*
Threespine stickleback	*Gasterosteus aculeatus*
Bluegill*	*Lepomis macrochirus*
Redear sunfish*	*Lepomis microlophus*
Green sunfish*	*Lepomis cyanellus*
White crappie*	*Pornoxis annularis*
Black crappie*	*Pornoxis nigromaculatus*
Largemouth bass*	*Micropterus salmoides*
Smallmouth bass*	*Micropterus dolomicui*
Spotted bass*	*Micropterus punctulatus*
Bigscale logperch*	*Percina marcolepida*
Tule perch*	*Hystcrocarpus traski*
Prickly sculpin	*Cottus asper*
Riffle sculpin	*Cottus gulosus*

*Introduced species

Source: BCWP 1998

APPENDIX D

FEDERAL SPECIAL STATUS SPECIES

LISTED SPECIES

Birds
- Aleutian Canada goose, *Branta canadensis leucopareia*(T)
- bald eagle, *Haliaeetus leucocephalus*(T)
- northern spotted owl, *Strix occidentalis caurina*(T)

Reptiles
- giant garter snake, *Thamnophis gigas*(T)

Amphibians
- California red-legged frog, *Rana aurora draytonii*(T)

Fish
- Central Valley steelhead, *Oncorhynchus mykiss*(T)
- delta smelt, *Hypomesus transpacificus*(T)
- winter-run chinook salmon, *Oncorhynchus tshawytscha*(E)
- Critical habitat, winter-run chinook salmon, *Oncorhynchus tshawytscha*(E)
- Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha*(T)
- Critical habitat, Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha*(T)
- Sacramento splittail, *Pogonichthys macrolepidotus*(T)

Invertebrates
- Conservancy fairy shrimp, *Branchinecta conservatio*(E)
- valley elderberry longhorn beetle, *Desmocerus californicus dimorphus*(T)
- vernal pool fairy shrimp, *Branchinecta lynchi*(T)
- vernal pool tadpole shrimp, *Lepidurus packardi*(E)

Plants
- Butte County (Shippee) meadowfoam, *Limnanthes floccosa ssp. californica*(E)
- Greene's tuctoria, *Tuctoria greenei*(E)
- Hoover's spurge, *Chamaesyce hooveri*(T)
- hairy Orcutt grass, *Orcuttia pilosa*(E)
- palmate-bracted bird's-beak, *Cordylanthus palmatus*(E)

CANDIDATE SPECIES

Birds
mountain plover, *Charadrius montanus*(C)

Fish
Central Valley fall/late fall-run chinook salmon, *Oncorhynchus tshawytscha*(C)
Critical habitat, Central Valley fall/late fall-run chinook, *Oncorhynchus tshawytscha*(C)

Amphibians
California tiger salamander, *Ambystoma californiense*(C)

SPECIES OF CONCERN

Mammals
California wolverine, *Gulo gulo luteus*(CA)
American (=pine) marten, *Martes americana*(SC)
Marysville Heermann's kangaroo rat, *Dipodomys californicus eximius*(SC)
Pacific fisher, *Martes pennanti pacifica*(SC)
Pacific western big-eared bat, *Plecotus townsendii townsendii*(SC)
San Joaquin pocket mouse, *Perognathus inornatus*(SC)
Sierra Nevada snowshoe hare, *Lepus americanus tahoensis*(SC)
Yuma myotis bat, *Myotis yumanensis*(SC)
fringed myotis bat, *Myotis thysanodes*(SC)
greater western mastiff-bat, *Eumops perotis californicus*(SC)
long-eared myotis bat, *Myotis evotis*(SC)
long-legged myotis bat, *Myotis volans*(SC)
pale Townsend's big-eared bat, *Plecotus townsendii pallescens*(SC)
pygmy rabbit, *Brachylagus idahoensis*(SC)
small-footed myotis bat, *Myotis ciliolabrum*(SC)
spotted bat, *Euderma maculatum*(SC)

Birds
California spotted owl, *Strix occidentalis occidentalis*(SC)
ferruginous hawk, *Buteo regalis*(SC)
northern goshawk, *Accipiter gentilis*(SC)
tricolored blackbird, *Agelaius tricolor*(SC)
western burrowing owl, *Athene cunicularia hypugea*(SC)
white-faced ibis, *Plegadis chihi*(SC)
American peregrine falcon, *Falco peregrinus anatum*(D)
Swainson’s hawk, *Buteo swainsoni*(CA)
bank swallow, *Riparia riparia*(CA)
greater sandhill crane, *Grus canadensis tabida*(CA)
little willow flycatcher, *Empidonax trailii brewsteri*(CA)

