Enclosure 2

<u>Magnuson-Stevens Fishery Conservation and Management Act</u>

ESSENTIAL FISH HABITAT CONSERVATION CONSULTATION

Long-Term Operations of the Central Valley Project and State Water Project

I. IDENTIFICATION OF ESSENTIAL FISH HABITAT

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), as amended (U.S.C. 1801 *et seq,*.), requires that Essential Fish Habitat (EFH) be identified and described in Federal Fishery Management Plans (FMPs). Federal action agencies must consult with NOAA's National Marine Fisheries Service (NMFS) on any activity which they fund, permit, or carry out that may adversely affect EFH. If NMFS determines that a proposed Federal or State activity would adversely affect EFH, then NMFS is obligated to provide EFH conservation recommendations to the action agency. The Federal action agency that receives the conservation recommendations must provide a detailed response in writing to NMFS within 30 days after receiving EFH conservation recommendations. The response must include a description of measures proposed by the agency for avoiding, mitigating, or offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with NMFS EFH conservation recommendations, the Federal agency must explain its reasons for not following the recommendations. 16 U.S.C. §1855(b)(4)(B).

EFH is defined as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. For the purposes of interpreting the definition of EFH, "waters" includes aquatic areas and their associated physical, chemical, and biological properties that are used by fish, and may include areas historically used by fish where appropriate; "substrate" includes sediment, hard bottom, structures underlying the waters, and associated biological communities; "necessary" means habitat required to support a sustainable fishery and a healthy ecosystem; and, "spawning, breeding, feeding, or growth to maturity" covers all habitat types used by a species throughout its life cycle. The action area of the proposed action is within the area identified as EFH for Pacific coast salmon species identified in Amendment 14 of the Pacific Coast Salmon FMP [Pacific Fishery Management Council (PFMC) 1999].

Chinook salmon (*Oncorhynchus tshawytscha*) are the largest of the Pacific salmon. Chinook salmon are highly prized by commercial, sport, and subsistence fishers. Pacific coast Chinook salmon stocks are managed by the Council under the Pacific Salmon FMP. These stocks include fall- and late fall-run Chinook salmon from the Central Valley system.

PFMC (1999) has identified and described EFH, and has identified adverse impacts and recommended conservation measures for salmon in amendment 14 to the Pacific Coast Salmon FMP. Freshwater EFH for Pacific salmon in the California Central Valley includes waters currently or historically accessible to salmon within the Central Valley ecosystem as described in

Myers *et al*., (1998). EFH includes not only the watersheds of the Sacramento and San Joaquin River basins but also the San Joaquin Delta (Delta) hydrologic unit (*i.e.*, number 18040003), Suisun Bay hydrologic unit (18050001) and the Lower Sacramento hydrologic unit (18020109). Sacramento River winter-run Chinook salmon (*O. tshawytscha*), Central Valley spring-run Chinook salmon (*O. tshawytscha*), and Central Valley fall- and late fall-run Chinook salmon (*O. tshawytscha*; hereafter, specific Chinook salmon species are identified by run only) are species managed under the Pacific Coast Salmon FMP that occur in these basins, as well as the Delta, Suisun Bay, and Lower Sacramento units.

Factors limiting salmon populations in the Delta include periodic reversed flows due to high water exports (drawing juveniles into large diversion pumps), loss of fish into unscreened agricultural diversions, predation by introduced species, and reduction in the quality and quantity of rearing habitat due to channelization, pollution, riprapping, *etc*. (Dettman *et al*,. 1987; California Advisory Committee on Salmon and Steelhead Trout 1988, Kondolf *et al.*, 1996a, 1996b). Factors affecting salmon populations in Suisun Bay include heavy industrialization within its watershed and discharge of wastewater effluents into the bay. Loss of vital wetland habitat along the fringes of the bay reduce rearing habitat and diminish the functional processes that wetlands provide for the bay ecosystem.

A. Life History and Habitat Requirements of Pacific Salmon

General life history information for fall- and late fall-run is summarized below. Information on winter-run and spring-run life histories is summarized in section 4 of the preceding biological opinion for the proposed action (Enclosure 1, hereafter referred to as Opinion). Further detailed information on Chinook salmon Evolutionarily Significant Units (ESU) are available in the NMFS status review of Chinook salmon from Washington, Idaho, Oregon, and California (Myers *et al.*, 1998), and the NMFS proposed rule for listing several ESUs of Chinook salmon (March 9, 1998, 63 FR 11482).

Adult fall-run enter the Sacramento and San Joaquin rivers from July through December and spawn from October through December, while adult late fall-run enter the Sacramento and San Joaquin rivers from October to April and spawn from January to April [U.S. Fish and Wildlife Service (USFWS) 1998].

Chinook salmon will spawn in water that ranges from a few centimeters to several meters deep provided that the there is suitable sub-gravel flow (Healey 1991). Spawning typically occurs in gravel beds that are located in marginally swift riffles, runs, and pool tails with water depths exceeding one foot and velocities ranging from 1 to 3.5 feet per second. Preferred spawning substrate is clean loose gravel ranging from one to four inches in diameter with less that five percent fines (Reiser and Bjornn 1979).

Egg incubation occurs from October through March (Reynolds *et al.*, 1993). Shortly after emergence from their gravel nests, most fry disperse downstream towards the Delta and into the San Francisco Bay and its estuarine waters (Kjelson *et al.*, 1982). The remaining fry hide in the gravel or station in calm shallow waters with bank cover such as tree roots, logs, and submerged or overhead vegetation. These juveniles feed and grow from January through mid-May, and emigrate to the Delta and estuary from mid-March through mid-June (Lister and Genoe 1970). As they grow, the juveniles associate with coarser substrates along the stream margin or farther from shore (Healey 1991). Along the emigration route, submerged and overhead cover in the form of rocks, aquatic and riparian vegetation, logs, and undercut banks provide habitat for food organisms, shade, and protect juveniles and smolts from predation.

B. Pacific Coast Salmon Fishery Management Plan

As noted by the PFMC, Chinook salmon eggs, alevins, and juveniles in freshwater streams provide an important nutrient input and food source for aquatic invertebrates, other fishes, birds, and small mammals. The carcasses of Chinook salmon adults can also be an important nutrient input in their natal watersheds, as well as providing food sources for terrestrial mammals such as bears, otters, minks, and birds such as gulls, eagles, and ravens. Finally, Chinook salmon in the marine environment serve as a source of prey in the diet of other fishes, marine mammals, and coastal sea birds. Southern Resident killer whales feed primarily on salmon, and some pinnipeds have learned to return to areas that concentrate salmon as they migrate upstream (*e.g.*, Bonneville Dam on the Columbia River).

In 1999, the PFMC identified EFH for Central Valley Chinook salmon stocks to include the Sacramento and San Joaquin rivers and their tributaries as EFH[3]. Freshwater EFH for Chinook salmon consists of four major habitat functions: (1) spawning and incubation; (2) juvenile rearing; (3) juvenile migration corridors; and 4) adult migration corridors and adult holding habitat (PFMC 1999). Projected impacts associated with the proposed action are expected to eliminate, diminish, and/or disrupt these EFH habitat functions for fall- and late fall-run at many sites within the project area. As concluded in the EFH Assessment prepared by the U.S. Bureau of Reclamation (Reclamation; Reclamation 2008a), Central Valley Project (CVP) and State Water Project (SWP) operations will adversely affect the EFH of fall- and late fall-run.

In developing its EFH Conservation Recommendations, NMFS recognized that all appropriate and practicable steps to avoid adverse effects to EFH and measures to minimize remaining adverse affects are constrained due to the existing operational conditions in the Central Valley that have transpired over the lifetime of managing water in the Central Valley. Consequently, available opportunities to avoid and minimize adverse effects may be limited. In addition, NMFS recognizes that there may be potential conflicts in fulfilling its conservation mandates under the Endangered Species Act (see Opinion) and protecting EFH for particular locations. Generally, however, actions (*e.g*., restrictions on Delta pumping, increased flows in tributaries) to protect listed anadromous fish species will provide benefits to non-listed salmonids (*e.g.*, fall- and late fall-run), since they share similar habitats and respond to environmental impacts in a comparable fashion.

Due to these limitations to avoid and minimize EFH impacts, NMFS believes that available conservation measures may be insufficient to offset the expected further deterioration of EFH habitat functions in parts of the project area. Consequently, the agency included EFH Conservation Recommendations that advise Reclamation to consider compensatory mitigation as part of this consultation. As stated in the EFH regulations [50 CFR §600.905 (b)], the EFH Conservation Recommendations provided by NMFS "...may include measures to avoid, minimize, mitigate, or other otherwise offset adverse effects on EFH from actions or proposed actions authorized, funded, or undertaken...” by the Federal action agency. Consequently, the agency believes that in order to provide meaningful EFH Conservation Recommendations for conserving and enhancing EFH, it needs to look beyond options for avoiding and minimizing adverse affects and also include compensatory mitigation for conserving and enhancing Chinook salmon EFH.

For this EFH consultation, compensatory mitigation is defined as activities used to offset unavoidable adverse impacts on stream miles and associated habitat functions and values by restoring, enhancing, or creating Chinook salmon habitat in other locations. In examining mitigation options, the agency recognizes that the proposed action occurs within the context of other water dependent operations that can also affect water quality and quantity. Because all aspects of Central Valley water usage are interrelated and interdependent, NMFS believes that reasonable opportunities for compensatory mitigation should look beyond the scope of the proposed action and consider opportunities related to other water dependent operations. That is, in order to properly mitigate, NMFS recognizes that Reclamation may need to look beyond its own operations in order to improve the functions and values of Chinook salmon EFH by combining suggested mitigation efforts with other government programs and initiatives as well as with non-regulatory initiatives and partnerships.

II. PROPOSED ACTION

The proposed action is the long-term operations of the CVP and SWP, described in the Appendix 1 to the Opinion, and as modified by the NMFS Reasonable and Prudent Alternatives (RPA). In general, Reclamation proposes to continue the operation of the CVP and SWP in the Central Valley, California. In addition to operations, several other actions are included in this consultation. These actions are: (1) an intertie between the California Aqueduct and the Delta-Mendota Canal; (2) Freeport Regional Water Project; (3) changes in the operation of the Red Bluff Diversion Dam (RBDD); and (4) Alternative Intake Project for the Contra Costa Water District.

III. EFFECTS OF THE PROPOSED ACTION

The effects of the proposed action on winter-run and spring-run habitat are described at length in section 6 (*Effects of the Action*) of the Opinion and are generally expected to apply to Pacific Coast Salmon EFH. The following provides additional analysis and effects on fall- and late fall-run habitat.

