

This section addresses fish species found in the lower Feather River and lower Yuba River, including species that are listed or are candidates for listing under the federal Endangered Species Act (ESA) and the California Endangered Species Act (CESA). Water quality, hydrology, and geomorphology are discussed in Section 5.3, “Water Resources and River Geomorphology.” Terrestrial biological resources (e.g., plants, wildlife) are discussed in Section 5.5, “Terrestrial Biological Resources.”

5.4.1 REGULATORY SETTING

FEDERAL PLANS, POLICIES, REGULATIONS, AND LAWS

Federal Endangered Species Act

Pursuant to ESA, the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) have authority over projects that may result in take of a federally listed species. Under ESA, “take” means “harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct.” USFWS has also interpreted the definition of “harm” to include significant habitat modification. If the project may affect a federally listed species, either an incidental take permit under ESA Section 10(a) or a federal interagency consultation under ESA Section 7 is required. USFWS has regulatory jurisdiction over freshwater and estuarine fishes (such as delta smelt), while NMFS has jurisdiction over anadromous and marine species (such as chinook salmon and steelhead).

Sustainable Fisheries Act

In response to growing concern about the status of U.S. fisheries, the Sustainable Fisheries Act of 1996 (Public Law [PL] 104-297) was passed by Congress to amend the Magnuson-Stevens Fishery Conservation and Management Act (PL 94-265), the primary law governing marine fisheries management in the federal waters of the United States. Under the Sustainable Fisheries Act, consultation is required by NMFS on any activity that might adversely affect essential fish habitat (EFH). EFH includes those habitats that fish rely on throughout their life cycles. It encompasses habitats necessary to allow sufficient production of commercially valuable aquatic species to support a long-term sustainable fishery and contribute to a healthy ecosystem.

Fish and Wildlife Coordination Act

The Fish and Wildlife Coordination Act (16 U.S. Code 661–666c), as amended, requires federal agencies to consult with USFWS, NMFS, and state fish and wildlife resource agencies before undertaking or approving projects that control or modify surface water. The recommendations made by these agencies must be fully considered in project plans by federal agencies.

Clean Water Act, Section 404

Section 404 of the Clean Water Act (CWA) establishes a requirement to obtain a permit from the U.S. Army Corps of Engineers (Corps) before undertaking any activity that involves any discharge of dredged or fill material into “waters of the United States,” including wetlands. Waters of the United States include navigable waters of the United States, interstate waters, all other waters where the use or degradation or destruction of the waters could affect interstate or foreign commerce, tributaries to any of these waters, and wetlands that meet any of these criteria or that are adjacent to any of these waters or their tributaries. Many surface waters and wetlands in California, including the Feather and Yuba Rivers, meet the criteria for waters of the United States. Under Section 404, the Corps must consider impacts on listed species under ESA; it thereby incorporates USFWS and NMFS findings on impacts on federally listed fish species in its permit conditions.

Clean Water Act, Section 401

CWA Section 401(a)(1) specifies that any applicant for a federal license or permit to conduct any activity that may result in any discharge into navigable waters shall provide the federal licensing or permitting agency with a certification that any such discharge will not violate state water quality standards. In California, the nine regional water quality control boards (RWQCBs) administer the Section 401 program, prescribing measures for projects as necessary to avoid, minimize, and mitigate adverse impacts on water quality and ecosystems.

STATE PLANS, POLICIES, REGULATIONS, AND LAWS

California Endangered Species Act

Pursuant to CESA, a permit from the California Department of Fish and Game (DFG) is required for projects that could result in the take of a species that is state-listed as threatened or endangered. Under CESA, “take” is defined as an activity that would directly or indirectly kill an individual of a species; the CESA definition of take does not include “harming” or “harassing,” as the ESA definition does. As a result, the threshold for take is higher under CESA than under ESA (i.e., habitat modification is not necessarily considered take under CESA).

Section 1600 et seq. of the California Fish and Game Code

All diversions, obstructions, or changes to the natural flow or bed, channel, or bank of any river, stream, or lake in California that supports wildlife resources are subject to regulation by DFG, pursuant to Sections 1600–1603 of the California Fish and Game Code. Under Section 1603, it is unlawful for any person to substantially divert or obstruct the natural flow or substantially change the bed, channel, or bank of any river, stream, or lake designated by DFG, or use any material from the streambeds, without first notifying DFG of such activity. A stream is defined as a body of water that flows at least periodically or intermittently through a bed or channel that has banks and supports fish or other aquatic life. This includes watercourses with a surface or subsurface flow that supports or has supported riparian vegetation. DFG’s jurisdiction within altered or artificial waterways is based on the value of those waterways to fish and wildlife. A DFG streambed alteration agreement must be obtained for any project that would result in an impact on a river, stream, or lake.

Flow Requirements Affecting the Lower Feather River and Lower Yuba River

In addition to the regulations described above, two processes have resulted in the establishment of flow requirements upstream of the project area for the enhancement and protection of fish habitat. Both affect conditions for fish in the lower Feather River and lower Yuba River.

Revised Water Right Decision 1644

The State Water Resources Control Board (SWRCB) adopted Water Right Decision 1644 on March 1, 2001 (State Water Resources Control Board 2001). On July 16, 2003, the SWRCB adopted Revised Decision 1644 (State Water Resources Control Board 2003). Revised Decision 1644 amends several water rights permits and licenses and requires other actions to protect fish in the reach of the Yuba River downstream of Englebright Reservoir. Revised Decision 1644 established interim and long-term instream flow requirements for fall-run chinook salmon, spring-run chinook salmon, steelhead, and American shad. The interim instream flow requirements were developed for the Yuba River in part to protect fisheries resources as the full use of Yuba County Water Agency's (YCWA's) existing water rights and water supplies occurs over time. It also requires the preparation of plans to reduce fish losses at two diversion facilities and requires actions to promote release of water from Englebright Dam at temperatures that benefit anadromous fish. Finally, Revised Decision 1644 includes several requirements to ensure that water diversions from the lower Yuba River are made pursuant to valid water rights.

The long-term instream flow requirements included in Revised Decision 1644 are higher flows that were scheduled to take effect on April 21, 2006. On November 18, 2005, YCWA petitioned the SWRCB requesting an extension of instream flow requirements under Revised Decision 1644 from April 21, 2006 to March 1, 2007. On April 6, 2006, the SWRCB issued an order (WR 2006-0009) concluding that it was appropriate to change the effective date of the long-term requirements to March 1, 2007, subject to provisions of the order (State Water Resources Control Board 2006).

The interim instream flow requirements developed and adopted by the SWRCB in 2003 are the current minimum flow requirements for the lower Yuba River. These requirements are shown in Table 5.4-1, "Interim Instream Flow Requirements for the Lower Yuba River Included in Revised Decision 1644."

Agreement Concerning Operation of the Oroville Facilities

The August 1983 agreement between the California Department of Water Resources (DWR) and DFG titled *Concerning the Operation of the Oroville Division of the State Water Project for Management of Fish & Wildlife* sets criteria for flow and temperature for the low-flow section of the Feather River (between Thermalito Diversion Dam and the Thermalito Afterbay river outlet) and the reach of the Feather River below the river outlet to the confluence with the Sacramento River. The required minimum flows specified in the agreement for the Feather River between Thermalito Afterbay and Verona (i.e., the confluence) are listed in Table 5.4-2, "Minimum Flow Requirements for the Feather River."

**Table 5.4-1
Interim Instream Flow Requirements for the Lower Yuba River Included in Revised Decision 1644**

Period	Wet and Above-Normal Years (cfs)		Below-Normal Years (cfs)		Dry Years (cfs)		Critical Years (cfs)	
	Smartville Gauge	Marysville Gauge	Smartville Gauge	Marysville Gauge	Smartville Gauge	Marysville Gauge	Smartville Gauge	Marysville Gauge
September 15–October 1	700	250	550	250	500	250	400	150
October 1–14	700	250	550	250	500	250	400	250
October 15–April 20	700	500	700	500	600	400	600	400
April 21		1,000		900		400		280
April 22–April 30		1,000		900		400		270
May 1–31		1,500		1,500		500		270
June 1		1,050		1,050		400		245*
June 2–30		800		800		400		245*
July 1		560		560		280		245*
July 2		390		390		250		245*
July 3		280		280		250		100
July 4–September 14		250		250		250		100

Note: cfs = cubic feet per second

* The interim instream flow requirements for June 1–30 of critical years shall be 245 cfs, except if a lower flow is allowed pursuant to the provisions of the 1965 Yuba County Water Agency/California Department of Fish and Game agreement. The minimum flow on July 1 shall be 70% of the flow on June 30, and the minimum flow on July 2 shall be 70% of the flow on July 1.