Reptiles
- California horned lizard, *Phrynosoma coronatum frontale*(SC)
- San Joaquin whipsnake, *Masticophis flagellum ruddocki*(SC)
- northwestern pond turtle, *Clemmys marmorata marmorata*(SC)

Amphibians
- Cascades frog, *Rana cascadae*(SC)
- foothill yellow-legged frog, *Rana boylii*(SC)
- mountain yellow-legged frog, *Rana muscosa*(SC)
- western spadefoot toad, *Scaphiopus hammondii*(SC)

Fish
- Pacific lamprey, *Lampetra tridentata*(SC)
- green sturgeon, *Acipenser medirostris*(SC)
- longfin smelt, *Spirinchus thaleichthys*(SC)
- river lamprey, *Lampetra ayresi*(SC)

Invertebrates
- Antioch Dunes anthicid beetle, *Anthicus antiochensis*(SC)
- Sacramento Valley tiger beetle, *Cicindela hirticollis abrupta*(SC)
- Sacramento anthicid beetle, *Anthicus sacramento*(SC)
- amphibious caddisfly, *Desmona bethula*(SC)
- California linderiella, *Linderiella occidentalis*(SC)

Plants
- Butte County (western) catchfly, *Silene occidentalis ssp. longistipitata*(SC)
- Butte County morning-glory, *Calystegia atriplicifolia ssp. buttensis*(SC)
- Butte County sidalcea, *Sidalcea robusta*(SC)
- Butte fritillary, *Fritillaria eastwoodiae*(SC)
- California beaked-rush, *Rhynchospora californica*(SC)
- Ferris's milk-vetch, *Astragalus tener var. ferrisiae*(SC)
- Jepson's onion, *Allium jepsonii*(SC)
- Tracy's sanicle, *Sanicula tracyi*(SC)
- adobe lily, *Fritillaria pluriflora*(SC)
- brittlescale, *Atriplex depressa*(SC)
- closed-lip (closed-throated) beardtongue, *Penstemon personatus*(SC)
- heartscale, *Atriplex cordulata*(SC)
- little mousetail, *Myosurus minimus ssp. apus*(SC)
- scalloped moonwort, *Botrychium crenulatum*(SC)

upswept moonwort, *Botrychium ascendens*(SC)
veiny monardella, *Monardella douglasii ssp. venosa*(SC)

KEY:

(E) *Endangered*	Listed (in the Federal Register) as being in danger of extinction.
(T) *Threatened*	Listed as likely to become endangered within the foreseeable future.
(P) *Proposed*	Officially proposed (in the Federal register) for listing as endangered or threatened.
(C) *Candidate*	Candidate to become a proposed species.
(SC) *Species of Concern*	May be endangered or threatened. Not enough biological information has been gathered to support listing at this time.
(D) *Delisted*	Delisted. Status to be monitored for 5 years.
(CA) State-Listed	Listed as threatened or endangered by the State of California.
Critical Habitat	Area essential to the conservation of a species.

Source: U.S. Fish and Wildlife Service, January 27, 2000

CALIFORNIA STATE SPECIAL STATUS SPECIES

LISTED SPECIES

Birds
- western yellow-billed cuckoo, *Coccyzus americanus occidentalis* (E)
- bank swallow, *Riparia riparia* (T)
- Swainson's hawk, *Buteo swainsoni* (T)
- bald eagle, *Haliaeetus leucocephalus* (E)
- American peregrine falcon, *Falco peregrinus anatum* (E)

Reptiles
- giant garter snake, *Thamnophis gigas* (T)

Fish
- Central Valley spring-run chinook salmon, *Oncorhynchus tshawytscha* (E)
- Central Valley winter-run chinook salmon, *Oncorhynchus tshawytscha* (E)
- delta smelt, *Hypomesus transpacificus* (T)

Plants
- Greene's tuctoria, *Tuctoria greenei* (E)
- hairy Orcutt grass, *Orcuttia pilosa* (E)
- slender Orcutt grass, *Orcuttia tenuis* (T)
- Butte County (Shippee) meadowfoam, *Limnanthes floccosa* ssp. *californica* (E)

KEY:

(E) Endangered
(T) Threatened
(C) Candidate

Source: California Department of Fish and Game Natural Diversity Data Base, March 24, 1999

APPENDIX E

Distributions, habitats, and reasons for decline for special status species that may occur in the area of the Proposed Actions. From USBR (1997b), CALFED (1997b), and USFWS (1997b).