A. Clear Creek

EFH for fall-run and late fall-run on Clear Creek has been improved by years of restoration work and the removal of Saeltzer Dam in 2000, which provided an additional 12 miles of spawning habitat. Funded for restoration, gravel augmentation, and increased flows has come from CALFED’s Ecosytem Restoration Program and a separate Clear Creek Restoration Program included in the Central Valley Project Improvement Act (CVPIA). Since 1995, increased releases from Whiskeytown Dam under the CVPIA section 3406 (b)(2) (hereafter referred to as (b)(2) water) have been providing suitable habitat and water temperatures for fall-run and late fall-run Chinook. The ten-year average (1997- 2007) fall-run escapement is 8,979 adults (CDFG GranTab data 2008). Recent surveys by the USFWS (2003-2008) have also observed an average of 64 late fall-run spawning in Clear Creek (USFWS 2008)

Abundance has generally improved overall since the 1950s, but decreased in the last several years consistent with other fall-run populations in the Central Valley. Lack of (b)(2) for fall-run would have a significant impact of the amount of habitat available for spawning and rearing. Actions as part of the RPA taken to provide suitable conditions for spring-run and steelhead will generally provide suitable conditions for other Chinook salmon races as well. Contrary to the most recent in-stream flow studies (USFWS 2007a) increasing flows to 600 cubic feet per second (cfs) for spring-run would negatively impact other Chinook salmon races by dewatering redds later when the flows are dropped to conserve storage (*i.e.*, most of the flow in Clear Creek originate from releases diverted from the Trinity River). The use of pulse flows to attract spring-run adults into Clear Creek, as described in the RPA, would aide out-migrating juvenile fall-run smolts by improving survival to the Sacramento River. The RPA also increases the frequency of flood control spills in every other year, which would improve habitat in general for all salmonids by moving spawning gravels downstream from injection sites and improving the diversity of rearing habitat available to multiple listed and non-listed species. Replacement of the Temperature Curtain in Whiskeytown Reservoir has been shown to improve cold water into Keswick Reservoir and may indirectly provide colder water to Clear Creek.

Based on the available evidence, the proposed RPA is expected to have beneficial impacts on Clear Creek fall-run/late fall-run EFH through greater flows for channel maintenance, continued water temperature requirements, and continued implementation of restoration and gravel augmentation programs. Adverse effects of climate warming are expected to be buffered by improved freshwater habitat diversity (Lindley 2009).

B. Upper Sacramento River Main Stem

Fall-run on the main stem Sacramento River have also shown a steady decline in abundance since 1999 (Figure 1). This long-term trend is partly attributed to operating Shasta Dam releases for temperature control and ramp downs in the fall to conserve storage. More recently, in the last three years, the decline in fall-run is consistent with Central Valley-wide declines attributed to poor ocean conditions (National Oceanic and Atmospheric Administration 2007). Conversely, late fall-run on the main stem Sacramento River have shown a stable and increasing trend in the recent past (Figure 2). Shasta Dam releases are typically reduced in the fall to conserve storage after the irrigation season. This reduction in fall flows can strand and dewater Chinook salmon redds that are located in shallow riffle areas in the upper Sacramento River (Red Bluf Diversion Dam [RBDD] to Keswick Dam).

Chinook salmon spawning above RBDD is negatively impacted by water temperature management proposed in the proposed action (Reclamation 2008, hereafter referred to as CVP/SWP operations BA). The use of cold water reserves for winter-run through the summer impacts Chinook spawning in September and October since the cold water is typically used up by the end of August. Temperature modeling indicates that in 50 percent of the years water temperatures will be above the temperature control criteria (56^{o}F) between Keswick Dam and Balls Ferry and cannot be met from Balls Ferry to Bend Bridge. Therefore, future operations are expected to reduce the available spawning habitat for Chinook salmon (*i.e*., spring-run, fall-run) and increase the mortality to eggs and pre-emergent fry. With climate change, egg and fry mortality are predicted to increase on average ten percent (Figures 3 to 5, CVP/SWP operations BA Salmon Mortality Model).

Under the RPA, temperature management would improve the likelihood that cold water would be available through the fall by increasing the carryover storage level in Shasta Reservoir during critically dry years. These years represent approximately ten percent of the historical years modeled by CalSim. Adverse impacts associated with dry year impacts would still occur with future climate change (drier, less precipitation) but would only impact approximately 13 percent of those fall-run population that spawn below the compliance point (see fall-run technical memos, Hannon 2009, and Oppenheim 2009 Appendix 3).

Fall- and late fall-run adults migrate up the Sacramento River in late summer through late winter (August – March). Fall-run and late fall-run utilize the main stem of the Sacramento River upstream of the RBDD, although a small percentage of the run spawns just downstream of the RBDD. RBDD gates will be raised on or before September 1, thereby blocking or delaying some of the upstream-migrating adult fall-run prior to September 1. After 2012, the RBDD gates will no longer be lowered; therefore, there will no longer be any adult Chinook salmon delays at RBDD. Interim gate operations under the RPA allow a two-month gate closure (July through August) until 2012, or a new pumping plant is constructed. With the gates out September 1, approximately ten percent of fall-run adults passing RBDD will no longer be delayed (TCCA 2008). After 2012, the gates will be open year-round and approximately 25 percent of the fall-run adults will have unimpeded passage upstream. In addition, approximately eight percent of the juvenile fall-run will no longer experience delays in Lake Red Bluff and increased predation from passing downstream under the gates in May, June, and July (TCCA 2008). The highest density spawning area occurs from the City of Anderson upstream to the first riffle downstream of Keswick Dam. Based on recent RBDD ladder counts, the percentage of other races encountering delays would be approximately 15 percent for winter-run, 70 percent for spring-run, and 0 percent for late fall-run (TCCA 2008).

The RPA includes restoration projects in Battle Creek and other tributaries to expand habitat for spring-run and winter-run. These restoration projects are likely to improve passage and habitat for fall-run and late-fall Chinook as well.

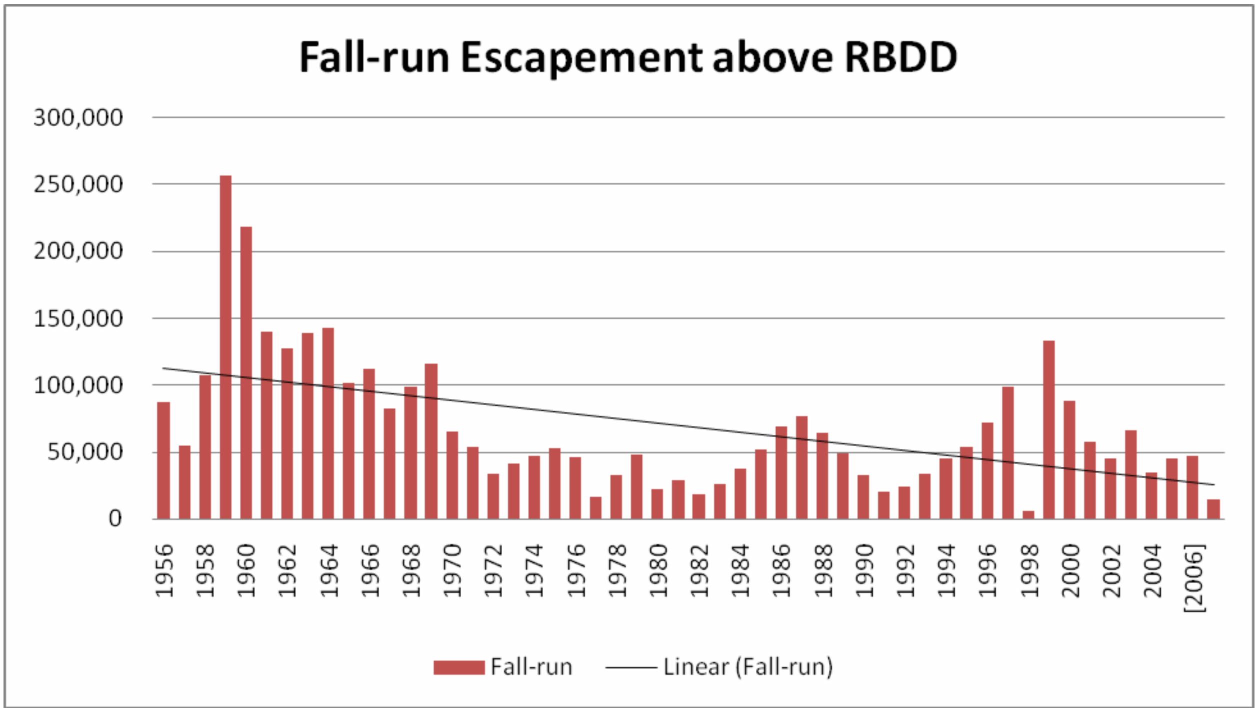

Figure 1. Fall-run Chinook salmon escapement above Red Bluff Diversion Dam 1956 – 2007. Years in parentheses indicate preliminary data [California Department of Fish and Game (CDFG) 2008].

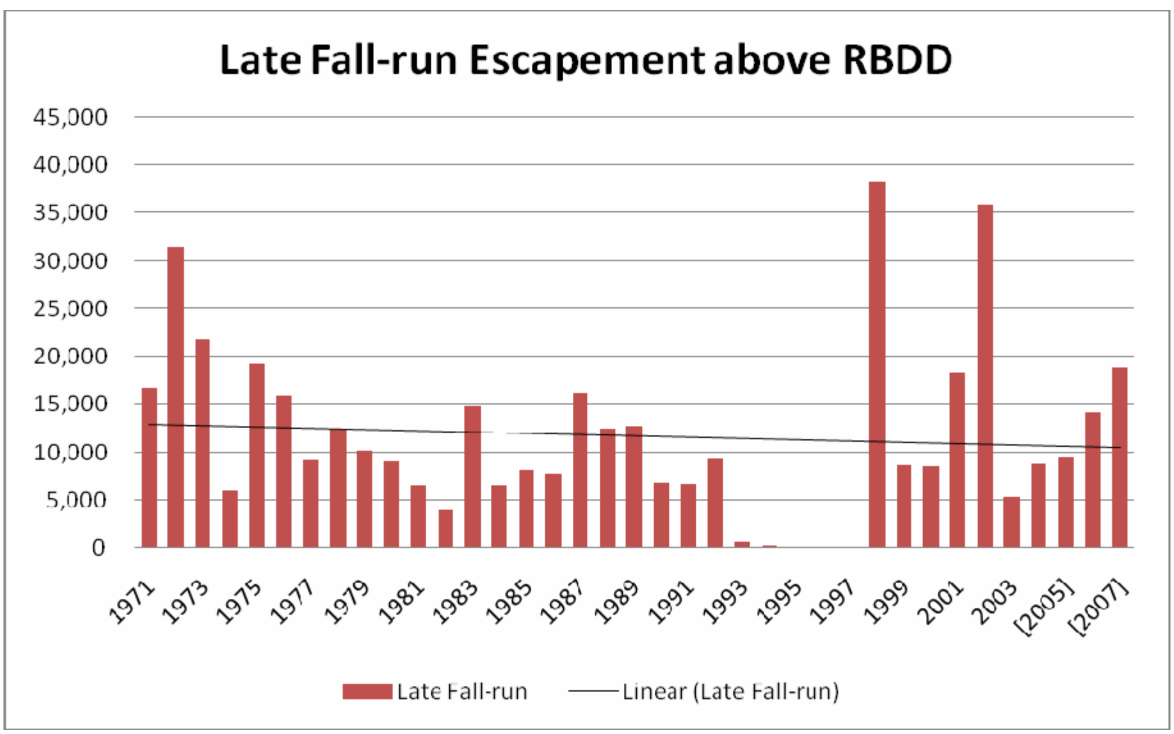

Figure 2. Late fall-run Chinook salmon escapement above Red Bluff Diversion Dam from 1971 – 2007. Years in parentheses indicate preliminary data (CDFG 2008).