Source: State Water Resources Control Board 2003

**Table 5.4-2
Minimum Flow Requirements for the Feather River**

Required Flow (cfs)	Months Affected	Criteria
1,700	October through March	Feather River unimpaired runoff for the preceding April through July >55% of normal (1,942,000 af)
1,000	April through September	
1,200	October through February	Runoff for the preceding April through July <55% of normal or Two or more consecutive years of April-through-July runoff <60% of normal
1,000	March through September	
900	October through February	Minimum allowable flows; additional deficiencies up to 25% can be imposed in the same proportion as those applied to agriculture if the Oroville storage would fall below 1.5 million af under projected operation
750	March through September	
2,500	October 15–November 30	Normal maximum flow for river channel spawning gravels; if this flow is exceeded except for flood control, failure, etc., the minimum flow through March 31 shall not be less than 500 cfs below the average maximum 1-hour flow
Variable	April through June	Release scheduled water in other than constant flows or release water in excess of minimum flows ahead of time

Notes: af = acre-feet; cfs = cubic feet per second

Source: California Department of Water Resources and California Department of Fish and Game 1983

Additional requirements that are specified in the agreement for the protection of fish govern flows at Thermalito Diversion Dam and the Feather River Fish Hatchery, water temperatures below the Thermalito Afterbay outlet and at the Feather River Fish Hatchery, and the rate of change in flows below Thermalito Afterbay.

CALFED Bay-Delta Program

The CALFED Bay-Delta Program (CALFED) is not a regulatory program but is arguably the largest water management and ecosystem restoration program in the nation. It is a comprehensive program established to solve the San Francisco Bay/Sacramento–San Joaquin Delta’s (Bay-Delta’s) water supply, water quality, ecosystem, and levee integrity problems. As such, CALFED deserves mention as part of the regulatory background for the Feather River Levee Repair Project (FRLRP) because implementation of CALFED projects is having a substantial effect on conditions and actions associated with the Bay-Delta system, including those affecting the Feather and Yuba Rivers.

CALFED was initiated in 1995 as a collaboration among state and federal agencies and the state’s leading urban, agricultural, and environmental interests to address and resolve the environmental and water management problems associated with the Bay-Delta system. The mission of CALFED is to develop and implement a long-term comprehensive plan that would restore ecological health and improve water management for beneficial uses of the Bay-Delta.

CALFED addresses four interrelated, interdependent programs concurrently: water supply reliability, water quality, ecosystem restoration, and levee system integrity. These four major programs are implemented through 11 major program elements: Storage, Conveyance, Water Use Efficiency, Water Transfers, Ecosystem Restoration, Environmental Water Account, Water Management, Watersheds, Drinking Water Quality, Levee System Integrity, and the CALFED Science Program.

The Feather and Yuba Rivers are addressed in the CALFED Ecosystem Restoration Program (ERP). The ERP effort presents the visions for ecological management zones in the Bay-Delta system and their ecological management units. The Feather River/Sutter Basin Ecological Management Zone includes a Feather River Management Unit.

The visions for the unit include the following (CALFED Bay-Delta Program 2000):

- ▶ Improve natural spawning populations of spring- and fall-run chinook salmon and steelhead. This involves improving spring (March) flows below Oroville in dry and normal water years, improving spring-through-fall base flows, providing suitable water temperatures for summer rearing, and improving spawning and rearing habitat in the lower river below Oroville.
- ▶ Reactivate or maintain important ecological processes that create and sustain habitats for anadromous fish. The most important processes include floodplain and flood processes and a natural streamflow pattern in the river, to which most of the anadromous and resident native fishes are adapted.

LOCAL PLANS, POLICIES, REGULATIONS, AND LAWS

The *Yuba County General Plan* (Yuba County 1996) provides overall guidance for resource conservation in Yuba County and includes several resource conservation objectives that aim to protect significant biological resources. Specific habitats identified for special consideration for preservation and protection are the Yuba River and watershed within Yuba County. The general plan also states that the anadromous fishery occurring within the streams of Yuba County shall be afforded the same protection from the adverse effects of development as terrestrial species.

5.4.2 ENVIRONMENTAL SETTING

The FRLRP could potentially affect aquatic resources within the lower Feather and Yuba Rivers. The Feather and Yuba Rivers provide important habitat for native anadromous and resident Central Valley fishes, including species that are listed or species of concern for listing under ESA and CESA. Because the two rivers support many of the same fish species, they are discussed together in this section.

SOURCES OF INFORMATION

Information on existing conditions was derived from other environmental documents prepared for the project area and vicinity, including the following:

- ▶ previous environmental documents for the Yuba-Feather Supplemental Flood Control Project and the Feather-Bear Rivers Levee Setback Project;
- ▶ field data collected by DFG and DWR;
- ▶ status reviews of winter-run, spring-run, and fall-run chinook salmon, steelhead, green sturgeon, and Sacramento splittail; and
- ▶ reports describing historical conditions before construction of dams and other barriers.

Information was also derived from the California Natural Diversity Database (California Natural Diversity Database 2006) and a reconnaissance-level site visit conducted in July 2006.

FEATHER AND YUBA RIVER FISHERIES RESOURCES

The lower Feather and Yuba Rivers support a diverse assemblage of native and nonnative species (Table 5.4-3, “Fishes Present in the Lower Feather and Yuba Rivers”). Anadromous and other migratory species include Central Valley fall-run chinook salmon, Central Valley spring-run chinook salmon, Central Valley steelhead, white sturgeon, green sturgeon, Pacific lamprey, striped bass, and American shad. Juvenile winter-run chinook salmon may also periodically move into the lower Feather River during their downstream migrations in the Sacramento River.

Table 5.4-3
Fishes Present in the Lower Feather and Yuba Rivers

Common Name	Scientific Name	Native (N) or Introduced (I)
Green sturgeon	<i>Acipenser medirostris</i>	N
White sturgeon	<i>Acipenser transmontanus</i>	N
Sacramento sucker	<i>Catostomus occidentalis</i>	N
Riffle sculpin	<i>Cottus gulosus</i>	N
Tule perch	<i>Hysterocarpus traski</i>	N
Pacific lamprey	<i>Lampetra tridentata</i>	N
California roach	<i>Lavinia symmetricus</i>	N
Hardhead	<i>Mylopharodon conocephalus</i>	N
Central Valley steelhead	<i>Oncorhynchus mykiss</i>	N
Rainbow trout	<i>Oncorhynchus mykiss</i>	N
Sacramento River winter-run chinook salmon	<i>Oncorhynchus tshawytscha</i>	N
Central Valley spring-run chinook salmon	<i>Oncorhynchus tshawytscha</i>	N
Central Valley fall/late fall-run chinook salmon	<i>Oncorhynchus tshawytscha</i>	N
Sacramento splittail	<i>Pogonichthys macrolepidotus</i>	N
Sacramento pikeminnow	<i>Ptychocheilus grandis</i>	N
Speckled dace	<i>Rhinichthys osculus</i>	N
American shad	<i>Alosa sapidissima</i>	I
Mosquitofish	<i>Gambusia affinis</i>	I
Green sunfish	<i>Lepomis cyanellus</i>	I
Bluegill	<i>Lepomis macrochirus</i>	I
Redear sunfish	<i>Lepomis microlophus</i>	I
Smallmouth bass	<i>Micropterus dolomieu</i>	I
Striped bass	<i>Morone saxatilis</i>	I

Sources: California Department of Fish and Game 1991, Moyle 2002

Special-Status Species

Special-status fish species are legally protected or are otherwise considered sensitive by federal, state, or local resource conservation agencies and organizations. Special-status fish species addressed in this section include:

- ▶ species listed as threatened or endangered under ESA or CESA;
- ▶ species identified by USFWS, NMFS, or DFG as species of special concern; and
- ▶ species fully protected in California under the California Fish and Game Code.

A total of nine special-status fish species have the potential to occur in the lower Feather and Yuba Rivers, as described below. Of the nine species, green sturgeon, Central Valley steelhead

Evolutionarily Significant Unit (ESU), Sacramento River winter-run chinook salmon ESU, and Central Valley spring-run chinook salmon ESU are federally listed as endangered or threatened species. Sacramento River winter-run chinook salmon ESU and Central Valley spring-run chinook salmon ESU are also listed as endangered species under CESA. USFWS delisted Sacramento splittail from its threatened status on September 22, 2003. NMFS determined that listing is not warranted for Central Valley fall-/late fall-run chinook salmon. However, this species is still designated a species of concern by NMFS and species of special concern by DFG because of concerns about specific risk factors. The three remaining species (Pacific lamprey, California roach, and hardhead) are considered species of special concern by DFG and/or federal species of concern by NMFS or USFWS. Brief descriptions follow for the special-status species with potential to occur in the lower Feather and Yuba Rivers (Table 5.4-4).