Species	California Distribution	Habitat	Reason for Decline or Concern
Conservancy fairy shrimp *Branchinecta conservatio*	Disjunct occurrences in Solano, Merced, Tehama, Butte, and Glenn counties	Large, deep vernal pools in annual grasslands	Habitat loss to agricultural and urban development
Vernal pool fairy shrimp *Branchinecta lynchi*	Central Valley from Shasta County to Tulare County, along the Coast Ranges from Solano County to Santa Barbara County, and in southern California in Riverside and San Diego counties	Vernal pools and other seasonal freshwater wetlands	Habitat loss to agricultural and urban development
Vernal pool tadpole shrimp *Lepidurus packardi*	Shasta County south to Merced County	Vernal pools; ephemeral stock ponds	Habitat loss to agricultural and urban development
Valley elderberry longhorn beetle *Desmocerus californicus dimorphus*	Streamside habitats below 3,000 feet through the Central Valley of California	Riparian and oak savanna habitats with elderberry shrubs	Loss and fragmentation of riparian habitats
California tiger salamander *Ambystoma californiense*	Central Valley, including Sierra Nevada foothills, up to approximately 1,000 feet, and coastal region from Butte County south to Santa Barbara County	Small ponds, lakes, or vernal pools in grasslands and oak woodlands for larvae; rodent burrows, rock crevices, or fallen logs for cover for adults and for summer dormancy	Loss of grasslands, vernal pools, and other wetlands to agricultural development and urbanization
California red- legged frog *Rana aurora draytoni*	Found along the coast and coastal mountain ranges of California from	Permanent and semipermanent aquatic habitats, such as creeks	Alteration of stream and wetland habitats, over-

Species	California Distribution	Habitat	Reason for Decline or Concern
	Humboldt County to San Diego County, and formerly in the Sierra Nevada foothills and midelevations from Butte County to Fresno County	and cold water ponds, with emergent and submergent vegetation and riparian species along the edges; may estivate in rodent burrows or cracks during dry periods	harvesting (historically), habitat destruction, and competition and predation by fish and bullfrogs
Giant garter snake *Thamnophis gigas*	Central Valley from Fresno north to the Gridley/ Sutter Buttes area; has been extirpated from areas south of Fresno	Sloughs, canals, and other small waterways where there is a prey base of small fish and amphibians; requires grassy banks and emergent vegetation for basking and areas of high ground protected from flooding during winter	Loss of habitat from agriculture and urban development
Aleutian Canada goose *Branta canadensis leucopareia*	The entire population winters in Butte Sink, then moves to Los Banos, Modesto, the Delta, and East Bay reservoirs; stages near Crescent City during spring before migrating to breeding grounds	Roosts in large marshes, flooded fields, stock ponds, and reservoirs; forages in pastures, meadows, and harvested grainfields; corn is especially preferred	Introduction of predators on breeding grounds; loss of traditional wintering habitat
Bald eagle *Haliaeetus leucocephalus*	Nests in Siskiyou, Modoc, Trinity, Shasta, Lassen, Plumas, Butte, Tehama, Lake, and Mendocino counties and Lake Tahoe Basin; reintroduced central coast; winters in rest of California, except southeastern deserts, high altitudes in Sierras, and east of Sierra Nevada south of Mono County; range expanding	In western North America, nests and roosts in coniferous forests within 1 mile of a lake, a reservoir, a river, or the ocean	Nest sites vulnerable to human disturbance; pesticide contamination
Swainson's hawk *Buteo swainsoni*	Lower Sacramento and San Joaquin valleys, the Klamath Basin, and Butte Valley; the state's highest nesting	Nests in oaks or cottonwoods in or near riparian habitats; forages in grasslands, irrigated pastures,	Loss of riparian, agriculture, and grassland habitats; vulnerable to human

