

PRELIMINARY DRAFT

**ECOSYSTEM RESTORATION ACTIONS POTENTIALLY COMPRISING
CALFED CORE ACTIONS
CLASSIFIED BY ECOLOGICAL ZONES OF THE BAY-DELTA AND ITS
WATERSHED**

Sacramento River Main Stem

UPSTREAM HABITAT RESTORATION

Improve Flows and Temperatures in Upstream Habitats

- Install and operate permanent structural temperature control devices at Shasta and Whiskeytown dams and develop and implement modifications in CVP operations as needed to assist in the Secretary of Interior's efforts to control water temperatures in the upper Sacramento River (p.5, CVAFP).

Maintain Adequate Spawning Substrates

- Develop and implement a program for restoring and replenishing spawning gravel, where appropriate, in the Sacramento River (p.31, AFRP).
- Replenish gravel and restore gravel recruitment blocked by Whiskeytown Dam on Clear Creek (p.35, AFRP). Restore spawning gravel in Clear Creek for salmon and steelhead (p.5, CVAFP).
- Develop cooperative agreements to promote the stockpiling of spawning gravel from existing mining operations in Cottonwood Creek for subsequent placement in the Sacramento River (p.7, CVAFP).
- Work with state and local agencies to protect spawning gravel and enhance recruitment of spawning gravel to the Sacramento River in the valley sections of Cottonwood Creek (p.37, AFRP).

Modify Fish Passage at Upstream Dams or Through Other Barriers

- Work with Anderson-Cottonwood Irrigation District (ACID) to implement operational modifications to the ACID diversion dam to eliminate passage and stranding problems for

chinook salmon and steelhead adult and early life stages in the Sacramento River (p.31, AFRP).

Revegetate Degraded Riparian Habitats

- Implement opportunities for restoring riparian forests in channelized sections of the upper mainstem Sacramento River that are appropriate with flood control and other water management constraints (p.32, AFRP).
- Continue acquisition of land and conservation easements from willing sellers to protect the riparian corridor along the Sacramento River (p.7, CVAFP).
- Acquire land or conservation easements from willing sellers along the riparian corridor of the Sacramento River.
- Pursue opportunities to replant riparian vegetation along channelized sections of the Sacramento River. All revegetation will be consistent with existing flood control and land use constraints.

REDUCTIONS IN THE EFFECTS OF DIVERSIONS

Install or Upgrade Screens on Upstream Diversions

- Implement a comprehensive program to install positive barrier fish screens at unscreened or poorly screened diversions on the Sacramento River, in the Sacramento-San Joaquin Delta, and Suisun Marsh Sloughs. Priorities for screen should be based on diversion location, size, period of use and available partnership funding.
- Continue to implement the Anadromous Fish Screen Program (p.30, AFRP).
- Implement structural and operational modifications to the Glenn-Colusa Irrigation District's (GCID) water diversion facility to minimize impingement and entrainment of juvenile salmon (p.30, AFRP).

Evaluate and Implement Effective Acoustic Barriers to Anadromous Fish Movement

- Implement a comprehensive program to install positive barrier fish screens at unscreened or poorly screened diversions on the Sacramento River. Priorities for screen should be based on diversion location, size, period of use and available partnership funding.
- Continue to evaluate effects of hydroacoustic barriers on fish movement (DNFRP, AFRP).

MANAGEMENT OF ANADROMOUS FISH

WATER SUPPLY ENHANCEMENT

INCREASING WATER SUPPLY PREDICTABILITY

MANAGEMENT OF WATER QUALITY

Establish Incentives for Retirement of Lands with Drainage Problems

- Develop a cooperative program to retire agricultural lands where large quantities or high concentrations of contaminants drain into the Delta (DNFRP).

Provide Incentives for Pollution Source Control on Agricultural Lands

- To improve conditions for winter -run chinook salmon, implement a program to promote water use efficiency and drainage source reduction and measures to reduce pesticide and herbicide discharge to the Colusa Basin Drain. Implement programs to provide for agricultural reuse of water from the Colusa Basin Drain.