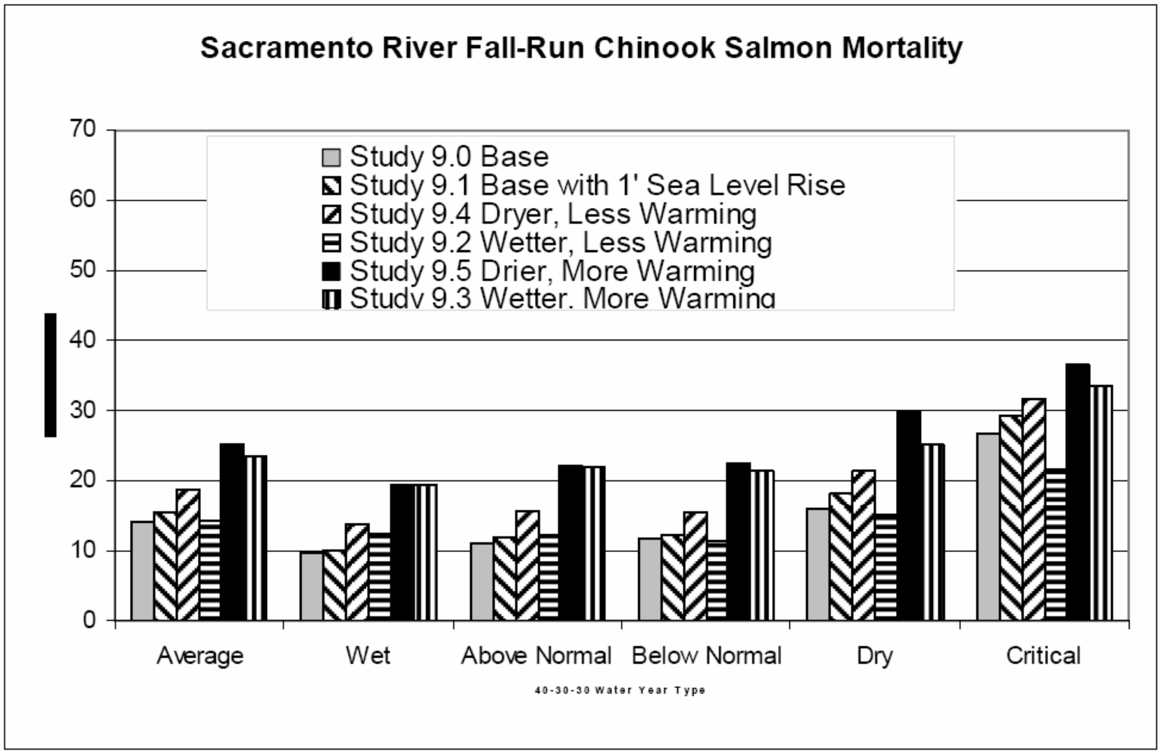

Figure 3. Sacramento River fall-run Chinook salmon mortality by run and climate change scenario from Reclamation salmon egg mortality model. All studies except 9.0 include a 1-foot sea level rise. Study 9.0 is future conditions with D-1641 (Reclamation 2008a Figure 49).

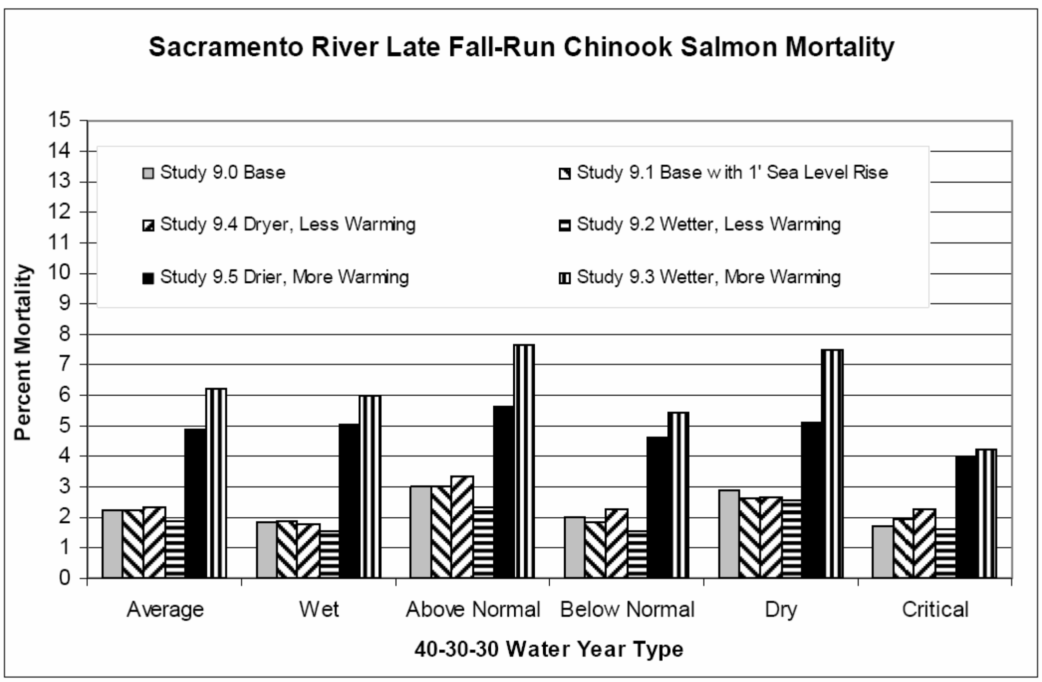

Figure 4. Sacramento River late fall-run Chinook salmon mortality by run and climate change scenario from Reclamation salmon egg mortality model. All studies except 9.0 include a 1-foot sea level rise. Study 9.0 is future conditions with D-1641 (Reclamation 2008a Figure 50).

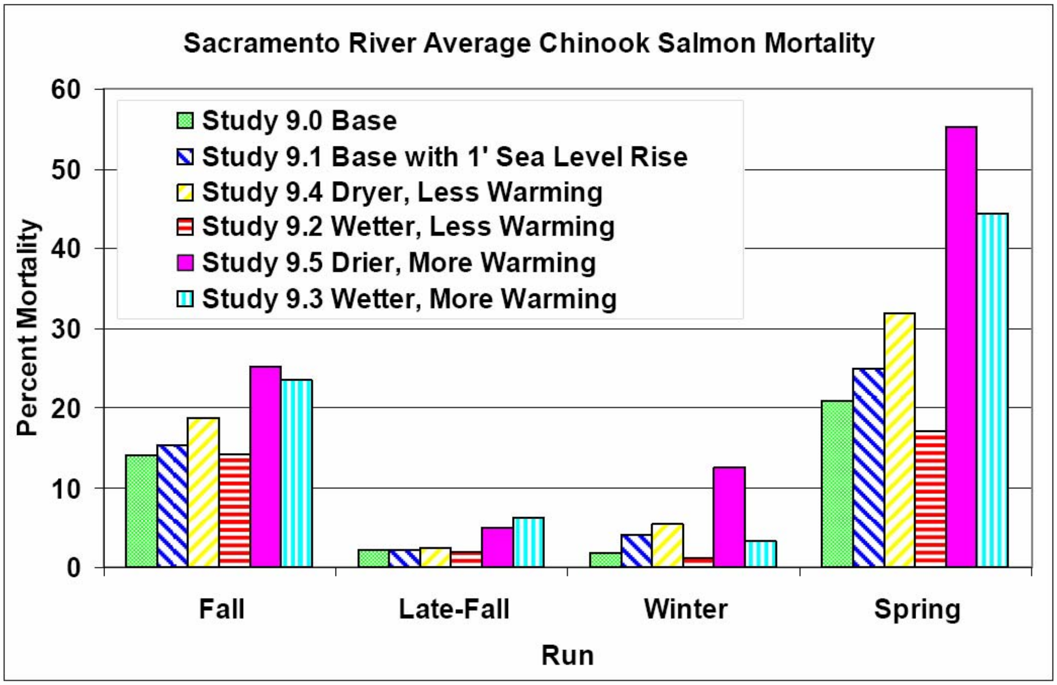

Figure 5. Sacramento River average Chinook salmon mortality by run and climate change scenario from Reclamation salmon egg mortality model. All studies except 9.0 include a 1-foot sea level rise. Study 9.0 is future conditions with D-1641 (Reclamation 2008a Figure 51).

Fall- and late fall-run spawning the upper Sacramento River are adversely affected in all years when flows are kept high for agricultural demand (*i.e*., rice decomposition) and then decreased in the fall to conserve water in Shasta Reservoir. Large numbers of fall-run redds have been dewatered in the upper Sacramento River when flows are lowered after the rice decomposition program (September – November) is completed and Shasta Dam releases decrease. The RPA at Shasta Reservoir is designed to minimize these future adverse effects through conserving water in Shasta reservoir on a year-round basis, and operating more conservatively (*i.e*., assuming that any initial dry-year hydrology could be the beginning of a drought sequence). Therefore, these adverse effects will be minimized, but not eliminated. What is unknown at this time is how higher storage levels in Shasta will effect fall-run and late fall-run spawning through more frequent flood control spills (*i.e.*, redd scouring, dewatering, isolation, and stranding events). NMFS will analyze this impact when data becomes available and, through the use of technical teams identified in the RPA, will adaptively manage this impact. Consequently, it is anticipated that some redd dewatering will continue in the future condition.

Outmigrating Chinook salmon juveniles are also subjected to potential entrainment from water diversions located along the Sacramento River — of the 879 diversions only 91 (11 percent) currently have fish screens (Calfish data base and AFSP 2009 annual report). These diversions adversely affect EFH by disrupting migration, diverting juveniles into unsuitable rearing habitat, and killing fish outright The RPA insures that continued funding of fish screens will continue through the AFSP to reduce entrainment at unscreened diversions.

Based on the available evidence, the proposed action is expected to adversely impact Sacramento River fall-run and late fall-run EFH through continuing degradation of spawning and rearing habitat, water temperature-related impacts, reduced flows, and entrainment at unscreened water diversions. Increased level of water demands through 2030, reduced diversions from the Trinity River, and future climate warming would exacerbate water temperature-related impacts to EFH. However, the many actions within the RPA will generally improve EFH for naturally spawning fall-run and late-fall run by improving adult passage at RBDD, increasing juvenile survival (*i.e.*, reducing predation, and entrainment at diversions), reducing water temperature related impacts, increasing reservoir storage, and restoring EFH in tributary spawning areas.

C. American River

This effects analysis assumes that impacts on lower American River Chinook salmon and their habitat that are expected with implementation of the proposed Project will be similar to (or more severe than) the impacts associated with the American River Division of the CVP, which have occurred in the recent past (*e.g.*, within the last ten years). This assumption is reasonable because the proposed action includes the continued operation of the American River Division through 2030 to meet increasing water demands. From 2000 through 2006, annual water deliveries from the American River Diversion ranged from 196 thousand acre-feet (taf) in 2000 to 297 taf in 2005. In the CVP/SWP operations BA, present level water demands for the American River Division were modeled at 325 taf per year, and the 2030 water demands are modeled at nearly 800 taf per year; an annual demand about 2.7 to 4.0 times higher than the annual deliveries from 2000 through 2006.