Species	California Distribution	Habitat	Reason for Decline or Concern
	densities occur near Davis and Woodland, Yolo County	and grain fields	disturbance at nest sites
American peregrine falcon *Falco peregrinus anatum*	Permanent resident on the North and South Coast ranges; may summer on the Cascade and Klamath ranges south through the Sierra Nevada to Madera County; winters in the Central Valley south through the Transverse and Peninsular ranges and the plains east of the Cascade Range	Nests and roosts on protected ledges of high cliffs, usually adjacent to lakes, rivers, or marshes that support large populations of other bird species	Pesticide contamination; population recovering
Mountain plover Charadrius montanus	Does not breed in California; in winter, found in the Central Valley south of Yuba County, along the coast in parts of San Luis Obispo, Santa Barbara, Ventura, and San Diego counties; parts of Imperial, Riverside, Kern, and Los Angeles counties	Occupies open plains or rolling hills with short grasses or very sparse vegetation; nearby bodies of water are not needed; may use newly plowed or sprouting grainfields	Loss of habitat to agriculture and urban development; declines of California's wintering population may be attributable to disturbance of breeding population
Western yellow- billed cuckoo *Coccyzus americanus occidentalis*	Nests along the upper Sacramento, lower Feather, south fork of the Kern, Amargosa, Santa Ana, and Colorado rivers	Wide, dense, riparian forests with a thick understory of willows for nesting; sites with a dominant cottonwood overstory are preferred for foraging; may avoid valley oak riparian habitats where scrub jays are abundant	Loss of riparian habitat to agriculture and water control development; possible pesticide contamination
Bank swallow *Riparia riparia*	State's largest breeding populations are along the Sacramento River from Tehama County to Sacramento County, along the Feather and lower	Nests in bluffs or banks, usually adjacent to water, where the soil consists of sand or sandy loam to allow digging	Loss of natural earthen banks to bank protection and flood control, erosion control related to stream regulation by dams

Species	California Distribution	Habitat	Reason for Decline or Concern
	American rivers, and the Owens Valley. Also breed on the plains east of the Cascade Range south through Lassen County, northern Siskiyou County, and small populations near the coast from San Francisco County to Monterey County		
Chinook salmon (winter-run) *Oncorhynchus tshawytscha*	Sacramento River, with successful spawning limited to the reach immediately downstream of Keswick Reservoir	Anadromous species favoring clean, cold water over gravel beds during summer months and appropriate habitats for rearing and smolt emigration through the Delta	Cumulative effects of degrading spawning, rearing, and migration habitats
Chinook salmon (fall-run) *Oncorhynchus tshawytscha*	Distributed throughout central California	Anadromous species favoring clean, cold water over gravel beds during fall months and appropriate habitats for rearing and smolt emigration through the Delta	Cumulative effects of degrading spawning, rearing, and migration habitats
Chinook salmon (late-fall-run) *Oncorhynchus tshawytscha*	Sacramento River and tributaries, including Butte and Battle Creeks	Anadromous species favoring clean, cold water over gravel beds during winter months and appropriate habitats for rearing and smolt emigration through the Delta	Cumulative effects of degrading spawning, rearing, and migration habitats
Delta smelt *Hypomesus transpacificus*	Delta, Suisun Bay, and Suisun Marsh	Euryhaline habitats with salinities no more than 10- 12 ppt in both main Delta channels and open waters	Low Delta outflow, poor food productivity, loss of low salinity habitat, poor spawning habitat, losses at water diversions
Sacramento splittail	Delta; Suisun Bay; and Suisun Marsh,	Primarily freshwater but tolerant	Loss of floodplain spawning and