IMPROVEMENTS TO SYSTEM RELIABILITY

Sacramento River Tributaries (Mokelumne, Calaveras, and Cosumnes)

UPSTREAM HABITAT RESTORATION

Improve Flows and Temperatures in Upstream Habitats

- Install and operate permanent structural temperature control devices at Shasta and Whiskeytown dams and develop and implement modifications in CVP operations as needed to assist in the Secretary of Interior's efforts to control water temperatures in the upper Sacramento River (p.5, CVAFP).
- Obtain 50 cubic feet per second (cfs) for fish migration in Cow Creek through a cooperative agreement with private water-rights holders (p.15, CVAFP).

- Obtain cooperative agreements to provide flows for suitable passage and spawning for fall-run chinook salmon adults and adequate summer rearing habitat for juvenile steelhead in Cow Creek (p.35, AFRP).
- Develop a cooperative agreement to increase flows past PG&E's hydropower diversions on Battle Creek in two phases to provide adequate holding, spawning, and rearing habitat for anadromous salmonids (p.39, AFRP):

Diversion	Months	Flow (cfs)
Keswick ditch	All year	30
North Battle Creek feeder	Sept-Nov	40
	Jan-Apr	40
	May-Aug	30
Eagle Canyon	May-Nov	30
	Dec-Apr	50
Wildcat	May-Nov	30
	Dec-Apr	50
South	May-Nov	20
	Dec-Apr	30
Inskip	May-Nov	30
	Dec-Apr	40
Coleman	Sept-Apr	50
	May-Aug	30

- Continue, through cooperative agreements, to provide instream flows in the valley reach of Mill Creek to facilitate the passage of adult and juvenile spring-, fall- and late-fall-run chinook salmon and steelhead (p.43, AFRP).

- Develop cooperative agreements to improve instream flows in the lower 10 miles of Deer Creek to ensure passage of adult and juvenile spring- and fall-run chinook salmon and steelhead over three diversion dams (p.46, AFRP).
- Develop cooperative agreements to obtain additional instream flows in Butte Creek from Parrott-Phelan Diversion (p.50, AFRP).
- Reconfigure Folsom Dam shutters for improved management of Folsom Reservoir's cold water pool and better control over the temperature of water released downstream (p.66, AFRP).
- Develop cooperative agreements to reduce water diversions or augment instream flows during critical periods for salmonids in Cosumnes River (p.71, AFRP).

Maintain Adequate Spawning Substrates

- Pursue opportunities to create a meander belt from Keswick Dam to Chico Landing to recruit gravel and large woody debris to moderate temperatures and to enhance nutrient input (p.30, AFRP).
- Replenish gravel and restore gravel recruitment blocked by Whiskeytown Dam on Clear Creek (p.35, AFRP). Restore spawning gravel in Clear Creek for salmon and steelhead (p.5, CVAFP).
- Develop cooperative agreements to promote the stockpiling of spawning gravel from existing mining operations in Cottonwood Creek for subsequent placement in the Sacramento River (p.7, CVAFP).
- Work with state and local agencies to protect spawning gravel and enhance recruitment of spawning gravel to the Sacramento River in the valley sections of Cottonwood Creek (p.37, AFRP).
- Restore and enhance spawning gravel in Paynes Creek (p.41, AFRP).
- Improve spawning habitats in lower Mill Creek and lower Deer Creek for fall- and late-fall-run chinook salmon (p.43, AFRP).
- Replenish spawning gravel in reaches modified for flood control in Big Chico Creek (p.48, AFRP).
- Replenish spawning gravel and restore existing spawning grounds in the American River (p.66, AFRP).

- Replenish gravel suitable for salmonid spawning and cleanse spawning gravel of fine sediments and prevent sedimentation of spawning gravel in the Mokelumne River (p.68, AFRP, p.7, CVAFP).

Encourage Gravel-Mining Practices that Protect Fish Habitat

- Develop cooperative agreements to modify gravel mining methods to reduce their effects on salmonid spawning habitat in Central Valley streams (p.44, AFRP).