Table 5.4-4
Special-Status Fish Species Potentially Occurring in the Lower Feather and Yuba Rivers

Species	Status ¹		Habitat	Potential to Occur in the Lower Feather River
	USFWS/ NMFS	DFG		
Green sturgeon <i>Acipenser medirostris</i>	T	--	Requires cold, freshwater streams with suitable gravel for spawning; rears seasonally inundated floodplains, rivers, tributaries, and Delta	Occurs in the lower Feather River; may occur in the lower Yuba River
Pacific lamprey <i>Lampetra tridentata</i>	SC	--	Requires cool, freshwater streams with suitable gravel for spawning	Occurs in the lower Feather and Yuba Rivers
California roach <i>Lavinia symmetricus</i> sp.	--	SSC	Spawning occurs in pools and side pools of rivers and creeks; juveniles rear in pools of rivers and creeks	Occurs in the lower Feather and Yuba Rivers
Hardhead <i>Mylopharodon conocephalus</i>	--	SSC	Spawning occurs in pools and side pools of rivers and creeks; juveniles rear in pools of rivers and creeks, and in shallow to deeper water of lakes and reservoirs	Occurs in the lower Feather and Yuba Rivers
Central Valley steelhead ESU <i>Oncorhynchus mykiss</i>	T	--	Requires cold, freshwater streams with suitable gravel for spawning; rears in seasonally inundated floodplains, rivers, and tributaries, and in the Delta	Occurs in the lower Feather and Yuba Rivers
Sacramento River winter-run chinook salmon ESU <i>Oncorhynchus tshawytscha</i>	E	E	Requires cold, freshwater streams with suitable gravel for spawning; rears in seasonally inundated floodplains, rivers, and tributaries, and in the Delta	Occurs in the Sacramento River and tributaries; adults and juveniles may stray into the Feather River; unlikely to occur adjacent to the project site

**Table 5.4-4
Special-Status Fish Species Potentially Occurring in the Lower Feather and Yuba Rivers**

Species	Status ¹		Habitat	Potential to Occur in the Lower Feather River
	USFWS/ NMFS	DFG		
Central Valley spring-run chinook salmon ESU <i>Oncorhynchus tshawytscha</i>	T	T	Requires cold, freshwater streams with suitable gravel for spawning; rears in seasonally inundated floodplains, rivers, and tributaries, and in the Delta	Occurs in the lower Feather and Yuba Rivers
Central Valley fall/late fall-run chinook salmon <i>Oncorhynchus tshawytscha</i>	--	SSC	Requires cold, freshwater streams with suitable gravel for spawning; rears in seasonally inundated floodplains, rivers, and tributaries, and in the Delta	Occurs in the lower Feather and Yuba Rivers
Sacramento splittail <i>Pogonichthys macrolepidotus</i>	DT	SSC	Spawning and juvenile rearing from winter to early summer in shallow weedy areas inundated during seasonal flooding in the lower reaches and flood bypasses of the Sacramento River, including the Yolo Bypass	Occurs in the lower Feather and Yuba Rivers

Notes: DFG = California Department of Fish and Game; ESU = Evolutionarily Significant Unit; NMFS = National Marine Fisheries Service; USFWS = U.S. Fish and Wildlife Service

¹ Legal Status Definitions

Federal Listing Categories (USFWS and NMFS)

E	Endangered (legally protected)
T	Threatened (legally protected)
DT	Recently delisted from threatened status
SC	Species of Concern

State Listing Categories (DFG)

E	Endangered (legally protected)
T	Threatened (legally protected)
FP	Fully Protected (legally protected, no take allowed)
SSC	Species of Special Concern (no formal protection)

Source: Data compiled by EDAW in 2006 from the California Natural Diversity Database (2006), past environmental impact reports addressing the project area, and sources cited in this section

Oroville Dam is the upstream limit of anadromous fish migration in the Feather River. Most of the water released from Oroville Reservoir is diverted at Thermalito Diversion Dam into the Thermalito Complex. During controlled releases, water is released at a constant rate of 600 cubic feet per second (cfs) through the Fish Barrier Dam to the Feather River Fish Hatchery and then into the low-flow section of the Feather River. This 8-mile reach, which extends downstream to the Thermalito Afterbay outlet, provides important spawning and rearing habitat for fall- and spring-run chinook salmon and steelhead. Fourteen miles of additional spawning and rearing habitat exists between the Thermalito Afterbay outlet and the mouth of Honcut Creek, which is located upstream of the FRLRP project area (see Figure 2-1, "Regional Setting," in Chapter 2).

Englebright Dam is the upstream limit of anadromous fish migration in the Yuba River. The lower Yuba River supports natural production of fall-run chinook salmon, steelhead, Pacific lamprey, and American shad. Spring-run chinook salmon also occur in the lower Yuba River, but

the origin (natural versus hatchery) and population status of these fish are unclear. American shad and striped bass occur seasonally downstream of Daguerre Point Dam. Resident species include Sacramento sucker, Sacramento pikeminnow, hardhead, rainbow trout, and largemouth and smallmouth bass.

Descriptions of the special-status species and some of the other key species supported by the lower Feather and Yuba Rivers are provided below.

Special-Status Species

Green Sturgeon

Green sturgeon (*Acipenser medirostris*) has recently has been listed as threatened by NMFS (71 *Federal Register* [FR] 17757, April 7, 2006). Green sturgeon occur in the lower reaches of large rivers, including the Sacramento and San Joaquin River basins, and in the Eel, Mad, Klamath, and Smith Rivers. Green sturgeon is found primarily in the Sacramento River and occasionally in the lower Feather River. Green sturgeon adults and juveniles occur throughout the upper Sacramento River, based upon observations incidental to winter-run chinook monitoring at the Red Bluff Diversion Dam in Tehama County (National Marine Fisheries Service 2005). Green sturgeon spawn predominantly in the upper Sacramento River. They are thought to spawn every 3–5 years (Tracy 1990). Their spawning period is March to July, with a peak from mid-April to mid-June (Moyle et al. 1992). Juveniles inhabit the Bay-Delta estuary until they are approximately 4–6 years old, when they migrate to the ocean (Kohlhorst et al. 1991).

Pacific Lamprey

Similar to chinook salmon and steelhead (described below), Pacific lamprey (*Lampetra tridentata*) adults migrate upstream from the ocean during the winter and spring to spawn (Moyle 2002). Spawning occurs over gravel substrates. Larval lamprey rear in sand and mud substrates, gradually moving downstream over the rearing period. Little is known about their habitat needs or population trends. Pacific lamprey is a federal species of concern.

California Roach

California roach (*Lavinia symmetricus* sp.) are distributed throughout the state; however, there is a specific subspecies found in the Sacramento River drainage (excluding the Pit River). California roach occupy small, warm streams with intermittent flow in midelevation foothills. Dense populations often occur in isolated pools. They are tolerant of high temperatures (30 degrees Celsius [°C] to 35°C) and low oxygen levels, although they also can be found in cold, well-oxygenated systems; human-modified habitats; and the main channels of larger rivers (Moyle 2002). The subspecies found in the Sacramento River system, including the Feather and Yuba Rivers, is a California species of special concern.

Hardhead

Hardhead (*Mylopharodon conocephalus*) are widely distributed throughout the low- to mid-elevation streams in the main Sacramento–San Joaquin River drainage, including the Feather and Yuba Rivers. Undisturbed portions of larger streams at low to middle elevations are preferred by

hardhead. Hardhead are able to withstand summer water temperatures above 20°C; however, they will select lower temperatures when they are available. Hardhead are fairly intolerant of low-oxygen waters, particularly at higher water temperatures. Pools with sand-gravel substrates and slow water velocity are the preferred habitat; adult fish inhabit the lower half of the water column, while the juvenile fish remain in the shallow water closer to the stream edges. Hardhead typically feed on small invertebrates and aquatic plants at the bottom of quiet water (Moyle 2002). Hardhead is a federal species of concern and a California species of special concern.

Central Valley Steelhead

Historically, Central Valley steelhead (*Oncorhynchus mykiss*) spawned and reared in most of the accessible upstream reaches of Central Valley rivers, including the Yuba, Feather, and Sacramento Rivers and their perennial tributaries. Steelhead generally migrated farther than chinook salmon (described below) into tributaries and headwater streams where cool, well-oxygenated water is available year round.