Species	California Distribution	Habitat	Reason for Decline or Concern
Pogonichthys macrolepidotus	Napa Marsh, and other parts of the estuary	of salinities of 10- 12 ppt in slow- moving sections of rivers and sloughs with flooded vegetation for spawning	rearing habitat; low stream flows limiting transport of young to nursery habitat
Steelhead trout *Oncorhynchus mykiss*	Distributed throughout coastal and central California	Anadromous species favoring large cold-water tributaries with deep pools for oversummering habitat	Cumulative effects of degrading spawning, rearing, and migration habitats; blockage of spawning streams by dams
Chinook salmon (spring-run) *Oncorhynchus tshawytscha*	Major isolated tributaries to the Trinity, Klamath, and Upper Sacramento rivers, including Mill, Deer, and Butte creeks and the Feather River	Anadromous species favoring large, cold-water tributaries with deep pools for oversummering habitat	Cumulative effects of degrading spawning, rearing, and migration habitats
Palmate- bracted bird's- beak *Cordylanthus palmatus*	Alameda, Colusa, Fresno, Madera [extirpated], San Joaquin [extirpated], Yolo	Chenopod scrub, valley and foothill grassland (alkaline)	Soil reclamation, draining of seasonal wetlands, conversion of land to agricultural use, urbanization, livestock grazing, and ORV use and trash dumping
Butte County meadowfoam *Limnanthes floccosa* ssp. *californica*	Butte, Tehama	Vernal pools, valley and foothill grassland (mesic)	Urban development, over-grazing, and the conversion of vernal pool habitat to agricultural fields.
Hairy Orcutt grass *Orcuttia pilosa*	Madera, Merced, Stanislaus, Tehama	Vernal pools	Conversion of vernal pool habitat to irrigated agriculture, overgrazing, agricultural practices, and competition from non-native weeds
Greene's tuctoria *Tuctoria greenei*	Butte, Fresno [extirpated], Madera [extirpated], Merced, Shasta, San Joaquin [extirpated],	Vernal pools	Agriculture, overgrazing, and urban development

Species	California Distribution	Habitat	Reason for Decline or Concern
Hoover's spurge *Chamaesyce hooveri*	Stanislaus [extirpated], Tehama, Tulare [extirpated] Butte, Glenn, Stanislaus, Tehama, Tulare	Vernal Pools	Loss of vernal pool habitat to irrigated agriculture and overgrazing

APPENDIX F

Summary of potential effects on environmental resources and associated mitigation and conservation measures. Mitigation and conservation measures are defined in Appendix B.

ACTION	POTENTIAL EFFECTS ON RESOURCES	MITIGATION AND CONSERVATION
Land Conservation	Socioeconomic Conditions Land uses may be altered or land use practices may be restricted. County tax revenues could change as a result of fee title acquisitions or conservation easements that restrict land uses or dedicate agricultural land to habitat management. All Other Effects All other effects are described under associated actions that may be implemented under land conservation agreements.	Socioeconomic Conditions SC1, SC2, SC3, SC4 Category codes for mitigation and conservation measures: VW = Vegetation and Wildlife FWQ = Fisheries and Water Quality SS = Special Status Species HSC = Hydrology and Stream Channel SC = Socioeconomic Conditions AQN = Air Quality and Noise CR = Cultural Resources R = Recreation HM = Hazardous Materials ART = Access, Roads, and Traffic

ACTION	POTENTIAL EFFECTS ON RESOURCES	MITIGATION AND CONSERVATION
Fish Passage	Vegetation and Wildlife Vegetation could be lost at access points, construction sites, and staging areas. Isolation of riparian vegetation and wetlands from water supplies due to changes in hydrology. Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction; incidental mortality or injury. Fisheries and Water Quality Risk of oil or grease discharge from equipment; temporary siltation and turbidity due to construction; temporary dewatered habitat; temporary disturbance of aquatic habitat; incidental mortality or injury. Improved fish migration within creek; reduced stranding and entrainment; reduced injuries during migration; reduced fish mortalities from warm water temperatures and poaching. Special Status Species Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Improved salmonid and splittail passage; reduced stranding and entrainment; reduced injuries mortalities from warm water temperatures and poaching. Hydrology and Stream Channel Changes in water control structures could alter streambank and streambed erosion, sediment transport and deposition, or inhibit beneficial uses of water. May alter flood control systems. Reduced sedimentation from instream structures; improved flows and water control for channel maintenance and beneficial uses of water. Socioeconomic Conditions Incidental flooding on adjacent cropland could affect crop production. Air Quality and Noise Dust and vehicle exhaust due to construction activities. Cultural Resources Disturbance of exposed or buried cultural resources. Recreation Recreational activities could be impeded during project construction.	Vegetation and Wildlife VW1-20, HM3, ART1-6, AQN2 Fisheries and Water Quality FWQ1-8, HM3 Special Status Species SS1-14 Hydrology and Stream Channel HSC1-9 Socioeconomic Conditions SC1 Air Quality and Noise AQN1, AQN2 Cultural Resources CR1, CR2, CR3 Recreation R1, R2, R3