The only persistent Chinook salmon population spawning in the American River is the fall-run. However, it should be noted that approximately 200 adult late fall-run returned to the American River in 2008. Analysis of coded wire tags revealed that most of these late fall-run were released in 2007 from Coleman National Fish Hatchery. Because these fish were hatchery stays, and it is uncertain whether a persistent naturally spawning population will emerge from this stray event, this American River EFH analysis will focus on fall-run.

Fall-run on their upstream spawning migration generally enter the American River beginning in September, with peak migration occurring during October and November. Spawning typically occurs from October through December, with fry emergence usually beginning in mid-to late January and peaking during mid- to late February. Fall-run emigration primarily occurs in the lower American River from January through June, with most salmon emigrating as post-emergent fry or young-of-year juveniles (Surface Water Resources, Inc. 2001).

Most spawning occurs in the upper three miles of river from Goethe Park upstream to Nimbus Dam. In general, the primary factors potentially limiting fall-run production within the lower American River are believed to be high water temperatures and flow fluctuations during portions of their freshwater residency in the river. Habitat quality during the adult immigration and spawning life stages is expected to be affected by the continued operation of the proposed action. High water temperatures during these life stages can delay the onset of Chinook salmon spawning and cause pre-spawning mortality of adults and latent mortality of incubating embryos.

These types of water temperature-related effects to Chinook salmon occur in the lower American River. As described in Water Forum (2005):

> "*In November 2001, the average daily water temperature at Watt Avenue in the lower American River was 61°F. Pronounced pre-spawning adult mortality as well as increased latent mortality to incubating embryos reportedly can result when ripe adult female Chinook salmon are exposed to water temperatures beyond the 56°F to 60°F range (McCullough 1999). Pre-spawning mortality of fall-run Chinook salmon was reported by CDFG to be approximately 67 percent during the 2001 adult immigration and adult spawning season, presumably because of high water temperatures (Healy 2004 in Lamb 2004).*"

Water temperature exceedence plots presented in the CVP/SWP operations BA demonstrate that with implementation of the proposed action adult Chinook salmon will be exposed to stressful water temperatures (> 60°F) during September, October, and November. During September, water temperatures are expected to range from just over 64°F during the coolest years up to about 71°F during the warmest years (Figure 6). In most years, by October, water temperatures are expected to have cooled to levels more suitable for successful spawning, but are still expected to be stressful to Chinook salmon immigration, spawning, and initial embryo incubation in 30 percent of the years (Figure 7). Even in November, water temperatures are expected to exceed 60°F in the warmest years (Figure 8), as was observed in 2001. In dry years, diversions from Folsom Reservoir, the need to make reservoir releases in order to meet Delta water quality objectives and demands, and the need to meet the water temperature requirements identified in this Opinion for steelhead throughout the summer, will likely limit the availability of coldwater for fall-run. In those years, the ability to provide 60°F or less in the lower American River will be largely dependent on ambient cooling of Folsom Reservoir.

Chinook salmon egg mortality modeling results presented in Appendix M of the CVP/SWP operations BA show that egg mortality is expected to range from about ten percent in above normal water year types to about 22 percent in critically dry years.

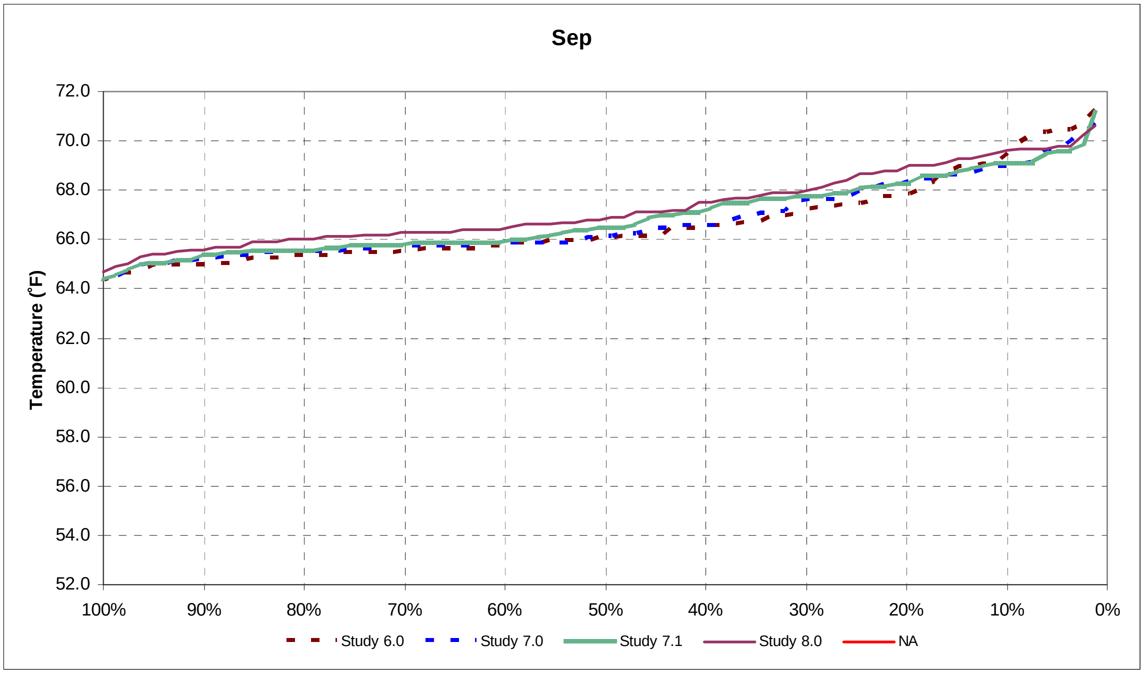

Figure 6. Exceedence plot of modeled water temperatures in the lower American River near Watt Avenue during September. This Figure was obtained from the CVP/SWP operations BA.

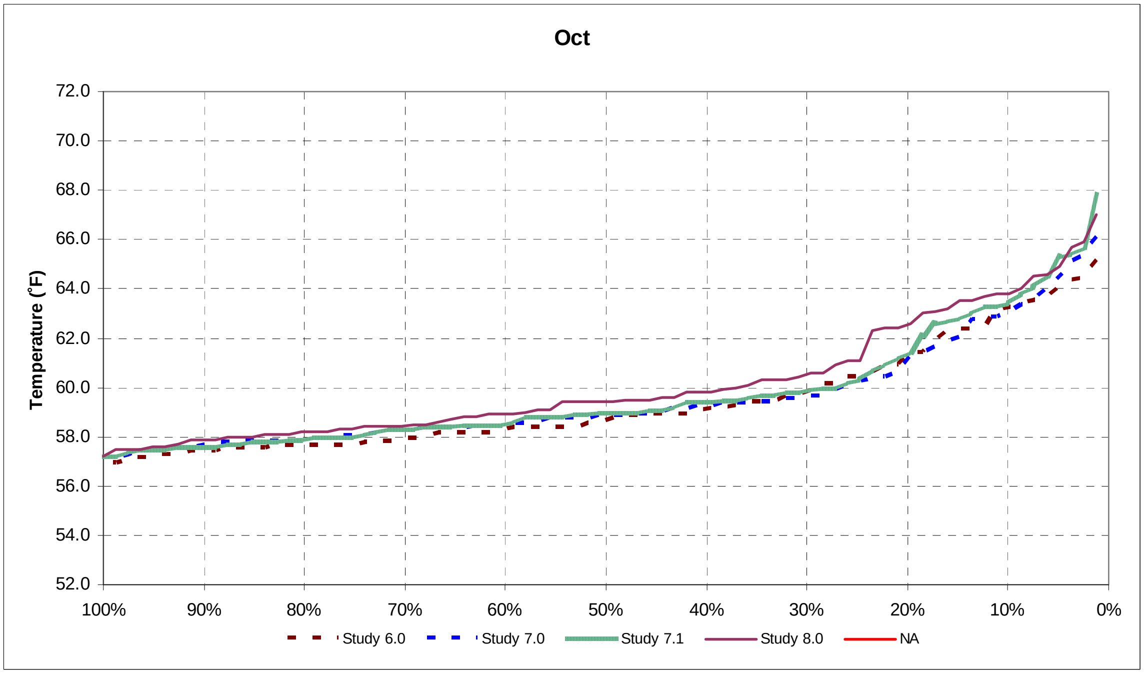

Figure 7. Exceedence plot of modeled water temperatures in the lower American River near Watt Avenue during October. This figure was obtained from the CVP/SWP operations BA.

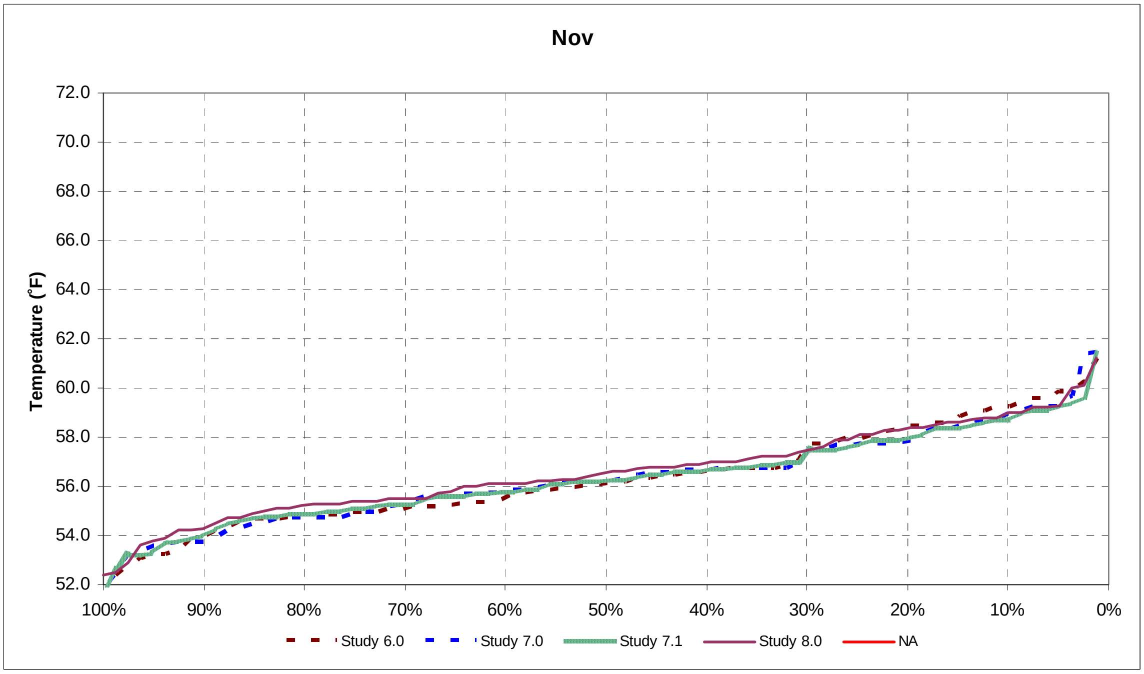

Figure 8. Exceedence plot of modeled water temperatures in the lower American River near Watt Avenue during November. This figure was obtained from the CVP/SWP operations BA.