In the Central Valley, steelhead are now restricted to the upper Sacramento River downstream of Keswick Reservoir; the lower reaches of large tributaries downstream of impassable dams; small, perennial tributaries of the Sacramento River mainstem and large tributaries; and the Bay-Delta system.

Population estimates of steelhead on the Feather River have not been performed; however, since 1967 an average of approximately 900 steelhead have returned each year to the Feather River Fish Hatchery (California Department of Fish and Game 2006).

The upstream migration of adult steelhead in the mainstem Sacramento River historically started in July, peaked in September, and continued through February or March. Central Valley steelhead spawn mainly from January through March, but spawning has been reported from late December through April (McEwan and Jackson 1996). During spawning, the female digs a redd (gravel nest) in which she deposits her eggs, which are then fertilized by the male. Egg incubation time in the gravel is determined by water temperature, varying from approximately 19 days at an average water temperature of 15.5°C to approximately 80 days at an average temperature of 14.5°C (McEwan and Jackson 1996).

Steelhead fry usually emerge from the gravel 2–8 weeks after hatching (Barnhart 1986, Reynolds et al. 1993), between February and May, sometimes extending into June (California Department of Fish and Game 1991). Newly emerged steelhead fry move to shallow, protected areas along streambanks but move to faster, deeper areas of the river as they grow. Juvenile steelhead feed on a variety of aquatic and terrestrial insects and other small invertebrates.

Juvenile steelhead rear throughout the year and may spend 1–3 years in fresh water before emigrating to the ocean. Smoltification, the physiological adaptation that juvenile salmonids undergo to tolerate saline waters, occurs in juveniles as they begin their downstream migration. Smolting steelhead generally emigrate from March to June (California Department of Fish and Game 1991).

NMFS completed a status review of steelhead populations in Washington, Oregon, Idaho, and California, and identified 15 ESUs in this range. On August 9, 1996, NMFS issued a proposed

rule to list five of these ESUs (including the Central Valley steelhead) as endangered under ESA, and five as threatened (61 FR 155). The Central Valley steelhead ESU was later listed as threatened (downgraded from its proposed status of endangered) (63 FR 13347, March 19, 1998), and critical habitat (which included the lower Feather and Yuba Rivers) was designated for this ESU (65 FR 7764, February 16, 2000). However, following a lawsuit (*National Association of Home Builders et al. v. Donald L. Evans, Secretary of Commerce, et al.*) (see “Central Valley Spring-Run Chinook Salmon” below), NMFS rescinded the listing. After further review, critical habitat for the Central Valley steelhead ESU was designated on August 12, 2005. Critical habitat is designated to include select waters in the Sacramento and San Joaquin River basins, including the Feather and Yuba Rivers.

Sacramento River Winter-Run Chinook Salmon

Sacramento River winter-run chinook salmon (*Oncorhynchus tshawytscha*) do not spawn in the Feather or Yuba Rivers, but juveniles may periodically move into the lower portions of these systems during downstream migration.

Juvenile winter-run chinook salmon rear and emigrate in the Sacramento River from July through March (Hallock and Fisher 1985). Juveniles descending the Sacramento River above Red Bluff Diversion Dam (RBDD) from August through October, and possibly November, are mostly presmolts (smolts are juveniles that are physiologically ready to enter seawater) and probably rear in the Sacramento River below RBDD. Juveniles have been observed in the Delta from October through December, especially during high Sacramento River discharges caused by late fall and early winter storms.

Cover structures, space, and food are necessary components of rearing habitat for all races of chinook salmon. Suitable habitat includes areas with instream and overhead cover in the form of undercut banks; downed trees; and large, overhanging tree branches. The organic materials forming fish cover also help provide sources of food, in the form of both aquatic and terrestrial insects. Growth of juvenile chinook salmon in floodplain habitat is fast relative to growth in river habitat. Juvenile salmon have been found to have growth rates in excess of 1 millimeter (mm) per day when they rear in flooded habitat and as much as 20 mm in 2–3 weeks (Jones & Stokes 2001). The water temperature is typically higher in floodplain habitat than in main channel habitats. Although increased temperature increases metabolic requirements, the productivity in flooded habitat is also increased, resulting in higher growth rates (Sommer et al. 2001). The production of drift invertebrates in the Yolo Bypass has been found to be one to two times greater than in the river (Sommer et al. 2001). Also, grasses that are flooded support invertebrates that are also a substantial source of food for rearing juveniles. Increased areas resulting from flooded habitat can also reduce the competition for food and space and potentially decrease the possible encounters with predators (Sommer et al. 2001). Juvenile chinook salmon that grow faster are likely to migrate downstream sooner, which helps to reduce the risks of predation and competition in freshwater systems.

Juvenile chinook salmon in the Sacramento River move out of upstream spawning areas into downstream habitats in response to many factors, including inherited behavior, habitat availability, flow, competition for space and food, and water temperature. The number of juveniles that move and the timing of movement are highly variable. Storm events and the

resulting high flows appear to trigger movement of substantial numbers of juvenile chinook salmon to downstream habitats. In general, juvenile abundance in the Delta increases as flow increases (U.S. Fish and Wildlife Service 1993).

Winter-run salmon smolts may migrate through the Delta and bay to the ocean from December through as late as May (Stevens 1989). The Sacramento River channel is the main migration route through the Delta. Adult winter-run chinook salmon spend 1–3 years in the ocean. About 67% of the adult escapement that leaves the ocean to spawn in the Sacramento River consists of 3-year-olds, 25% consists of 2-year-olds, and 8% consists of 4-year-olds (Hallock and Fisher 1985).

Adult winter-run chinook salmon leave the ocean and migrate through the Delta into the Sacramento River from November through July. Salmon migrate upstream past RBDD from mid-December through July, and most of the spawning population has passed RBDD by late June.

Winter-run chinook salmon spawn from mid-April through August, and incubation continues through October. The primary spawning grounds in the Sacramento River are above RBDD. As mentioned above, adult winter-run chinook salmon do not enter the Feather or Yuba Rivers.

Central Valley Spring-Run Chinook Salmon

Central Valley spring-run chinook salmon (*Oncorhynchus tshawytscha*) historically were the second most abundant run of Central Valley chinook salmon (Fisher 1994). They occupied the headwaters of all major river systems in the Central Valley where there were no natural barriers. Adults returning to spawn ascended the tributaries to the upper Sacramento River, including the Pit, McCloud, and Little Sacramento Rivers. They also occupied Cottonwood, Battle, Antelope, Mill, Deer, Stony, Big Chico, and Butte Creeks, and the Feather, Yuba, American, Mokelumne, Stanislaus, Tuolumne, Merced, San Joaquin, and Kings Rivers. Spring-run chinook salmon migrated farther into headwater streams where cool, well-oxygenated water is available year round.

Current surveys indicate that remnant, nonsustaining spring-run chinook salmon populations may be found in Cottonwood, Battle, Antelope, and Big Chico Creeks (California Department of Water Resources 1997). More sizable, consistent runs of naturally produced fish are found only in Mill and Deer Creeks. The Feather River Fish Hatchery sustains the spring-run population on the Feather River, but the genetic integrity of that run is questionable (California Department of Water Resources 1997). Estimates since 1953 on the Feather River indicate that numbers of spring-run returning to the hatchery average around 2,115, although the estimates have increased dramatically since 1990 (California Department of Fish and Game 2006).

Juveniles display considerable variation in stream residence and migratory behavior. Juvenile spring-run chinook salmon may leave their natal streams as fry soon after emergence or rear for several months to a year before migrating as smolts or yearlings (Yoshiyama et al. 1998). Triggers for downstream movement are similar to those described above for winter-run chinook salmon.

Historical records indicate that adult spring-run chinook salmon enter the mainstem Sacramento River in February and March and continue to their spawning streams, where they then hold in deep, cold pools until they spawn. Spring-run are sexually immature during their spawning migration. Some adult spring-run chinook salmon start arriving in the Feather River below the Fish Barrier Dam in June. They remain there until the fish ladder is opened in early September. Spawning and rearing requirements for spring-run chinook salmon are similar to those identified above in the discussion for winter-run chinook salmon.

Spawning occurs in gravel beds in late August through October, and emergence takes place in March and April. Spring-run chinook salmon appear to emigrate at two different life stages: fry and yearlings. Fry move between February and June, while the yearling spring-run emigrate October to March, peaking in November (Cramer and Demko 1997).