ACTION	POTENTIAL EFFECTS ON RESOURCES	MITIGATION AND CONSERVATION
Fish Screens	Vegetation and Wildlife Vegetation could be lost at the access points, construction sites, and staging areas. Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Fisheries and Water Quality Risk of oil or grease discharge from equipment; temporary siltation and turbidity due to construction; dewatered habitat; temporary disturbance of aquatic habitat. Reduced straying and entrainment of juvenile and adult fish into water diversions. Special Status Species Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Reduced straying and entrainment of juvenile and adult fish into water diversions. Hydrology and Stream Channel Changes in channel geomorphology may alter streambank and streambed erosion and sediment transport and deposition. Flood control systems could be altered. Socioeconomic Conditions No effects expected. Air Quality and Noise Dust and vehicle exhaust due to construction activities. Cultural Resources Disturbance of exposed or buried cultural resources. Recreation Recreational activities could be impeded during project construction.	Vegetation and Wildlife VW1-20, HM3, ART1-6, AQN2 Fisheries and Water Quality FWQ1-8, HM3 Special Status Species SS1-14 Hydrology and Stream Channel HSC1-7 Socioeconomic Conditions n/a Air Quality and Noise AQN1, AQN2 Cultural Resources CR1, CR2, CR3 Recreation R1, R2, R3
Spawning	Vegetation and Wildlife	Vegetation and Wildlife

ACTION	POTENTIAL EFFECTS ON RESOURCES	MITIGATION AND CONSERVATION
Gravel	Vegetation could be lost at the access points, construction sites, and staging areas. Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Fisheries and Water Quality Risk of oil or grease discharge from equipment; temporary siltation and turbidity due to construction ; dewatered habitat; temporary disturbance of aquatic habitat. Increased quantity and quality of spawning habitat; improved hatching and rearing success; improved aquatic invertebrate production. Special Status Species Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Increased quantity and quality of spawning habitat; improved hatching and rearing success; improved aquatic invertebrate production. Hydrology and Stream Channel Changes in channel geomorphology may alter streambank and streambed erosion and sediment transport and deposition. Flood control systems could be altered. Socioeconomic Conditions No effects are expected. Air Quality and Noise Dust and vehicle exhaust due to construction activities. Cultural Resources Disturbance of exposed or buried cultural resources. Recreation Recreational activities could be impeded during project construction.	VW1-13, VW16, VW18-20, HM3, ART1-6, AQN2 Fisheries and Water Quality FWQ1-8, HM3 Special Status Species SS1-14 Hydrology and Stream Channel HSC1-7 Socioeconomic Conditions n/a Air Quality and Noise AQN1, AQN2 Cultural Resources CR1, CR2, CR3 Recreation R1, R2
Riparian	Vegetation and Wildlife	Vegetation and Wildlife

ACTION	POTENTIAL EFFECTS ON RESOURCES	MITIGATION AND CONSERVATION
Revegetation	Loss of vegetation from equipment use and earth disturbing activities; loss of vegetation from streambank erosion during and after land recontouring; injury to native vegetation during exotic vegetation removal. Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Increased riparian habitat area and quality; improved shade and cover for fish and wildlife; enhanced nutrient cycling and invertebrate production; stabilized banks; improved dispersion and migration pathways; reduced water velocities. <u>Fisheries and Water Quality</u> Temporary siltation and turbidity from construction on streambank or within stream channel. Reduced sedimentation in creek; increase SRA habitat; reduced aquatic temperature; buffer impacts from adjacent uplands. <u>Special Status Species</u> Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Benefits are similar to those in Vegetation and Wildlife and Fisheries and Water Quality, and includes enhancement of special status species habitats. <u>Hydrology and Stream Channel</u> Riparian vegetation in floodplain could increase. <u>Socioeconomic Conditions</u> Loss of agricultural productivity due to dedication of agricultural land to riparian habitat. <u>Air Quality and Noise</u> Dust and vehicle exhaust due to construction activities. <u>Cultural Resources</u> Disturbance of exposed or buried cultural resources. <u>Recreation</u> Recreational activities could be impeded during project construction. However, the long term effect would increase visual aesthetics and shade.	VW1-20, HM1-6, ART1-6, AQN2 <u>Fisheries and Water Quality</u> FWQ7, HM2-6 <u>Special Status Species</u> SS1-14 <u>Hydrology and Stream Channel</u> HSC1-7 <u>Socioeconomic Conditions</u> SC1, SC2, SC3, SC4 <u>Air Quality and Noise</u> AQN1, AQN2 <u>Cultural Resources</u> CR1, CR2, CR3 <u>Recreation</u> VW11, R1, R2
Channel and	<u>Vegetation and Wildlife</u>	<u>Vegetation and Wildlife</u>