Effects of flow fluctuations on lower American River salmonids have been examined in CDFG (2001), Reclamation (2002), and Water Forum (2005). The following discussion was derived from these studies. Reservoir operations that cause river flows to exceed and then decrease below certain water surface elevations have been identified as a source of mortality to lower American River salmonids because of redd dewatering, fry stranding, and juvenile isolation. Redd dewatering is reported to occur when flows are decreased from commonly observed spawning flow levels (*e.g.*, 1,000 to 4,000 cfs; CDFG 2001). Redd dewatering can affect salmonid embryos and alevins by impairing development and causing direct mortality due to desiccation, insufficient oxygen levels, waste metabolite toxicity, and thermal stress (Becker *et al.*, 1982, Reiser and White 1983). Isolation of redds in side channels can result in direct mortalities due to these factors, as well as starvation and predation of emergent fry. In 2006, about four Chinook salmon redds were dewatered and about 40 more total redds of unknown species were dewatered at Nimbus Basin and Sailor Bar (Figure 9, Hannon and Deason 2008).

Rapid flow decreases from flow levels that inundated low and medium sloping gravel bars when salmonid fry are present in the lower American River (*i.e.*, late-December through May) reportedly can result in fry stranding (CDFG 2001). In 2003, several observations of Chinook salmon stranding were made, including one made by the California Department of Fish and Game (CDFG) where up to 10,000 Chinook salmon fry were stranded on an island near the lower Sunrise area (Water Forum 2005).

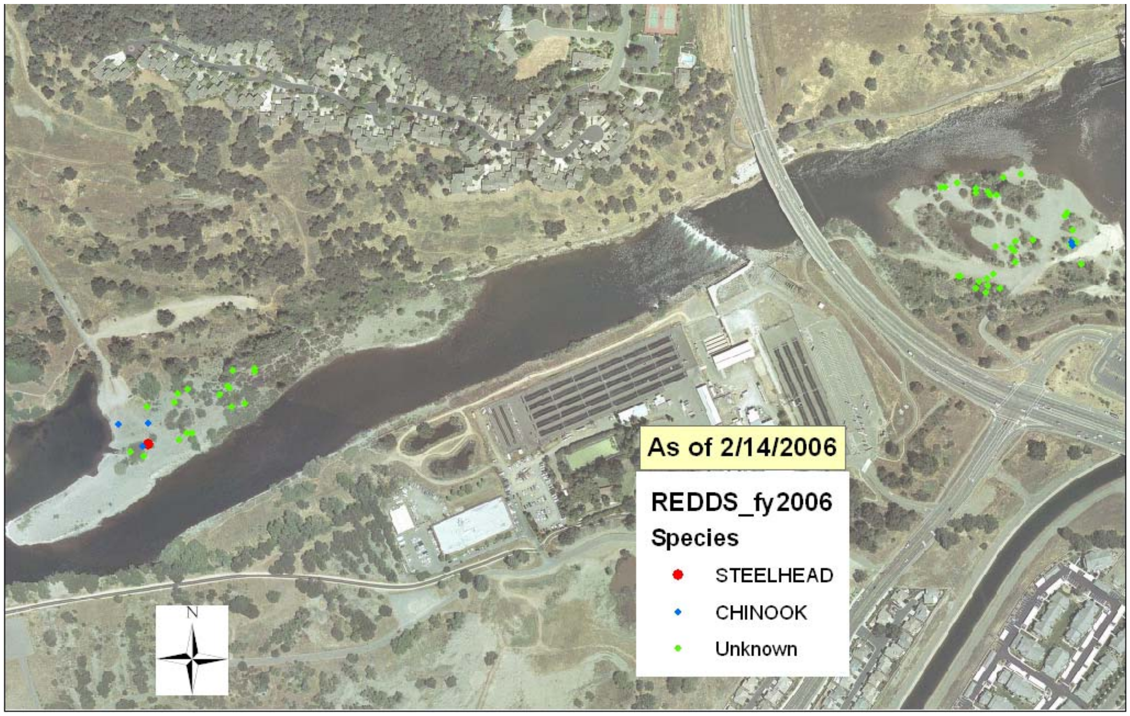

Figure 9. Dewatered redds at Nimbus Basin and Sailor Bar, February 2006 (figure was modified from Hannon and Deason 2008).

Also, as flows in the lower American River approach and exceed 4,000 cfs, many areas in the lower American River channel reportedly become inundated and subsequently are newly available to rearing fish (CDFG 2001). Thus, reductions in flow, after flows reach or exceed 4,000 cfs, have the potential to isolate juvenile salmonids (CDFG 2001). On April 28, 2004, CDFG reported that seining surveys within the isolation areas along the lower Sunrise side channel indicated that more than 2,000 juvenile Chinook salmon/seine haul had been isolated from the main channel (Water Forum 2005). CDFG seining surveys also collected more than 300 juvenile Chinook salmon/seine haul from an isolated area near Sunrise Boulevard (not the lower Sunrise side channel) and from an area near Watt Avenue (Water Forum 2005)

Based on the available evidence, the proposed Project is expected to adversely impact American River fall-run EFH through water temperature- and flow fluctuation-related effects. Both increasing water demands through 2030 and local warming expected with climate change would exacerbate water temperature-related impacts to EFH.

D. Stanislaus River

The Stanislaus River is the northernmost tributary in the San Joaquin River basin used by Chinook salmon. The river supports fall-run and small populations of late fall-run. These populations are at a low and declining state (Figure 10).

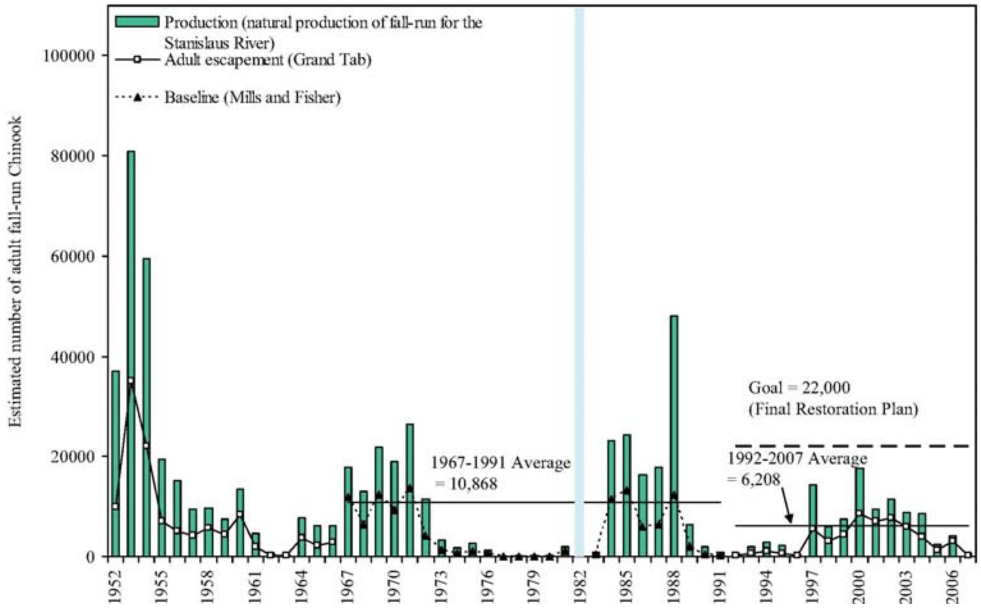

Figure 10. Estimated yearly natural production, and in river escapements of Stanislaus River adult fall-run Chinook salmon. 1952-1966 and 1992-2007 numbers are from CDFG (2008). Baseline numbers (1967-1991) are from Mills and Fisher (1994). Data were not available for 1982. Graphic from http://www.fws.gov/stockton/afrp/.

Salmonid spawning habitat availability and quality has been reduced on the order of 40 percent since 1994 (Kondolf *et al*., 2001). Mesick (2001) hypothesized that this reduction is likely underestimated, based on the sampling methodology of that assessment. His results indicated that higher concentrations of fine sediments and low intragravel dissolved oxygen in riffles downstream of Orange Blossom Bridge would be expected to reduce fall-run egg survival by 23 percent, as compared to the natural riffles at the Orange Blossom Bridge and upstream. Operational criteria have resulted in channel incision of one to three feet since the construction and operation of New Melones Reservoir (Kondolf *et al.*, 2001). This downcutting, combined with operational criteria, have effectively cut off overbank flows. These flows would have inundated floodplain rearing habitat as well as provided areas for fine sediment deposition, rather than within spawning gravels as occurs now. Additionally, the flow reductions in late spring and early summer are too rapid to allow recruitment of large riparian trees, such as Fremont cottonwoods. Consequently, within 10 to 20 years, as existing trees senesce and fall, there will be no younger riparian trees to replace them, resulting in less riparian shading, higher in-stream temperatures, less food production from allochthonous sources, and less large woody debris (LWD) for nutrients and channel complexity.

Past operations of the East Side Division have eliminated channel forming flows and geomorphic processes that maintain and enhance salmon spawning beds and juvenile rearing areas associated with floodplains and channel complexity. The reduction in peak, channel-forming flows over time is summarized in Table 1 (from Kondolf *et al.*, 2001). Since the operation of New Melones Dam, channel-forming flows above 8,000 cfs have been reduced to zero, and mobilizing flows in the 5,000-8,000 cfs range have only occurred twice in the past ten years. Channel-forming flows are important to rejuvenate spawning beds and floodplain rearing habitat and to recruit allochthonous nutrients and large wood into the river.

Status quo operations will result in further degradation of spawning habitat and rearing habitat Reduction and degradation of spawning gravels directly reduces the productivity of the species by reducing the amount of usable habitat area and causing direct egg mortality. Lower productivity leads to a reduction in abundance. Restoration actions have improved spawning riffles, but these need to be implemented at a higher level to balance losses of gravel mobilized by normal flows. Implementation of salmon habitat projects that restore floodplain connectivity and strategic implementation of channel-forming flows are important actions needed to restore and maintain adequate rearing conditions for fall-run.

Table 1. Summary of flow conditions on the Stanislaus River during historical periods from 1904-1998. New Melones Dam construction was completed in 1979. Goodwin Dam was completed in 1912 and the first dam in the basin dates at 1853 (Kondolf *et al.* 2001 table 5.2).

Period	Years	Total Years	% Years Peak over 8,000 cfs	% Years Peak over 16,000 cfs	Max Flow (cfs)	Max Flow (date)
I.	1904-1937	34	68%	32%	64,500	3/19/1907
II.	1938-1957	20	60%	25%	62,900	12/23/1955
III.	1958-1978	21	29%	14%	40,200	12/24/1964
III.	1979-1998	20	0%	0%	7,350	1/03/1997

Construction of the dams on the Stanislaus River has prevented anadromous salmonids from accessing their historical habitat. The populations persists in a reach of the river that historically was unsuitable because of high temperatures (Lindley *et al.*, 2006), and current utilization of these reaches is successful only if dam operations are managed to maintain suitable temperatures for all life history stages of salmon. There are no temperature control devices on any of the East Side Division facilities, so the only mechanism for temperature management is direct flow management. This has been achieved in the past through a combination of augmenting baseline water operations, for meeting senior water right deliveries and D-1641 water quality standards, with additional flows from: (1) the CDFG fish agreement; and (2) from (b)(2) or (b)(3) water acquisitions. The analysis of temperature effects presented in the CVP/SWP operations BA (Appendix I) assumes that these augmentations will be available. If water for fish needs is indeed allocated as their model suggests, future operations likely would meet fall-run temperature needs, except in dry or critical years, depending on the future climate change and assuming that (b)(2) and (b)(3) water allocations can be made.