On March 9, 1998 (63 FR 11481), NMFS issued a proposed rule to list spring-run chinook salmon as endangered. NMFS designated the Central Valley spring-run chinook as threatened on September 16, 1999 (64 FR 50393). On February 5, 1999, the California Fish and Game Commission listed spring-run chinook salmon as threatened under CESA. Critical habitat had originally been designated for Central Valley spring-run chinook salmon by NMFS (65 FR 7764, February 16, 2000). However, following a lawsuit (*National Association of Home Builders et al. v. Donald L. Evans, Secretary of Commerce, et al.*), NMFS rescinded the listing. After further review, critical habitat for the Central Valley spring-run chinook salmon ESU was designated on August 12, 2005. Critical habitat is designated to include select waters in the Sacramento and San Joaquin River basins, including the Feather and Yuba Rivers.

Central Valley Fall-/Late Fall-Run Chinook Salmon

Spawning escapement surveys on the Feather River are conducted between the Oroville Fish Barrier Dam and the Thermalito Afterbay outlet and between the afterbay outlet and the Gridley boat ramp above Honcut Creek. Annual estimates (since 1953) of the population of fall-/late fall-run chinook salmon (*Oncorhynchus tshawytscha*) based on spawning escapement survey counts and hatchery returns have averaged approximately 49,000 fish (California Department of Fish and Game 2006).

Spawning and rearing requirements for fall-/late fall-run chinook salmon are similar to those identified above in the discussion for winter-run chinook salmon. Juvenile fall-/late fall-run chinook salmon typically rear in fresh water (in their natal streams, the Sacramento River, and the Delta) for up to 5 months before entering the ocean. Juveniles migrate downstream during January through June. Juvenile chinook salmon prefer water depths of 0.5–3.3 feet and velocities of 0.26–1.64 feet per second (Raleigh et al. 1986). Important winter habitat for juvenile chinook salmon includes flooded bars, side channels, and overbank areas with relatively low water velocities. Juvenile chinook salmon have been found to successfully rear in floodplain habitat, which routinely floods but is dry at other times. Growth rates appear to be enhanced by the conditions found in floodplain habitat.

Fall-/late fall-run chinook salmon emigrate as fry and subyearlings and remain off the California coast during their ocean migration (63 FR 11481, March 9, 1998).

Adult fall-/late fall–run chinook salmon enter the Sacramento and San Joaquin River systems from July through April and spawn from October through February. During spawning, the female digs a redd (gravel nest) in which she deposits her eggs, which are then fertilized by the male. Optimal water temperatures for egg incubation are 6.7°–12.2°C (Rich 1997). Newly emerged fry remain in shallow, lower-velocity edgewater, particularly where debris congregates and makes the fish less visible to predators (California Department of Fish and Game 1998). The duration of egg incubation and time of fry emergence depends largely on water temperature. In general, eggs hatch after a 3- to 5-month incubation period, and alevins (yolk-sac fry) remain in the gravel until their yolk-sacs are absorbed (2–3 weeks).

Sacramento Splittail

Recent data indicate that Sacramento splittail (*Pogonichthys macrolepidotus*) occur in the Sacramento River as far upstream as RBDD (Sommer et al. 1997) and that some adults spend the summer in the mainstem Sacramento River rather than returning to the estuary (Baxter 1999). The distribution and extent of spawning and rearing along the mainstem Sacramento River is unknown.

Sacramento splittail spawn over flooded terrestrial or aquatic vegetation in lower reaches of the Sacramento River between early March and May (Wang 1986, Moyle et al. 1995, Moyle 2002). Spawning has been observed to occur as early as January and to continue through July (Wang 1986). Larval splittail are commonly found in the shallow, vegetated areas where spawning occurs. Larvae eventually move into deeper, open-water habitats as they grow and become juveniles. During late winter and spring, young-of-year juvenile splittail (i.e., those less than 1 year old) are found in floodplain habitat, sloughs, rivers, and Delta channels near spawning habitat. Juvenile splittail gradually move from shallow, nearshore habitats to the deeper, open-water habitats of Suisun and San Pablo Bays (Wang 1986). In areas upstream of the Delta, juvenile splittail can be expected to be present in the flood basins (i.e., Sutter and Yolo Bypasses and the Sacramento River) when these areas are flooded during the winter and spring.

In 1999, after 4 years of candidate status, the splittail was listed as threatened under ESA (64 FR 25, March 10, 1999). Fall midwater trawl surveys indicate that abundance of juvenile splittail has been highly variable from year to year, with peaks and declines coinciding with wet and dry periods, respectively, and correlated with the availability of flooded shallow-water habitat. After the listing, the State Water Contractors, the San Luis and Delta-Mendota Water Authority, and others challenged the listing, contending that it violated ESA and the Administrative Procedures Act. On June 23, 2000, the U.S. District Court in Fresno ruled in favor of the plaintiffs and found the listing unlawful. On September 22, 2003, USFWS delisted splittail as a threatened species, indicating that habitat restoration actions such as CALFED and the Central Valley Project Improvement Act are likely to keep the splittail from becoming endangered in the foreseeable future (68 FR 55139, September 22, 2003).

Other Key Species Supported by the Lower Feather and Yuba Rivers

American Shad

American shad (*Alosa sapidissima*) is an anadromous fish species that has been introduced into the Central Valley and has become established as a popular sport fish. American shad enter the Feather and Yuba Rivers to spawn during the spring (primarily May and June) and support a seasonal fishery downstream of the dams. Shad abundance increases at higher Yuba River flows relative to flows in the Feather and Sacramento Rivers (Painter et al. 1977).

Sacramento Sucker

Sacramento sucker (*Catostomus occidentalis*) is widely distributed throughout the Sacramento River system. Sacramento sucker occupy waters from cold, high-velocity streams to warm, nearly stagnant sloughs. They are common at moderate elevations (600–2,000 feet). Sacramento sucker feed on algae, detritus, and benthic invertebrates. They usually spawn for the first time in their fourth or fifth years. When they cannot move upstream and instead spawn in lake habitat, they typically orient themselves near areas where spring freshets flow into the lake. They typically spawn in stream habitat on gravel riffles from late February to early June. The eggs hatch in 3–4 weeks, and the young typically live in the natal stream for a couple of years before moving downstream to a reservoir or large river (Moyle 2002).

Striped Bass

Striped bass (*Morone saxatilis*) is an anadromous fish that has been an important part of the sport-fishing industry in the Delta. They were introduced into the Sacramento–San Joaquin estuary between 1879 and 1882 (Moyle 2002). Striped bass will not typically use fish ladders; therefore, their range in the lower Feather and Yuba Rivers is limited to the river reaches below dams. Striped bass may move into the lower reaches of the rivers year round but probably most often between April and June, when they spawn. The species tends to remain in deep, slow-moving water, where it has access to prey without having to expend a great deal of energy.

Sacramento Pikeminnow

Sacramento pikeminnow (*Ptychocheilus grandis*) occupy rivers and streams throughout the Sacramento–San Joaquin River system, mainly at elevations between 300 and 2,000 feet. The Yuba, Feather, and Sacramento Rivers support populations of Sacramento pikeminnow. Sacramento pikeminnow spawn in April and May, with eggs hatching in less than a week. Within a week of hatching, the fry are free-swimming and schooling.

Adult pikeminnow may feed on other fish, including juvenile pikeminnow, chinook salmon, and steelhead. According to Moyle (2002), they are overrated as predators on salmonid species in natural environments. They can, however, be major predators on juvenile salmon and steelhead in riverine environments modified by dams and fish ladders. Pikeminnow tend to remain in well-shaded, deep pools with sand or rock substrate and are less likely to be found in areas where there are higher numbers of introduced predator species, such as largemouth bass and other centrarchid species.

5.4.3 ENVIRONMENTAL IMPACTS

THRESHOLDS OF SIGNIFICANCE

Thresholds for determining the significance of impacts related to fisheries were based on the environmental checklist form in Appendix G of the California Environmental Quality Act Guidelines (State CEQA Guidelines). A project alternative would have a significant impact on aquatic resources if it would:

- ▶ substantially reduce or degrade the habitat of a state or federal special-status species, potentially resulting in a reduction in special-status species abundance;
- ▶ directly or indirectly reduce the growth, survival, or reproductive success of substantial numbers of federal candidate species; state-listed endangered, threatened, rare, or special-concern species; or regionally important commercial or game species;
- ▶ directly or indirectly reduce the growth, survival, or reproductive success of individuals of a species listed or proposed for listing as threatened or endangered under ESA;
- ▶ substantially interfere with, or prevent the movement or migration of, any fish species;
- ▶ substantially reduce any fish populations; or
- ▶ substantially reduce the quality and quantity of important habitat for any fish species or their prey species.