ACTION	POTENTIAL EFFECTS ON RESOURCES	MITIGATION AND CONSERVATION
Instream Habitat Modification	Vegetation could be lost at the access points, construction sites, and staging areas. Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Fisheries and Water Quality Risk of oil or grease discharge from equipment; temporary siltation and turbidity due to construction ; dewatered habitat; temporary disturbance of aquatic habitat. Special Status Species Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Hydrology and Stream Channel Changes is channel geomorphology may alter streambank and streambed erosion and sediment transport and deposition. Flood control systems could be altered. Socioeconomic Conditions No adverse effects are expected. Air Quality and Noise Dust and vehicle exhaust due to construction activities. Cultural Resources Disturbance of exposed or buried cultural resources. Recreation Recreational activities could be impeded during project construction.	VW1-13, VW16, VW18-20, HM3, ART1-6, AQN2 Fisheries and Water Quality FWQ1-8, HM3 Special Status Species SS1-14 Hydrology and Stream Channel HSC1-7 Socioeconomic Conditions n/a Air Quality and Noise AQN1, AQN2 Cultural Resources CR1, CR2, CR3 Recreation R1, R2
Meander Belt and Floodplain	Vegetation and Wildlife Loss of vegetation from equipment use and earth disturbing activities; loss of vegetation from	Vegetation and Wildlife VW1-20, HM1-6, ART1-6, AQN2

ACTION	POTENTIAL EFFECTS ON RESOURCES	MITIGATION AND CONSERVATION
Management	streambank erosion during and after land recontouring; injury to native vegetation during exotic vegetation removal. Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Fisheries and Water Quality Temporary siltation and turbidity from revegetation activities on or near streambanks and within stream channels. Special Status Species Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Hydrology and Stream Channel Changes is channel geomorphology may alter streambank and streambed erosion and sediment transport and deposition. Riparian vegetation in floodplain could increase. Flood control systems could be altered. Socioeconomic Conditions Loss of agricultural productivity due to dedication of agricultural land to flooding or establishment of riparian habitat. Air Quality and Noise Dust and vehicle exhaust due to construction activities. Cultural Resources Disturbance of exposed or buried cultural resources. Recreation Recreational activities could be impeded during project construction.	Fisheries and Water Quality FWQ1, FWQ2, FWQ4-7, HM2-6 Special Status Species SS1-14 Hydrology and Stream Channel HSC1-7 Socioeconomic Conditions SC1, SC2, SC3, SC4 Air Quality and Noise AQN1, AQN2 Cultural Resources CR1, CR2, CR3 Recreation R1, R2, R3

ACTION	POTENTIAL EFFECTS ON RESOURCES	MITIGATION AND CONSERVATION
Streambank Modification	Vegetation and Wildlife Loss of vegetation from equipment use and earth disturbing activities; loss of vegetation from streambank erosion during and after land recontouring; injury to native vegetation during exotic vegetation removal. Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Improved substrates for riparian vegetation growth. Fisheries and Water Quality Temporary siltation and turbidity from construction on streambank or within stream channel. Reduced erosion; enhanced near-shore cover for fish and other aquatic species Special Status Species Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Benefits are similar to those in Vegetation and Wildlife and Fisheries and Water Quality, and includes enhancement of special status species habitats. Hydrology and Stream Channel Changes in streambank geomorphology may alter streambank and streambed erosion and sediment transport and deposition. Streambank and streambed should be more stable in problematic areas. Socioeconomic Conditions Temporary or minor loss of agricultural productivity due to construction. Air Quality and Noise Dust and vehicle exhaust due to construction activities. Cultural Resources Disturbance of exposed or buried cultural resources. Recreation Recreational activities could be impeded during project construction.	Vegetation and Wildlife VW1-20, HM1-6, ART1-6, AQN2 Fisheries and Water Quality FWQ1-8, HM3 Special Status Species SS1-14 Hydrology and Stream Channel HSC1-4, HSC6, HSC7 Socioeconomic Conditions SC1, SC2, SC3, SC4 Air Quality and Noise AQN1, AQN2 Cultural Resources CR1, CR2, CR3 Recreation VW11, R1, R2