The Project Description does not specify how (b)(2) or (b)(3) water are committed for fishery uses of any particular amount, timing, or duration. The CVP/SWP operations BA analysis does not evaluate their assumptions without the addition of CVPIA assets for fish, so the change in temperature of these reduced flows for fish cannot be quantified with available data.

Aceituno (1993) applied the in-stream flow incremental methodology to the Stanislaus River between Riverbank and Goodwin Dam (24 river miles) and determined that 155 taf was needed to maximize weighted usable habitat area for fall-run, not including outmigration flows or fall attraction flows. This study also identified that in-stream flow needs for each life history stage are somewhat different between fall-run and steelhead (Table 2). Steelhead flow needs are somewhat lower than fall-run needs for some life stages, but potentially higher for adult migration. The total amount of water needed for maximum in-stream habitat support is equal to or greater than 155 taf, and also greater than 98.3 taf fishery agreement allotment to CDFG.

The proposed allocation-year strategy for the East Side Division fundamental operating principles only commits to providing sufficient water for fisheries in 41 percent of the years, based on operations since 1982 (Table 3). The CDFG Fish Agreement allotment alone is less than what fall-run need, but the CDFG allocation schedule is predominantly directed by Chinook salmon needs. Consequently, fall-run are likely to have unmet flow needs less often than steelhead. If (b)(2) or (b)(3) water is available, this effect could be reduced in some Mid-Allocation years. Because the guidance for allocation of (b)(2) and (b)(3) water specifically for the Stanislaus River is not specific, the magnitude of this reduction cannot be determined.

Table 2. Comparison by life stage of instream flows which would provide maximum weighted usable area of habitat for steelhead and Chinook salmon in the Stanislaus River, between Goodwin Dam and Riverbank, California (adapted from Aceituno 1993). No value for Chinook salmon adult migration flows was reported.

Life Stage	Steelhead Flow	Steelhead Timing	Fall-Run Chinook Salmon Flow	Fall-Run Chinook Salmon Timing
Spawning	200	Dec-Feb	300	Oct 15-Dec 31
Egg incubation/ fry rearing	50	Jan – Mar	150	Jan. 1-Feb 15
Juvenile rearing	150	all year	200	Feb 15-Oct 15
Adult migration	500	Oct-April	-	

Table 3. Occurrence of High Allocation, Mid-Allocation and Conference Year types for New Melones Transitional Operation Plan, based on New Melones Operations since 1982 (data available at http://cdec.water.ca.gov).

Allocation Year Type	Fishery Allocation	% occurrence 1982-2008
High Allocation Years New Melones Index is greater than 1.7 MAF	457 TAF	41%
Mid-Allocation	98.3 TAF	33%
"Conference Year" conditions – New Melones Index is less than 1.0 MAF	unspecified	26%

The IFIM analysis did not include an assessment of the volume of water needed for a spring pulse flow to convey fall-run from the Stanislaus River into the Delta. The San Joaquin River Agreement (SJRA) and associated Vernalis Adaptive Management Program (VAMP) were agreed upon by the State Water Resources Control Board and the signatory parties as a mechanism to address this fishery need in the context of refining the understanding of what specific flow standards are needed to meet the requirements of the 1995 Water Quality Control Plan. The SJRA will conclude in 2011, and the funding for VAMP studies and flows is scheduled to end in 2009. The Project Description indicates that Reclamation and the California Department of Water Resources (DWR) intend to "continue VAMP-like flows", but the description of these flows lacks critical fish benefits now provided by the SJRA and VAMP.

Under the SJRA, operators on the Tuolumne and Merced rivers release spring pulse flows in a manner coordinated with Stanislaus River pulse flows to convey salmonids from these tributaries into the San Joaquin River and to the Delta. When the SJRA concludes, there will be no commitment by operators on the Merced and Tuolumne rivers to continue with spring pulse flows. This will affect fall-run in the Stanislaus by requiring modification of New Melones operations to meet Vernalis water quality standards.

Without the SJRA in effect, Reclamation is solely responsible to meet water quality standards (flow and salinity) at Vernalis. Without the contribution from rivers upstream of the Stanislaus, Reclamation likely will be required to release more water from New Melones in order to meet that standard. This can result in unsuitable flows and temperatures for fall-run, dewatering of redds, and reduction of storage volumes at the end of September. This last factor will result in more years falling into the Conference Year or Mid-Allocation Year categories, which provide less suitable conditions for fall-run as described above on a more frequent basis.

Flows are projected to be adequate for fall-run spawning in High Allocation years, which have occurred 41 percent of the time, but temperatures will be warm in the lower part of the river during the early part of the adult immigration period. In Mid-Allocation years, supplementary water from b(2) or b(3) will be required if adequate flows are to be maintained for fall-run. Under dry conditions, notably Conference Years, flows are likely to be less than desirable for optimal outmigration prior to the VAMP period and for adult immigration in the fall. Since the future implementation of “VAMP-like flows” is uncertain, fall-run outmigration is expected to be impeded by lack of increased flows.

Based on the available evidence, the proposed action is expected to adversely impact Stanislaus River fall-run EFH through continuing degradation of spawning and rearing habitat, water temperature-related, and low flow-related effects. Both increasing water demands through 2030 and local warming expected with climate change would exacerbate water temperature-related impacts to EFH.

E. Delta Ecosystem

Juvenile fall- and late fall-run normally migrate down from the Sacramento and San Joaquin River basins through the rich feeding grounds of the Delta to the San Francisco Estuary, then into the Pacific Ocean. The suitability of the Delta migration corridor as part of juvenile salmon rearing EFH is reduced by various aspects of the proposed action. Adverse impacts to EFH related to the ongoing project action may complicate normal habitat functions. Such impacts include, but are not limited to, prolongation of migration routes (*i.e.*, entrainment into complex channel configurations under the influence of pumping hydraulics makes it difficult for salmon to find their way to the ocean), increasing exposure to elevated water temperatures in late spring, increasing susceptibility to predators, and adding direct mortality from salvage and entrainment operations.

Once juvenile salmon are in the vicinity of the SWP and CVP export water diversion facilities, they are more likely to be drawn into these facilities during water diversion operations. Water diversions are expected to increase under the near future and future operations of the CVP and

SWP. With exports increasing in the future with the implementation of the proposed action, and assuming that diversion into waterways leading to the export facilities and the entrainment of fish at those facilities is directly proportional to the amount of water exported, the proposed project increases the current vulnerability of emigrating salmonids to loss at the salvage facilities and reduces the already diminished quality of the habitat within the zone of entrainment to fish utilizing it. Currently, exports are reduced during the VAMP period (31 days in April and May), providing some relief to the entrainment of emigrating salmonids. Future actions under the proposed project reduce the extent of pumping reductions surrounding the VAMP period due to reduced amounts of environmental water available to compensate for the loss in exports. This exacerbates the loss of fish during the April to May period when spring-run and fall-run Chinook salmon are emigrating through the Delta. While screening facilities allow for many fish longer than 38 mm to be salvaged, considerable mortality is believed to occur when fish are less than 38 mm. In addition, smaller fish are not screened effectively (Kimmerer 2002, Brown *et al*., 1996). Evaluations of the salvage operations show them to be inefficient. Overall survival of fish going through the CVP facilities is estimated to be approximately 35 percent, while the SWP facilities have a survival rate of only 16.5 percent. The primary cause of low survival in the CVP is the reduced overall efficiency of the louvers, while at the SWP, losses in Clifton Court Forebay are the predominant reason for low survival. Loss of fish following the salvage operations can also be significant, ranging from 10 to 30 percent following release back into the Delta environment,

Though there are efforts in place to minimize entrainment, the Tracy Fish Collecting Facility (TFCF) primary louver (screen) panels cannot be cleaned without leaving gaping openings in the screen face. Further, cleaning the secondary channel and louver panels takes the entire facility offline. Also, during secondary louver screen cleaning operations, and secondary channel dewatering, the entire secondary system is shut down. As a result, all fish salvage is compromised for the duration of the outage. This loss in fish protection allows unscreened water to pass through the facility a minimum of 4 hours per day and up to 12 hours per day, depending on the debris loading of the louvers. These periods of non-operation result in an underestimation of the loss of Chinook salmon to the pumps. Also, significant delays in routine maintenance and replacement of critical control systems at the TFCF have occurred in the past and are likely to continue into the future, based on current practices. Finally, the TFCF was designed for a maximum export rate of 4600 cfs, the rated capacity of the Tracy Pumping Plant (TPP). The modeling completed to date indicates that the CVP intends to utilize the TPP to maximize the pumping capacity of the facilities to the greatest extent possible, thus operating the TFCF at its maximum design capacity, even with its current operational deficiencies.

With regards to the John E. Skinner Fish Facility, there is currently no standard method for reporting problems associated with the operation and maintenance of the facility. Delays in routine maintenance and replacement of critical control systems at the facility are not being reported to NMFS, as they are experienced. Furthermore, reports of electrical power outages, which shut down the fish collection facility, are not reported in a timely fashion to NMFS.

A fish barrier at the head of Old River is constructed in April and operated for 31 days to limit the movement of both water and outmigrant Chinook salmon into Old River. The anticipated effect is to increase survival of fall-run smolts down the San Joaquin River past the Port of Stockton and westwards through the Delta. However, if export levels are not reduced in concert with increasing San Joaquin River flows under the VAMP experimental protocol, fall-run smolts from the San Joaquin River basin are diverted southwards towards the export facilities in the South Delta via one of the interconnecting waterways. Recent telemetry studies conducted during the VAMP experiments confirm the diversion of Chinook salmon outmigrants to the CVP and SWP facilities in the south Delta (Vogel 2004, San Joaquin River Group Authority 2007, 2008).

The fish barrier at the Head of Old River is constructed again in the fall to improve water quality conditions for adult Chinook salmon returning to the San Joaquin River basin. A previous study found that the placement of the barrier in the fall improves the dissolved oxygen content in the Stockton Deep Water Ship Channel, downstream from the head of Old River on the San Joaquin River (Hallock *et al.*, 1970). Having poor water quality/low dissolved oxygen in the ship channel has become a fish passage problem for returning adult salmon entering the San Joaquin River basin.

In addition to the Head of Old River barrier, three agricultural barriers are constructed in each of the three main channels of the South Delta. One is constructed in the Old River near the CVP's TFCF location, the second is constructed in Grant Line Canal near the Tracy Boulevard Bridge, and the third is constructed in Middle River near its confluence with Victoria Canal. These three barriers present passage impediments to migrating Chinook salmon due to channel blockage, predation, and alterations to the channel flow patterns in the affected area.