The term “substantial,” in relation to a reduction in a fish population, its habitat, or its range, has not been quantitatively defined in CEQA. What is considered substantial varies with each species and with the circumstances pertinent to a particular geographic area. Impacts were considered less than significant if they did not meet at least one of the criteria listed above. The specific criteria regarding construction effects, water quality effects, habitat effects, and fish movement that were used to determine the significance of impacts on fish are described in the impact analysis. Effects on fish were considered for populations in the lower Feather and Yuba Rivers.

IMPACT ANALYSIS

Alternative 1 – The Levee Strengthening Alternative

Impact
LS-5.4-a

Loss of Fish Habitat during Levee Repair and Strengthening Activities. Construction-related increases in sediments, turbidity, and contaminants could adversely affect fish habitats immediately adjacent to and downstream of project construction activities, possibly resulting in adverse effects on fish species listed or proposed for listing as threatened or endangered under ESA. This impact would be **potentially significant**.

Strengthening the existing left (east) bank Feather River levee and left (south) bank Yuba River levee would disturb soils along the top, and potentially the water side, of the existing levees. Any resulting erosion could temporarily increase turbidity and sedimentation downstream of the construction sites if soils are transported in river flows or stormwater runoff. (See Impact LS-5.3-

a in Section 5.3, “Water Resources and River Geomorphology,” for additional discussion of this issue.)

Fish population levels and survival have been linked to levels of turbidity and siltation in a watershed. Prolonged exposure to high levels of suspended sediment could create a loss of visual capability in fish, leading to a reduction in feeding and growth rates; a thickening of the gill epithelia, potentially causing the loss of respiratory function; clogging and abrasion of gill filaments; and increases in stress levels, reducing the tolerance of fish to disease and toxicants (Waters 1995).

Also, high levels of suspended sediments would cause the movement and redistribution of fish populations, and could affect physical habitat. Once suspended sediment is deposited, it could reduce water depths in pools, decreasing the water’s physical carrying capacity for juvenile and adult fish (Waters 1995). Increased sediment loading could degrade food-producing habitat downstream of the project area as well. Sediment loading could interfere with photosynthesis of aquatic flora and displace aquatic fauna. Many fish are sight feeders, and turbid waters reduce the ability of these fish to locate and feed on prey. Some fish, particularly juveniles, could become disoriented and leave areas where their main food sources are located, ultimately reducing their growth rates.

Avoidance is the most common result of increases in turbidity and sedimentation. Fish will not occupy areas unsuitable for survival unless they have no other option. Some fish, such as bluegill and bass species, will not spawn in excessively turbid water (Bell 1991). Therefore, FRLRP Alternative 1 could cause fish habitat to become limited if high turbidity resulting from construction-related erosion were to preclude a species from occupying habitat required for specific life stages.

In addition, the potential exists for contaminants such as fuels, oils, and other petroleum products used in construction activities to be introduced into the water system directly or through surface runoff. Contaminants may be toxic to fish or may alter oxygen diffusion rates and cause acute and chronic toxicity to aquatic organisms, thereby reducing growth and survival.

Any of the impact mechanisms listed above could directly or indirectly reduce the growth, survival, or reproduction success of individuals of a species listed or proposed for listing as threatened or endangered under ESA. Therefore, this impact would be potentially significant.

Impact
LS-5.4-b

Loss of Overhead Cover and Instream Woody Material Associated with Levee Repair and Strengthening Activities. Small amounts of riparian vegetation (i.e., individual trees) may need to be removed or cleared at the waterside toe of the existing levee during repairs at erosion problem areas in project Segment 2. The loss of overhead cover for fish would be negligible and temporary, however, and revegetation would occur over time. Therefore, this impact would be **less than significant**.

No riparian habitat is located on the surface of the existing Feather and Yuba River levees in the project area and no losses of riparian habitat are anticipated during the repair and strengthening of these levees. However, small amounts of riparian vegetation (i.e., individual trees) that potentially provide overhead cover for fish or contribute instream woody material to the Feather River, may need to be removed or cleared from the waterside toe of the existing levee during the

correction of identified erosion problem areas in project Segment 2 (see Figure 4-1, “FRLRP Project Features,” in Chapter 4). Removal of riparian vegetation adjacent to the existing levee or otherwise in the floodplain would be minor and temporary, and revegetation would occur over time. Effects on fish habitat would be negligible. Therefore, this impact would be less than significant.

Alternative 2 – The Levee Strengthening and ASB Setback Levee Alternative

Impact
ASB-5.4-a

Loss of Fish Habitat during Levee Repair and Strengthening Activities and Setback Levee Construction. Construction-related increases in sediments, turbidity, and contaminants could adversely affect fish habitats immediately adjacent to and downstream of project construction activities, possibly resulting in adverse effects on fish species listed or proposed for listing as threatened or endangered under ESA. This impact would be **potentially significant**.

This impact would be the same as Impact LS-5.4-a, described under Alternative 1 above, except that the areas of construction disturbance and potential contribution of sediments to fish habitat would be expanded with construction of the Above Star Bend (ASB) setback levee in project Segment 2. Under Alternative 2, removal of portions of the existing Feather River levee in Segment 2 and clearing and excavation at the potential borrow area would disturb soils in the floodplain or adjacent to drainage canals that discharge into the floodway. Any erosion resulting from project construction could temporarily increase turbidity and sedimentation downstream of the construction sites if soils are transported in high river flows or stormwater runoff. This impact would be potentially significant.

Impact
ASB-5.4-b

Loss of Overhead Cover and Instream Woody Material Associated with Setback Levee Construction. In project Segment 2, vegetation may need to be removed to allow drainage from the levee setback area to the river channel, or it may be cleared at the waterside toe of the existing levee to accommodate levee removal. The loss in overhead cover for fish would be limited and temporary, however, and revegetation would occur over time. Therefore, this impact would be **less than significant**.

For project Segments 1 and 3 this impact would be the same as Impact LS-5.4-b, described under Alternative 1 above, with no effect on riparian vegetation associated with levee repairs. In Segment 2, small amounts of riparian vegetation that potentially provide overhead cover for fish or contribute instream woody material to the Feather River channel, could be cleared on the water side of the existing levee if drainage channels need to be constructed to allow drainage of the levee setback area to the Feather River channel. Removal of portions of the existing levee also could result in a minor loss of riparian vegetation along the waterside toe of the existing levee. Removal of any riparian vegetation or woody material in the floodplain would be minor and entirely offset by increased riparian habitat within the alignment of the existing levee over time. Effects on fish habitat would be negligible. Therefore, this impact would be less than significant.

**Impact
ASB-5.4-c**

Effects on Habitat from Contaminants in Borrow Material. If contaminants are present in soil in the levee setback area or in borrow material used for the setback levee, they could be released when the area is inundated during flood events, resulting in harm to sensitive fish and habitat. This impact would be **potentially significant**.

Some of the borrow material for construction of the setback levee in project Segment 2 would be obtained from segments of the existing Feather River levee and some would be obtained from soil borrow area(s) between the setback levee alignment and the Feather River and/or east of Star Bend. Because of the age of the existing levee and the unknown condition of the proposed borrow areas, there is potential for soil material used in the setback levee to contain elevated levels of hazardous substances. Other disturbed soils in the proposed levee setback area could contain such substances as well. (See Impact ASB-5.3-g in Section 5.3, “Water Resources and River Geomorphology,” for additional discussion of this issue.) If present, hazardous substances could be released into flowing water when it enters the levee setback area and could harm sensitive fish and habitat resources. This impact would be potentially significant.

**Impact
ASB-5.4-d**

Fish Stranding Following Flooding of the Levee Setback Area. Following construction of the setback levee, the levee setback area may contain depressions where water could pond following inundation and fish could become trapped as floodwaters recede to the main river channel. Stranded fish, particularly juvenile chinook salmon and steelhead, would be exposed to predators and increasing water temperatures; with no means to return to the river, they would inevitably die. This impact would be **significant**.

Because it would increase the extent of floodplain habitat potentially available to native fishes for rearing, the proposed ASB levee setback would be expected to have long-term fisheries benefits. However, following periods when high flows pass through the levee setback area, receding floodwater could collect in existing ponds, channels and ditches, borrow areas, and other depressions there. Fish that enter the floodway during higher flows, particularly juvenile chinook salmon and steelhead, could become stranded in these areas. Fish that are trapped in such depressions for long periods of time would experience high mortality rates as a result of lethal water temperatures, poor water quality, predation, or desiccation of these areas. Because stranding could adversely affect populations of special-status fish species, this impact would be significant.