ACTION	POTENTIAL EFFECTS ON RESOURCES	MITIGATION AND CONSERVATION
Agricultural Management	Vegetation and Wildlife Temporary disturbance due to management activities. Protection and enhancement of aquatic, riparian, and upland habitats through revision or elimination of incompatible agricultural practices. Fisheries and Water Quality Temporary siltation and turbidity due to management activities. Protected and enhanced aquatic ecosystem through reductions in pesticide, herbicide, and chemical use; reduced damage to riparian zones from agricultural practices; reduced sedimentation; prevention of widening and aggrading creek channels; reduced livestock wastes into creek. Special Status Species Temporary disturbance due to management activities. Benefits are similar to those in Vegetation and Wildlife and Fisheries and Water Quality, and includes enhancement of special status species habitats. Hydrology and Stream Channel Temporary disturbance due to management activities. Socioeconomic Conditions Temporary or minor loss of agricultural productivity due to management activities or dedication of agricultural land to habitat management. Air Quality and Noise Dust and vehicle exhaust due to management activities. Cultural Resources Disturbance of exposed or buried cultural resources Recreation Recreational activities could be impeded due to management activities.	Vegetation and Wildlife VW1-7, VW9-14, ART1, AQN2 Fisheries and Water Quality FWQ4, FWQ5, FWQ7 Special Status Species SS1-14 Hydrology and Stream Channel HSC2 Socioeconomic Conditions SC1, SC2, SC3, SC4 Air Quality and Noise AQN1, AQN2 Cultural Resources CR1, CR2, CR3 Recreation R1, R2

ACTION	POTENTIAL EFFECTS ON RESOURCES	MITIGATION AND CONSERVATION
Road Management	Vegetation and Wildlife Impacts to vegetation from construction equipment and earth-disturbing activities; vegetation loss from temporary streambank erosion. Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Fisheries and Water Quality Temporary siltation and turbidity due to construction near stream channels or at road crossings. Long term effects should be reduced erosion and sedimentation. Special Status Species Temporary disturbance from construction noise and activities; temporary loss or degradation of habitat during construction and before habitat restoration; incidental mortality or injury. Enhancement of anadromous salmonid spawning habitats by reducing sedimentation and degradation of stream habitat. Hydrology and Stream Channel Stream channel could be damaged at road crossings. However, stream channel would be prevented from excessive erosion in problematic areas. Socioeconomic Conditions No effects are expected Air Quality and Noise Dust and vehicle exhaust due to construction activities. Cultural Resources Disturbance of exposed or buried cultural resources. Recreation Recreational activities could be impeded during project construction.	Vegetation and Wildlife VW1-20, HM1, HM3, ART1, ART2, AQN2 Fisheries and Water Quality FWQ1-8 Special Status Species SS1-14 Hydrology and Stream Channel HSC1-4, HSC6, HSC7 Socioeconomic Conditions n/a Air Quality and Noise AQN1, AQN2 Cultural Resources CR1, CR2, CR3 Recreation R1, R2

ACTION	POTENTIAL EFFECTS ON RESOURCES	MITIGATION AND CONSERVATION
Monitoring	Vegetation and Wildlife Temporary disturbance due to monitoring activities. Data would be acquired to improve vegetation and wildlife management. Fisheries and Water Quality Temporary increases in sedimentation and turbidity due to monitoring activities. Data would be acquired to improve fishery and water quality management. Special Status Species Temporary disturbance of special-status species and their habitats due to monitoring activities. Data would be acquired to improve management of special status species. Hydrology and Stream Channel Data would be acquired to improve hydrology and stream channel management. Socioeconomic Conditions No effects are expected. Air Quality and Noise Dust and vehicle exhaust due to monitoring activities. Cultural Resources Disturbance of exposed or buried cultural resources. Recreation Recreational activities could be impeded during monitoring activities.	Vegetation and Wildlife VW1, VW3, VW9, VW10, VW18, AQN2 Fisheries and Water Quality FWQ1, FWQ4, FWQ9 Special Status Species SS1-14 Hydrology and Stream Channel n/a Socioeconomic Conditions n/a Air Quality and Noise AQN1, AQN2 Cultural Resources CR1, CR2, CR3 Recreation R1, R2