F. Fish Passage

As noted above, opportunities to avoid or minimize adverse affects to EFH in specific project area may be constrained, and the potential for substantive habitat gains in these areas is minimal. Yoshiyama *et al*., (2001) noted that the primary cause in the reduction of in-stream habitat for Chinook salmon has been the construction of dams and other barriers. Many of the direct adverse impacts to fall- and late fall-run EFH or the indirect impacts caused by these dams to the EFH of other Chinook salmon runs could be alleviated if fish passage were provided. In Central Valley watersheds, dams block 95 percent of historic salmonid spawning habitat. Additionally, non-Federal Federal Energy Regulatory Commission licensed dams account for approximately 40 percent of all surface water storage in the Central Valley. As a result, Chinook salmon are extirpated from approximately 80 percent of their historic habitat in the Central Valley. In most cases, the habitat remaining is restricted to the valley floor where it was historically limited to seasonal migration use only. Remnant populations below these dams are now subject to intensive river regulation and to further direct and indirect impacts of hydroelectric operations.

IV. CONCLUSION

Based on the best available information, NMFS believes that the proposed action would adversely affect EFH for Pacific salmon.

V. EFH CONSERVATION RECOMMENDATIONS

Appendix A of Amendment 14 to the Pacific Coast Salmon Plan (PFMC 1999) provides a general list of conservation measures. NMFS recommends that the following be implemented in the action area. Although these are general recommendations without specific actions, they are designed to indicate to Reclamation where opportunities exist within their authorities to compensate for the effects of the proposed project within other actions undertaken by Reclamation.

Riparian Habitat Management: In order to prevent adverse effects to riparian corridors, Reclamation and DWR should:

- Maintain riparian management zones of appropriate width along Old River, Middle River, Grant Line/Fabian –Bell Canal, the lower San Joaquin River, and wherever the agencies have jurisdiction;
- Reduce erosion and runoff into waterways within the project area; and
- Minimize the use of chemical treatments within the riparian management zone to manage nuisance vegetation along the levee banks.

Bank Stabilization: The installation of riprap or other streambank stabilization devices can reduce or eliminate the development of side channels, functioning riparian and floodplain areas and off-channel sloughs. In order to minimize these impacts, Reclamation and DWR should:

- Use vegetative methods of bank erosion control whenever feasible. Hard bank protection should be a last resort when all other options have been explored and deemed unacceptable;
- Determine the cumulative effects of existing and proposed bio-engineered or bank hardening projects on salmon EFH, including prey species, before planning new bank stabilization projects; and
- Develop plans that minimize alterations or disturbance of the bank and existing riparian vegetation.

Conservation Measures for Construction/Urbanization: Activities associated with urbanization (*e.g.*, building construction, utility installation, road and bridge building, and storm water discharge) can significantly alter the land surface, soil, vegetation, and hydrology, and subsequently adversely impact salmon EFH through habitat loss or modification. In order to minimize these impacts, the Reclamation and DWR should:

- Plan development sites to minimize clearing and grading;
- Use Best Management Practices in building as well as road construction and maintenance operations such as avoiding ground disturbing activities during the wet season, minimizing the time disturbed lands are left exposed, using erosion prevention and sediment control methods, minimizing vegetation disturbance, maintaining buffers of vegetation around wetlands, streams, and drainage ways, and avoiding building activities in areas of steep slopes with highly erodible soils. Use methods such as sediment ponds,

sediment traps, or other facilities designed to slow water runoff and trap sediment and nutrients; and
- Where feasible, reduce impervious surfaces.

Wastewater/Pollutant Discharges: Water quality essential to salmon and their habitat can be altered when pollutants are introduced through surface runoff, through direct discharges of pollutants into the water, when deposited pollutants are re-suspended (*e.g.*, from dredging), and when flow is altered. Indirect sources of water pollution in salmon habitat includes runoff from streets, yards, and construction sites. In order to minimize these impacts, Reclamation and DWR should:

- Monitor water quality discharge following National Pollution Discharge Elimination System requirements from all discharge points;
- Work with State and Federal agencies to establish total maximum daily loads and develop appropriate management plans to attain management goals for those waters that are listed under Clean Water Act section 303 (d) criteria (*e.g.*, the Delta); and
- Establish and update, as necessary, pollution prevention plans, spill control practices, and spill control equipment for the handling and transport of toxic substances in salmon EFH (*e.g.*, oil and fuel, organic solvents, raw cement residue, sanitary wastes, *etc.*). Consider bonds or other damage compensation mechanisms to cover cleanup, restoration, and mitigation costs.

Irrigation Water Withdrawal, Storage, and Management: Water withdrawn for irrigation can have adverse impacts on Chinook salmon EFH. Diversions may cause impediments to migration, physical entrainment or injury due to impingement altered flow profiles, changes in water temperature regimes, and fluctuations in water levels. Alterations in the chemical and physical attributes of the aquatic environment may in turn affect the biological components of the aquatic habitat. Return agricultural water discharging to salmonid-bearing waterways can substantially alter and degrade habitat. General problems associated with agricultural return flows to surface waters include increased water temperatures, salinity, pathogens, decreased dissolved oxygen, increased contaminant loads from pesticides and fertilizers, and an increase in sediment loads. In order to minimize these impacts, Reclamation and DWR should:

- Apply conservation and enhancement measures for dams to water management activities and facilities where applicable;
- Establish adequate in-stream flow conditions for salmonids using, for example, Instream Flow Incremental Methodology (IFIM);
- Identify and use appropriate water conservation measures in accordance with state law;
- Install flow meters at major diversion points to account for water delivered to users, in accordance with state law;
- Screen water diversions on all fish bearing streams and waterways;
- Incorporate juvenile and adult salmonid passage on all water diversions where migration blockage occurs; and
- Undertake efforts to purchase or lease, from willing sellers and lessors, water rights necessary to maintain in-stream flows in accordance with appropriate State and Federal laws.

Dam Construction and Operation: Dams built to generate power, store water, or provide flood control have significantly contributed to declines in salmonid populations in the Central Valley. Adverse effects include impaired fish passage (including complete blockage of natal streams); downstream alterations to water temperatures, water quality parameters, water quantity, flow patterns and hydrological profiles; interruption of nutrient flow downstream; loss of LWD input to downstream segments of the watershed from upstream reaches; disruption of the sediment transport mechanism which affects riparian, river, wetland, and estuarine systems downstream of the dam; increased competition from non-native species more adaptable to the altered conditions below the dams; and increased predation rates due to disorientation or injury from passing over or through the dam structure. In order to minimize these impacts, Reclamation and DWR should:

- Operate facilities to create flow conditions adequate to provide for passage, water quality, proper timing of life history attributes, avoid juvenile stranding and redd dewatering, and maintain and restore properly functioning channel, floodplain, riparian, and estuarine conditions;
- Provide for adequate designing and screening of all dams, hydroelectric installations, and bypasses to meet specific passage criteria developed for dam operations on the West Coast;
- Develop water and energy conservation guidelines and integrate them in to the daily dam operations and into regional and watershed-based water resource plans; and
- Provide mitigation for non-avoidable adverse effects to salmonid EFH, including monitoring and evaluation of any mitigation or conservation plans undertaken under this section.

NMFS also recommends that the habitat-based actions within the reasonable and prudent alternative from the Opinion be adopted as EFH Conservation Recommendations. Finally, NMFS recommends that the following Conservation Recommendations be implemented.

A. Clear Creek

1) Reclamation should increase the frequency of flood control spills from Whiskeytown Reservoir consistent with the RPA to improve channel maintenance and habitat variability.

2) Reclamation should continue funding the CVPIA Clear Creek Restoration Program, the Gravel Augmentation Program, the (b)(2) water for anadromous fish, and the adult separation weir every year.

3) Reclamation should replace the Whiskeytown Reservoir Temperature Curtain by March 2010 to retain the original design efficiency and improve cold water releases to the Sacramento River.

4) Reclamation should implement short duration spring-time pulse flows (500 to 600 cfs) every year in order to attract spring-run Chinook adults before flows are reduced in the summer months.

5) Reclamation should provide short duration (one to three days) fall spawning attraction flows of 500 cfs, as recommended by Denton (1986 *op. cit*. CVP/SWP operations BA), in October and November.

6) Reclamation should manage flows for listed and non-listed salmonids only after all of the four IFIM studies planned for Clear Creek have been completed. A new flow prescription should not be implemented until these study results can be reviewed and discussed by the Clear Creek Technical Team and agreement reached between the fish agencies. The final flow regime should to balance the biological needs of all life stages (*e.g*., juveniles rearing vs. adult spawning) of the different runs (*e.g*., spring-run, fall-run, late fall-run, and steelhead).

B. Upper Sacramento River

1) Reclamation should, working through the appropriate CALFED program, investigate alternatives to the rice decomposition program (*i.e*., baling rice straw, mulching, *etc*.,), and recommend ways of stabilizing, or increasing flows after September 30, to reduce redd dewatering.

2) Reclamation should provide the necessary modeling and real time temperature data to the Sacramento River Temperature Control Task Group starting in February with the first water year allocation announcement and operations forecast. In this way, decisions on water temperature management throughout the summer in the upper Sacramento River relative to fish habitat conditions and coldwater pool storage in Shasta Reservoir can also consider the habitat needs of fall and late fall-run.

3) Reclamation should increase Spring Creek diversions in April, May, and June to 1500 cfs to provide colder water for Clear Creek and the main stem Sacramento River (benefits winter-run and fall-run).

4) Reclamation should ramp down Sacramento River flows from August to December, as quickly as possible, following the RPA and CVPIA Anadromous Fish Restoration Program guidelines for stabilizing flows during the fall-run/late fall-run spawning period to reduce risk of dewatering redds. Minimum flows for fall-run spawning have typically been 4,000 cfs from October through December, based on IFIM studies of habitat suitability curves. Exceptions are allowed in critical and dry years when the RPA specifies ramping down to 3,250 cfs to preserve limited cold water resources in Shasta Reservoir. Temperature targets should be moved downstream in September and October to protect fall- and late fall-run spawning and incubation. Therefore, a 56ºF criterion should be maintained through October down to Bend Bridge in all years to protect at least 30 percent of the main stem spawning population. Fall-run will spawn as far downstream

as to RBDD, but usually not until November when ambient air temperatures cool the river.

B. American River

1) Implement the Flow Management Standard for the American River by following the flow schedule in Appendix D. The flow management standards are minimum flows and should not preclude Reclamation from making higher releases at Nimbus Dam.

   The Flow Management Standard includes fall-run protections. Implementing this schedule should also protect fall-run. In the event that specific actions are needed to maintain flows for fall-run, NMFS recommends that Reclamation use (b)(2) water to achieve these flows.

2) Reclamation should operate to achieve a daily average water temperature of 60°F or less as early as possible in October for fall-run holding and spawning. Reclamation shall strive to maintain a daily average water temperature of 60ºF or less until November 1, and target 56°F or less as early in November as possible, for fall-run spawning and egg incubation. These Water Temperature Objectives for fall-run should be met at Hazel Avenue in the Lower American River.

   The priority for use of the lowest water temperature control shutters at Folsom Dam shall be to achieve the Water Temperature Objectives for steelhead, and thereafter may also be used to meet the fall-run spawning water temperature objective.

3) Fully evaluate below physical/structural actions to improve temperature management and make recommendations for implementation by June 2010. Implement selected projects by 2012.