Modify Fish Passage at Upstream Dams or Through Other Barriers

- Provide fish passage facilities at McCormick-Saeltzer Dam (Clear Creek) and remove sediment from behind the dam (p.34, AFRP).
- Improve passage at agricultural diversion dams on Cow Creek (p.36, AFRP).
- Restore the stream channel to prevent ACID Siphon on Cottonwood Creek from becoming a barrier to migration of spring- and fall-run chinook salmon and steelhead (p.37, AFRP).
- Eliminate adult fall-run chinook stranding by stopping attraction flows in Crowley Gulch or by constructing a barrier at the mouth of Crowley Gulch (p.37, AFRP).
- Construct barrier racks at the Gover Diversion Dam and wastegates from the Gover Canal to prevent adult chinook salmon in Battle Creek from entering Gover Diversion (p.40, AFRP).
- Improve fish passage in Eagle Canyon on Battle Creek. Allow adult spring-run access to Battle Creek above the Coleman Hatchery Weir.
- Construct a fish passage structure over the Corning Canal siphon in Elder Creek (p.8, CVAFP).
- Work cooperatively to develop a permanent solution for fish passage at Clough Dam on Mill Creek (p.44, AFRP).
- Develop cooperative agreements to reduce use of seasonal diversion dams that may be barriers to migrating chinook salmon and steelhead in Thomes Creek (p.45, AFRP).
- Repair the Iron Canyon fish ladder on Big Chico Creek (p.48, AFRP).

- Repair the Lindo Channel weir and fishway at the Lindo Channel box culvert at the Five-Mile Diversion on Big Chico Creek (p.48, AFRP).
- Build a new high-water-volume fish ladder at Durham Mutual Dam on Butte Creek (p.50, AFRP).
- Remove the Western Canal Dam on Butte Creek and construct the Western Canal Siphon. If the dam is not removed and siphon not constructed, support California Department of Fish and Game's (DFG's) efforts to build a new-high-water volume fish ladder and to install fish screens on both diversions at the Western Canal Dam (p.51, AFRP).
- Remove McPherrin and McGowan dams on Butte Creek and provide an alternate source of water as part of the Western Canal Dam (WCD) removal and siphon construction. If McPherrin and McGowan dams are not removed and alternate sources of water are not supplied as part of the WCD dam removal and siphon construction, support DFG's efforts to build new high-water-volume fish ladders at both dams and to install fish screens on both diversions (p.51, AFRP).
- Build a new high-water-volume fish ladder at Adams Dam and Gorril Dam on Butte Creek (p.52, AFRP).
- Work cooperatively with the operators to establish operational criteria for Sanborn Slough Bifurcation and Nelson Slough on Butte Creek (p.52, AFRP).
- Develop a cooperative agreement to eliminate stranding of chinook salmon at White Mallard Duck Club outfall on Butte Creek (p.53, AFRP).
- Implement new operational criteria, modifications to existing structures, or new fish ladders at the following locations in the Butte Creek watershed: Butte Slough Outfall; East-West Diversion Weir; Sutter Bypass Weir #2; Sutter Bypass Weir #1; Sutter Bypass Weir #5; Sutter Bypass Weir #3; and the natural barrier below Centerville Dam
- Implement a program to allow spring-run access to Butte Creek above Centerville Dam.
- Rebuild and maintain existing culvert and riser at Drumheller Slough outfall on Butte Creek (p.53, AFRP).
- Install a high-water-volume fish ladder at White Mallard Dam (p.54, AFRP).
- Construct or improve fish bypasses at Hallwood-Cordua and Brophy-South Yuba water diversions in the Yuba River (p.61, AFRP).

- Negotiate removal or modification of the culvert crossing at Patterson Sand and Gravel and other physical barriers impeding anadromous fish migration in Bear River (p.63, AFRP)
- Develop cooperative agreements to facilitate passage of adult and juvenile salmonids at existing diversion dams and barriers in Calaveras River (p.72, AFRP).

Modify Natural Barriers to Improve Fish Passage

- Improve fish passage in Eagle Canyon on Battle Creek by modifying a bedrock ledge and boulders that are potential barriers to adult salmonids (p.40, AFRP).

Encourage Improved Livestock Management in Riparian Habitats

- Develop cooperative agreements to fence select riparian corridors within the Cow Creek watershed to exclude livestock (p.36, AFRP).
- Develop cooperative agreements to employ the most ecologically sound grazing practices by implementing the Forest Plan on federal lands with the Thomes Creek drainage (p.45, AFRP).
- Cooperate with landowners to install livestock exclusion fencing along Deer Creek.