**Impact
ASB-5.4-e**

Increased Aquatic and Riparian Habitat in the Levee Setback Area. Setting back the Feather River levee in project Segment 2 could allow the expansion of the available aquatic and riparian habitat corridor and could improve the success of fish species that use the area. This effect would be **potentially beneficial**.

The levee system along much of the lower Feather and Yuba Rivers limits aquatic and riparian habitats to relatively narrow corridors. Setting back the levee along the proposed ASB setback levee alignment would widen the lower Feather River floodway by as much as approximately 0.5 mile. This action would expand the available floodplain habitat for fish.

Floodplains provide important seasonal habitat for native fish species during the winter and spring flood periods. For this reason, a key restoration goal of CALFED is to improve the connectivity between rivers and floodplain habitat, as well as increase the amount of shallow-water habitat in the Central Valley (CALFED Bay-Delta Program 2001). Numerous studies have

shown that shallow water and dense vegetation in these areas provide highly productive rearing areas for numerous species, including chinook salmon and splittail. Seasonally flooded habitat provides rearing habitat for chinook salmon and spawning, rearing, and foraging habitat for splittail (Sommer et al. 1997, 2001, 2002; Baxter et al. 1996; Moyle et al. 2000; Jones & Stokes 1999). Floodplain habitat offers protection from large piscivorous fish such as striped bass. The temporary nature of the flooded habitat and the protection offered by relatively shallow water and dense vegetative cover serve to exclude predatory fish. The productivity of floodplains is generally related to the frequency, timing, water depths, velocities, vegetation, water quality, and duration of inundation relative to the life history and habitat requirements of fish species. Physical conditions (e.g., type and extent of vegetation, soil conditions, and drainage patterns) may also contribute to habitat quality.

Flooded vegetation provides an abundant source of food, including detrital material, insect larvae, crustaceans, and other invertebrates. Juvenile chinook salmon and splittail apparently forage among a variety of vegetation types, including trees, brush, and herbaceous vegetation, but their relative importance, alone or in combination, is unknown. As noted in Section 5.4.2, “Environmental Setting,” juvenile chinook salmon that rear in seasonally flooded habitat have higher survival and growth rates than juveniles that remain in the main river channel to rear (Jones & Stokes 1999, Sommer et al. 2001). The increased rate of growth may be related to the higher temperatures in the shallow water in this habitat and the higher associated rate of production of invertebrates, which are a substantial source of food for rearing juveniles, and of the grasses that support the invertebrates. Increases in the area available to juveniles could also reduce the competition for food and space, and could reduce the likelihood of encounters with predators (Sommer et al. 2001). In addition, juvenile chinook salmon that grow faster are likely to migrate downstream sooner, which helps to reduce the risks of predation and competition in freshwater systems.

In summary, widening the floodway by setting back the levee would expand the available habitat for fish. The newly created floodplain could create refugia for fish during peak flows even if the habitat is only temporary. Many of these benefits would occur even if the levee setback area continued in agricultural operations. If habitat restoration were undertaken in all or part of the levee setback area, this could help reverse regional riparian habitat losses; increase the effective amount and quality of habitat available to fish; and improve the conveyance capacity of the floodplain to provide migration corridors for, and sustain, fish populations. Providing wider floodplains and larger habitat units is especially important for migratory fish species, such as salmon and steelhead. Because the proposed ASB levee setback could increase the extent of floodplain habitat potentially available to native fishes for rearing, this impact would be potentially beneficial.

Alternative 3 – The Levee Strengthening and Intermediate Setback Levee Alternative

Impact
IS-5.4-a

Loss of Fish Habitat during Levee Repair and Strengthening Activities and Setback Levee Construction. This impact would be the same as Impact ASB-5.4-a, described under Alternative 2 above. For the same reasons as described above, this impact would be **potentially significant**.

Impact
IS-5.4-b

Loss of Overhead Cover and Instream Woody Material Associated with Setback Levee Construction. This impact would be the same as Impact ASB-5.4-b, described under Alternative 2 above. For the same reasons as described above, this impact would be **less than significant**.

Impact
IS-5.4-c

Effects on Habitat from Contaminants in Borrow Material. If contaminants are present in soil in the levee setback area or in borrow material used for the setback levee, they could be released when the area is inundated during flood events, resulting in harm to sensitive fish and habitat. This impact would be **potentially significant**.

This impact would be the same as Impact ASB-5.4-c, described under Alternative 2 above, except that the areas of potential contamination (the levee setback area and the setback levee alignment) would be smaller under this alternative. This impact would be potentially significant.

Impact
IS-5.4-d

Fish Stranding Following Flooding of the Levee Setback Area. Following construction of the setback levee, the levee setback area may contain depressions where water could pond following inundation and fish become trapped as floodwaters recede to the main river channel. Stranded fish, including chinook salmon and steelhead, would be exposed to predators and increasing water temperatures; with no means to return to the river, they would inevitably die. This impact would be **significant**.

This impact would be the same as Impact ASB-5.4-d, described under Alternative 2 above, except that there would be a smaller amount of land with potential stranding areas in the levee setback area with the intermediate setback levee alignment. This impact would be significant.

Impact
IS-5.4-e

Increased Aquatic and Riparian Habitat in the Levee Setback Area. Setting back the Feather River levee in project Segment 2 could allow the expansion of the available aquatic and riparian habitat corridor and could improve the success of fish species that use the area. This effect would be **potentially beneficial**.

This impact would be the same as Impact ASB-5.4-e, described under Alternative 2 above, except that setting back the levee along the intermediate setback levee alignment would expand the Feather River floodway less than would a levee setback along the ASB setback levee alignment. Therefore, the potential for benefits to fish species would be reduced. However, this impact would remain potentially beneficial.

5.4.4 MITIGATION MEASURES

ALTERNATIVE 1 – THE LEVEE STRENGTHENING ALTERNATIVE

No mitigation is required for Impact LS-5.4-b (loss of overhead cover and instream woody material associated with construction). Mitigation is provided below for Impact LS-5.4-a (habitat loss during construction).

LS-5.4-a(1): Prepare a SWPPP, File an NOI, and Comply with the NPDES Stormwater Permit for Project Construction Activities. This measure is identical to Mitigation Measure LS-5.3-a(1) in Section 5.3, “Water Resources and River

Geomorphology.” This mitigation, together with Mitigation Measure LS-5.4-a(2), would reduce the potential temporary impact to a less-than-significant level.

LS-5.4-a(2): Obtain a Use Permit from Yuba County and Comply with Permit Conditions for Erosion Control. This measure is identical to Mitigation Measure LS-5.3-a(2) in Section 5.3, “Water Resources and River Geomorphology.” This mitigation, together with Mitigation Measure LS-5.4-a(1), would reduce the potential temporary impact to a less-than-significant level.

ALTERNATIVE 2 – THE LEVEE STRENGTHENING AND ASB SETBACK LEVEE ALTERNATIVE

No mitigation is required for Impacts ASB-5.4-b (loss of overhead cover and instream woody material associated with construction) and ASB-5.4-e (changes in aquatic and riparian habitat in the levee setback area). Mitigation is provided below for Impacts ASB-5.4-a (habitat loss during construction), ASB-5.4-c (borrow material effects on habitat), and ASB-5.4-d (fish stranding).

ASB-5.4-a(1): Prepare a SWPPP, File an NOI, and Comply with the NPDES Stormwater Permit for Project Construction Activities. This measure is identical to Mitigation Measure LS-5.3-a(1) in Section 5.3, “Water Resources and River Geomorphology.” This mitigation, together with Mitigation Measures ASB-5.4-a(2) and ASB-5.4-a(3), would reduce the potential temporary impact to a less-than-significant level.

ASB-5.4-a(2): Obtain a Use Permit from Yuba County and Comply with Permit Conditions for Erosion Control. This measure is identical to Mitigation Measure LS-5.3-a(2) in Section 5.3, “Water Resources and River Geomorphology.” This mitigation, together with Mitigation Measures ASB-5.4-a(1) and ASB-5.4-a(3), would reduce the potential temporary impact to a less-than-significant level.

ASB-5.4-a(3): Obtain and Comply with Terms and Conditions of a Streambed Alteration Agreement for Construction Activities Associated with the Setback Levee. This mitigation, together with Mitigation Measures ASB-5.4-a(1) and ASB-5.4-a(2), would reduce the potential temporary impact to a less-than-significant level.

Three Rivers Levee Improvement Authority (TRLIA) or its representative shall consult with DFG regarding potential disturbance to fish habitat as part of the process for obtaining a streambed alteration agreement, pursuant to Section 1602 of the California Fish and Game Code, for construction work associated with the setback levee. TRLIA shall comply with conditions set forth in the streambed alteration agreement to protect fish habitat.