Revegetate Degraded Riparian Habitats

- Implement partnership programs to maintain and restore the riparian habitat along the lower reaches of Mill Creek (p.43, AFRP).
- Preserve the habitat productivity of upper Mill Creek through cooperative watershed management (p.43, AFRP).
- Negotiate long-term agreements to maintain and restore riparian habitats along the lower reaches of Deer Creek (p.46, AFRP). Control or remove bamboo at several sites.
- Plan and coordinate required flood management activities with least damage to the fishery resources and riparian habitats of lower Deer Creek (p.47, AFRP).
- Cooperate with local landowners in Big Chico watershed to encourage revegetation of denuded stream reaches and establish a protected riparian strip (p.49, AFRP).
- Protect spring-run chinook salmon summer holding pools in Big Chico Creek by obtaining titles or conservation easements from willing sellers on lands adjacent to the pools (p.49, AFRP).

- Along Butte Creek, cooperate with landowners to revegetate denuded stream reaches and to establish a protected riparian strip.
- Purchase streambank conservation easements from willing sellers to improve salmonid habitat and instream cover in the Yuba River (p.61, AFRP).
- Implement partnership programs to enhance and maintain the riparian corridor to improve streambank and channel rearing habitat for juvenile salmonids in the Mokelumne River (p.69, AFRP).
- Establish a partnership program to expand the riparian corridor protection zone on the Cosumnes River (p.71, AFRP).
- Implement a cooperative program to rehabilitate damaged areas and remedy incompatible land practices to reduce sedimentation and instream water temperatures in Cosumnes River (p.71, AFRP).

REDUCTIONS IN THE EFFECTS OF DIVERSIONS

Install or Upgrade Screens on Upstream Diversions

- Continue to implement the Anadromous Fish Screen Program (p.30, AFRP).
- Implement structural and operational modifications to the Glenn-Colusa Irrigation District's (GCID) water diversion facility to minimize impingement and entrainment of juvenile salmon (p.30, AFRP).
- Screen Orwick Diversion (Battle Creek) to prevent entrainment of juvenile salmonids and straying of adult chinook salmon (p.40, AFRP).
- Screen tailrace of Coleman Powerhouse (Battle Creek) to eliminate attraction of adult chinook salmon and steelhead into an area with little spawning habitat and great potential for entrainment into the CNFH water supply (p.40, AFRP).
- Construct fish screens on all PG&E diversions after both phases of upstream flow actions are completed and fish ladders on Coleman Powerhouse and Eagle Canyon Diversion Dams are opened (p.40, AFRP).
- Install fish screens on both diversions at Durham Mutual Dam on Butte Creek (p.50, AFRP).
- Install fish screens on both diversions at Adams Dam and at Gorrill Dam on Butte Creek (p.52, AFRP).

- Install fish screens at White Mallard Dam and on Little Dry Creek pumps in the Butte Creek catchment (p.53, AFRP).
- Improve efficiency of screening devices at Hallwood-Cordua and Brophy-South Yuba water diversions, and construct screens at the Browns Valley water diversion and other unscreened diversions on the Yuba River (p.60, AFRP).
- Improve the fish screen at Fairbairn Water Treatment Plant on the American River (p.66, AFRP).
- Upgrade existing fish screens in the Mokelumne River at Woodbridge Irrigation District's diversion (p.7, CVAFP).
- Improve upstream fish passage in the Mokelumne River at Woodbridge Irrigation District Dam (p.7, CVAFP).
- Install fish screens in the Mokelumne River at North San Joaquin Water Conservation District diversions, north and south (p.7, CVAFP).
- Screen all diversions to protect all life history stages of anadromous fish in Cow and Bear creeks and in the Bear, Mokelumne, Cosumnes, and Calaveras rivers (AFRP).

MANAGEMENT OF ANADROMOUS FISH

REDUCTION IN EXPORT RELIANCE

WATER SUPPLY ENHANCEMENT

INCREASING WATER SUPPLY PREDICTABILITY

MANAGEMENT OF WATER QUALITY

IMPROVEMENTS TO SYSTEM RELIABILITY

WATERSHED MANAGEMENT

- Cooperate with landowners and managers to organize and/or support local watershed conservancies. Local conservancies should be encouraged on Clear Creek, Deer Creek, Cow Creek, Big Chico, Antelope Creek, and Butte Creek.
- Cooperate with local watershed conservancies to develop and implement watershed management and restoration plans.

San Joaquin River Tributaries (Merced, Tuolumne, and Stanislaus)

UPSTREAM HABITAT RESTORATION

Maintain Adequate Spawning Substrates

- Restore habitat for salmon migration, spawning, and rearing in the Merced River by rehabilitating riffle areas, repairing or constructing levees and channels, and isolating mining pit areas from the active channel (p.6, CVAFP).
- Restore habitat for spawning, rearing, and migration on the Tuolumne River at 17 sites by renovating spawning gravel and riffle areas, increasing side-channel diversity, recontouring channels, and isolating predator habitat (p.6, CVAFP).
- Restore habitat for spawning, rearing, and migration on the Stanislaus River by renovating spawning and rearing habitat and modifying channel morphometry (p.6, CVAFP).

Encourage Gravel-Mining Practices that Protect Fish Habitat

- Develop cooperative agreements to modify gravel mining methods to reduce their effects on salmonid spawning habitat in Central Valley streams (p.44, AFRP).

REDUCTIONS IN THE EFFECTS OF DIVERSIONS

Install or Upgrade Screens on Upstream Diversions

- Screen all diversions to protect all life history stages of anadromous fish in the Merced, Tuolumne, and Stanislaus rivers (AFRP).
- Reduce or eliminate entrainment of juvenile chinook salmon at Banta-Carbona, West Stanislaus, Patterson, and El Soyo diversions by implementing the Anadromous Fish Screen Program in conjunction with other programs (p.80, AFRP).

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IMPROVEMENTS TO SYSTEM RELIABILITY

WATERSHED MANAGEMENT

- Cooperate with local watershed conservancies to develop and implement watershed management and restoration plans.

The Delta

BAY-DELTA HABITAT RESTORATION

Protect and Enhance Existing Shallow-Water Habitat

- Develop additional habitat and vegetation zones within the Delta. The following spawning and rearing areas should be considered for restoration as tidal, shallow-water vegetated habitat: Prospect Island, Hastings Tract, Liberty Island, Medford Island, New Hope Tract, Brack Tract, and Terminous Tract.
- Develop additional shallow-water habitat and vegetation zones in freshwater areas.

Protect and Enhance Existing Wetlands

- Conserve, restore and expand tidal wetlands and shallow-water habitat within the chinook salmon rearing and migratory habitat areas that should be evaluated for tidal marsh and shallow- water habitat restoration. Include the Sacramento River portion of the Northern Delta.

UPSTREAM HABITAT RESTORATION

REDUCTIONS IN THE EFFECTS OF DIVERSIONS

Install Screens on Other In-Delta Diversions

- Implement a comprehensive program to install positive barrier fish screens at unscreened or poorly screened diversions in the Delta. Priorities for screen should be based on diversion location, size, period of use and available partnership funding.
- Implement a program to screen agricultural diversions in the Delta and to consolidate agricultural diversions (p.108, DNFRP).

Evaluate and Implement Effective Acoustic Barriers to Anadromous Fish Movement

- Continue to evaluate effects of hydroacoustic barriers on fish movement (DNFRP, AFRP).
- Continue to evaluate the benefits and detriments of hydroacoustic barriers at locations where positive barrier fish screens are infeasible.
- Seek out opportunities to consolidate agricultural diversions in the Delta.

MANAGEMENT OF ANADROMOUS FISH

REDUCTION IN EXPORT RELIANCE

WATER SUPPLY ENHANCEMENT

INCREASING WATER SUPPLY PREDICTABILITY

MANAGEMENT OF WATER QUALITY

Establish Incentives for Retirement of Lands with Drainage Problems

- Develop a cooperative program to retire agricultural lands where large quantities or high concentrations of contaminants drain into the Delta (DNFRP).

IMPROVEMENTS TO SYSTEM RELIABILITY

Suisun Bay and San Pablo Bay

BAY-DELTA HABITAT RESTORATION

MANAGEMENT OF ANADROMOUS FISH

REDUCTION IN EXPORT RELIANCE

WATER SUPPLY ENHANCEMENT

MANAGEMENT OF WATER QUALITY

Establish Incentives for Retirement of Lands with Drainage Problems

- Develop a cooperative program to retire agricultural lands where large quantities or high concentrations of contaminants drain into the Delta (DNFRP).

IMPROVEMENTS TO SYSTEM RELIABILITY