Implementing Mitigation Measures ASB-5.4-a(1), ASB-5.4-a(2), and ASB-5.4-a(3) together would reduce the potential temporary impact on fish habitat immediately adjacent to and downstream of project construction activities to a less-than-significant level.

ASB-5.4-c(1): Conduct a Phase I Environmental Site Assessment for the Levee Setback Area and Implement Recommendations. This measure is identical to Mitigation Measure ASB-5.3-g(1) in Section 5.3, “Water Resources and River Geomorphology.” This mitigation, together with Mitigation Measures ASB-5.4-

c(2) and ASB-5.4-c(3), would reduce the potential impact to a less-than-significant level.

ASB-5.4-c(2): Evaluate Levee Borrow Material for Potential Contaminants in Coordination with the RWQCB. This measure is identical to Mitigation Measure ASB-5.3-g(2) in Section 5.3, “Water Resources and River Geomorphology.” This mitigation, together with Mitigation Measures ASB-5.4-c(1) and ASB-5.4-c(3), would reduce the potential impact to a less-than-significant level.

ASB-5.4-c(3): Remove Nonhazardous Waste and Debris from the Levee Setback Area. This measure is identical to Mitigation Measure ASB-5.3-g(3) in Section 5.3, “Water Resources and River Geomorphology.” This mitigation, together with Mitigation Measures ASB-5.4-c(1) and ASB-5.4-c(2), would reduce the potential impact to a less-than-significant level.

ASB-5.4-d: Develop and Implement a Drainage and Grading Plan that Minimizes Loss or Incidental Loss of Fish from Stranding. This mitigation would reduce the impact to a less-than-significant level.

TRLIA and its primary contractors for engineering design and construction shall ensure that the following measures are implemented to minimize the potential for fish stranding in the levee setback area:

- (a) Plan and implement drainage improvements. TRLIA or its designated construction contractors, through a combination of grading and drainage improvements, shall minimize the potential for floodwater to pond in the levee setback area in such a way that substantial numbers of fish become stranded and consequently become exposed to hostile environments (warm water temperatures and increased predation).

As part of the development of the final design for the levee setback area, TRLIA or its representatives shall determine the specific topographic and hydrologic characteristics of the levee setback area and shall define the anticipated flooding regime (depth, duration, and extent of flooding), drainage patterns, and potential for fish stranding risks there. The final project design shall include recontouring as necessary to ensure complete drainage and provide fish passage back to the main river channel as floodflows recede from the levee setback area. Features with substantial stranding risk shall be identified for filling and/or grading.

Complete drainage is important to reduce the risk of stranding; however, maintaining some seasonal aquatic habitat in the levee setback area and/or hydrologic connectivity to the Feather River may also be important features if enhancement of fish habitat and production is selected as a management activity in the levee setback area.

Before the design of the setback levee and levee setback area is finalized, TRLIA or its representatives shall obtain the approval of DFG and NMFS indicating that the planned drainage and grading features are sufficient to address concerns about fish stranding potential, similar to the process used for the Feather-Bear Rivers Levee Setback Project

currently under construction downstream. The features of the setback levee and levee setback area shall be constructed in accordance with the approved final design.

- (b) Monitor the success of the drainage features and adjust if necessary. A mitigation monitoring plan shall be developed by a qualified biologist on behalf of TRLIA and shall be approved by DFG and NMFS before implementation of the levee setback. This monitoring plan shall evaluate the effectiveness of the grading and drainage features in the levee setback area in reducing the risk of fish stranding and the stability of the drainage features and shall determine the need for maintenance or modification. The monitoring plan shall include provisions for remediation should the design of the levee setback area prove to be unsuccessful in preventing fish stranding. These measures shall include, as appropriate, such activities as regrading or filling depressions in the levee setback area.

The recommended monitoring scheme shall include annual monitoring for a period of 5 years following the removal of any part of the existing levee. Additional monitoring may be required for areas where remediation is necessary. Monitoring is recommended to include the following actions:

- ▶ Visual assessment of the levee setback area by a qualified biologist before the flood season (i.e., by October 31). This assessment should note any substantial changes in the overall structure since implementation of the final design for the area, including reestablishment of vegetation and the presence of “holes” or pits.
- ▶ A visual survey by a qualified biologist at the end of each event that floods the levee setback area (i.e., after the recession of waters that inundate the floodplain). This survey should identify whether there is any ponding that would result in fish stranding, or whether channels have formed that flow through completely to the low-flow channel of the Feather River.

Following each flood season (i.e., after April 16), a letter report shall be submitted to NMFS and DFG summarizing the overall condition of the floodplain area and any changes that have occurred from the previous year(s). If any remediation measures are required, they shall be outlined in the letter report, along with a schedule specifying when the remediation activities will occur. Appropriate remediation measures shall be implemented as soon as is practicable to minimize the potential for fish stranding while maintaining the desired habitat values (if habitat enhancement is included in the floodplain area) and hydraulic characteristics of the area.

The performance of the mitigation measure shall be considered successful if there is no isolated standing water and/or barriers to fish passage capable of resulting in substantial fish stranding following a flood event that inundates the levee setback area.

Implementing Mitigation Measure ASB-5.4-d would reduce the potential fish stranding impact to a less-than-significant level.

ALTERNATIVE 3 – THE LEVEE STRENGTHENING AND INTERMEDIATE SETBACK LEVEE ALTERNATIVE

No mitigation is required for Impacts IS-5.4-b (loss of overhead cover and instream woody material associated with construction) and IS-5.4-e (increased aquatic and riparian habitat in the levee setback area). Mitigation is provided below for Impacts IS-5.4-b (habitat loss during construction), IS-5.4-c (borrow material effects on habitat), and IS-5.4-d (fish stranding).

- IS-5.4-a(1): Prepare a SWPPP, File an NOI, and Comply with the NPDES Stormwater Permit for Project Construction Activities.** This measure is identical to Mitigation Measure LS-5.3-a(1) in Section 5.3, “Water Resources and River Geomorphology.” This mitigation, together with Mitigation Measures IS-5.4-a(2) and IS-5.4-a(3), would reduce the potential temporary impact to a less-than-significant level.
- IS-5.4-a(2): Obtain a Use Permit from Yuba County and Comply with Permit Conditions for Erosion Control.** This measure is identical to Mitigation Measure LS-5.3-a(2) in Section 5.3, “Water Resources and River Geomorphology.” This mitigation, together with Mitigation Measures IS-5.4-a(1) and IS-5.4-a(3), would reduce the potential temporary impact to a less-than-significant level.
- IS-5.4-a(3): Obtain and Comply with Terms and Conditions of a Streambed Alteration Agreement for Construction Activities Associated with the Setback Levee.** This measure is identical to Mitigation Measure ASB-5.4-a(3) above. This mitigation, together with Mitigation Measures IS-5.4-a(1) and IS-5.4-a(2), would reduce the potential temporary impact to a less-than-significant level.
- IS-5.4-c(1): Conduct a Phase I Environmental Site Assessment for the Levee Setback Area and Implement Recommendations.** This measure is identical to Mitigation Measure ASB-5.3-g(1) in Section 5.3, “Water Resources and River Geomorphology.” This mitigation, together with Mitigation Measures IS-5.4-c(2) and IS-5.4-c(3), would reduce the potential impact to a less-than-significant level.
- IS-5.4-c(2): Evaluate Levee Borrow Material for Potential Contaminants in Coordination with the RWQCB.** This measure is identical to Mitigation Measure ASB-5.3-g(2) in Section 5.3, “Water Resources and River Geomorphology.” This mitigation, together with Mitigation Measures IS-5.4-c(1) and IS-5.4-c(3), would reduce the potential impact to a less-than-significant level.
- IS-5.4-c(3): Remove Nonhazardous Waste and Debris from the Levee Setback Area.** This measure is identical to Mitigation Measure ASB-5.3-g(3) in Section 5.3, “Water Resources and River Geomorphology.” This mitigation, together with Mitigation Measures IS-5.4-c(1) and IS-5.4-c(2), would reduce the potential impact to a less-than-significant level.
- IS-5.4-d: Develop and Implement a Drainage and Grading Plan that Minimizes Loss or Incidental Loss of Fish from Stranding.** This measure is identical to

Mitigation Measure ASB-5.4-d above. This mitigation would reduce the impact to a less-than-significant level.

5.4.5 IMPACTS REMAINING SIGNIFICANT AFTER MITIGATION

With implementation of the mitigation described above, all impacts on fisheries would be reduced to a less-than-significant level.