   The following temperature management actions have the potential to improve conditions for aquatic species in the Lower American River. However, the precise benefits and costs of these actions need to be analyzed. Alternatives for each of the actions listed below should be fully developed and analyzed, and the most effective alternatives to each action should be implemented.

   a) **Improve the Folsom Dam temperature control device.** The objective of this action is to improve access to and management of Folsom Reservoir's cold water pool. Alternatives for this action include operational and physical improvements including enhancement of the existing shutters, replacement of the shutter system, and construction of a device to access cold water below the penstocks.
   b) **Improve cold water transport through Lake Natoma.** The objective of this action is to transfer cold water from Folsom Dam to Nimbus Dam with a minimum increase in temperature. Alternatives for this action include physical or operational changes to Lake Natoma or Nimbus Dam including dredging, construction of temperature curtains or pipelines, and changes in Lake Natoma water surface elevation.

c) **El Dorado Irrigation District (EID) Temperature Control Device.** The objective of this action is to conserve cold water in Folsom Lake. Alternative intake structures have been analyzed by EID. The most effective device should be constructed.

4.) The following ramping rates should be followed:

a) January 1 through May 30, at flow levels <5, 000 cfs, flow reductions should not exceed more than 500 cfs/day and not more than 100 cfs/hour; and
b) each year from January 1 through May 30, Reclamation should coordinate with NMFS, CDFG, and USFWS to implement and fund monitoring in order to estimate the incidental take of salmonids associated with reductions in Nimbus Dam releases.
c) Minimize flow increases to 4000 cfs or more year round.

C. Stanislaus River

1) Reclamation should implement an in-stream flow schedule, as measured at Goodwin Dam, that provides optimum flows for fall-run as defined by Aceituno (1993), or as defined by future analyses of salmon in-stream flow needs. Additionally, this schedule should include sufficient spring flows in April and May to convey salmon smolts through the lower river and to the Delta.

2) Reclamation should conduct fall attraction flows of a minimum of 1,250 cfs for two weeks in October. This recommendation will assist adult fall-run immigration to the Stanislaus River. The purpose is to provide flow cues downstream for incoming adults, as well as providing some remedial effect on the low dissolved oxygen conditions that develop in the Stockton Deep Water Ship Channel.

3) Reclamation should implement late spring and early summer flow ramping rates to allow establishment of riparian trees at a minimum frequency of every five years.

4) Reclamation should implement spawning gravel replenishment projects on the Stanislaus River, in addition to the current 3,000 cy/year base level augmentation rate applied under CVPIA (b)(13) authorities.

5) Reclamation should implement projects to improve salmonid rearing habitat and floodplain connectivity, including creation of side-channel habitat, isolation of predator-rich in-river mining pits, and periodic increased flows to inundate floodplain habitat.

D. Delta Ecosystem

1) <u>Delta Cross Channel (DCC) Gates:</u> To increase the survival of out-migrating fall- and late fall-run, NMFS recommends that the DCC gates be closed as early as possible, under an adaptive management program based on monitoring outmigrant movements starting November 1. No later than on December 15 of each year, the DCC gates should be closed to protect outmigrant Chinook salmon, unless NMFS approves a later date. The DCC gates should remain closed for the protection of Pacific salmonids until June 15 of

each year, unless NMFS approves an earlier date. Water quality considerations in the Delta will be one cause for a request to vary from these dates, but NMFS will have final authority on closure.

2) Tracy Fish Collection Facility (TFCF)

a) At the TFCF, Reclamation should submit to NMFS for approval, no later than 12 months from the date of issuance of this document, one or more solutions to the loss of Chinook salmon associated with the cleaning of the primary louvers. In the event that a solution is not in place within 24 months after the issuance of this document, NMFS recommends that export pumping at the Tracy Pumping Plant cease during Tracy Pumping Plant louver screen cleaning operations.
b) Also at the TFCF, Reclamation should submit to NMFS for approval, no later than 12 months from the date of issuance of this document, one or more solutions to the loss of Chinook salmon with regard to the secondary louver screen cleaning and secondary channel dewatering. In the event that a solution is not in place within 24 months after the date of issuance of this document, NMFS recommends that export pumping at the Tracy Pumping Plant cease during outages of the secondary system, such as occurs during the secondary louver screen cleaning operations, debris removal, and predator management programs.
c) Beginning on the first day of the month following the issuance of this document, and monthly thereafter, but no later than five working days after the first day of the month, Reclamation should submit a TFCF Status Report to the NMFS Engineering Team Leader. The report should be in a format acceptable to both parties, but should describe the status of each component of the fish salvage system, and should provide a schedule for the correction of each deficiency, with defined checkpoints for completion. Failure to comply should result in the cessation of pumping at the Tracy Pumping Plant until said report is issued.
d) NMFS staff (scientific and enforcement) should be permitted reasonable access to the TFCF, and its records of: (i) operation; (ii) fish salvage; (iii) fish transportation and release activities; and (iv) research activities conducted at the TFCF, during both announced and unannounced inspection visits.
e) NMFS recommends that Reclamation undertake ways to reduce predation on juvenile fall- and late fall-run by undertaking predator removal studies at the Tracy facility and also at post-release sites for salvaged juveniles. Loss calculations should be adjusted reflecting results of these predation studies.

3) Tracy Pumping Plant (TPP)

A plan to limit TPP exports to 4,600 cfs should be prepared and implemented. This restriction should remain in place until a plan to expand the TFCF capacity is prepared, approved by NMFS, and implemented.

4) <u>J.E. Skinner Delta Fish Facility</u>

   a) Beginning on the first day of the month following the issuance of this document, and monthly thereafter, but no later than five working days after the first day of the month, DWR should submit a J.E. Skinner Delta Fish Facility Status Report to the NMFS Engineering Team Leader. The report should be in a format acceptable to both parties, but should describe the status of each component of the fish salvage system, and provide a schedule for correcting each deficiency, with defined checkpoints for completion. Failure to comply should result in the cessation of pumping at the Banks Pumping Plant until said report is issued.
   b) NMFS staff (scientific and enforcement) should be permitted reasonable access to the J.E. Skinner Delta Fish Protective Facility and its records of: (i) operation; (ii) fish salvage; (iii) fish transportation and release activities; and (iv) research activities conducted at the facility, during both announced and unannounced inspection visits.
   c) NMFS recommends that DWR undertake ways to reduce predation on juvenile fall- and late fall-run by undertaking predation management studies at post-release sites for salvaged juveniles. Within 12 months of the issuance of this document, a final proposal should be sent to NMFS for review. Within 24 months of NMFS' acceptance of the proposal, the "plan" should be implemented. Failure to meet this timeline should result in the cessation of pumping at SWP facilities unless NMFS agrees to an extended timeline.
   d) NMFS recommends that alternatives to reduce "pre-screen" losses (predation) in Clifton Court Forebay be developed within 12 months of the issuance of this document. Within two years of developing such a plan, the "plan" will be implemented to reduce the predation impact. Failure to meet this timeline should result in the cessation of pumping at SWP facilities unless NMFS agrees to an extended timeline.

5) <u>CVP and SWP Fish Hauling Protocols</u>

   Fish hauling runs for salmonids should be scheduled at least every 12 hours, or more frequently if required by the "Bates Table" calculations (made at each count and recorded on the monthly report).

6) <u>Rock Slough Intake and Other Fish Screening Projects, Including CVPIA-Anadromous Fish Screening Program (AFSP)</u>

   a) Reclamation should ensure that the CVP and SWP aggressively move to fully engage the CVPIA-AFSP, with appropriate funding, and implement the major projects already designed.
   b) Until the Rock Slough diversion is screened, pumping at this site should be avoided whenever Chinook salmon are detected in the vicinity of the intake. The Contra Costa Water District should use its two operating screened diversions (Los Vaqueros-Old River and Mallard Slough), the Alternative Intake Diversion on Victoria Canal

once completed, and the available storage in the Los Vaqueros Reservoir, to offset this restriction.

c) The current fish-monitoring plan should continue until such time as the use of the unscreened Rock Slough diversion is resolved, whether by screening or other means.

7) Habitat Restoration

a) Reclamation should aggressively pursue opportunities to acquire land and/or obtain easements to create habitat restoration sites in the Delta region.
b) Habitat restoration projects should target the creation of riparian habitat, freshwater and tidal marshes, and shallow water habitats beneficial to salmonid life histories. Habitat restoration activities should target actions that increase the amount of useable habitat for salmonids and reverse the simplification of the Delta habitat created by channelization of Delta waterways and riprapping of levee banks.
c) Reclamation should seek out opportunities to partner with other Federal, State, or non-governmental parties to further this recommendation.

VI. STATUTORY REQUIREMENTS

Section 305(b)(4)(B) of the MSFCMA requires that the Federal agency provide NMFS with a detailed written response within 30 days, and 10 days in advance of any action, to the EFH conservation recommendations, including a description of measures adopted by the Federal agency for avoiding, minimizing, or mitigating the impact of the project on EFH [50 CFR 600.920(j)]. In the case of a response that is inconsistent with our recommendations, Reclamation must explain its reasons for not following the recommendations, including the scientific justification for any disagreement with NMFS over the anticipated effects of the proposed action and the measures needed to avoid, minimize, or mitigate such effects.

VI. LITERATURE CITED

Aceituno, M.E. 1993. The relationship between in-stream flow and physical habitat availability for Chinook salmon in the Stanislaus River, California. U.S. Fish and Wildlife Service, Ecological Services, Sacramento Field Office, Sacramento, California. 71 pages.

Becker, C.D., D.A. Neitzel, and D.H. Fickeisen. 1982. Effects of Dewatering on Chinook Salmon Redds - Tolerance of 4 Developmental Phases to Daily Dewaterings. Transactions of the American Fisheries Society **111**: 624-637.

Brown, R., S. Greene, P. Coulston, and S. Barrow. 1996. An evaluation of the effectiveness of fish salvage operations at the intake to the California Aqueduct, 1979-1993. *In* J. T. Hollibaugh (ed.) San Francisco Bay: The Ecosystem. AAAS, San Francisco, California. Pp. 497-518.

California Advisory Committee on Salmon and Steelhead Trout. 1998. Restoring the balance. California Department of Fish and Game, Inland Fisheries Division, Sacramento, California, 84 pages.

California Department of Fish and Game. 2001. Evaluation of effects of flow fluctuations on the anadromous fish populations in the lower American River. Prepared for U.S. Bureau of Reclamation. Stream Evaluation Program Technical Report No. 01-2.

California Department of Fish and Game. 2008. Grand Tab database for Central Valley Chinook salmon. Fisheries Branch. Updated March 7.

Dettman, D.H., D.W. Kelley, and W.T. Mitchell. 1987. The influence of flow on Central Valley salmon. Prepared by the California Department of Water Resources. Revised July 1987. 66 pages.

Hallock, R. J., Elwell, R.F. and D.H. Fry, Jr. 1970 . Migrations of adult king salmon, *Oncorhynchus tshawytscha*, in the San Joaquin Delta. California Dept. of Fish and Game Bulletin 151. Sacramento, California. 92 pages.

Hannon, J. and B. Deason. 2008. American River Steelhead Spawning 2001 – 2007. U.S. Bureau of Reclamation, Central Valley Project, American River, California Mid-Pacific Region.

Healey, M. C. 1991. Life history of Chinook salmon. *In* C. Groot and L. Margolis (editors) Pacific salmon life histories, pages 213-393. University of British Columbia Press, Vancouver, British Columbia.

Kimmerer, W. J. 2002. Physical, biological, and management responses to variable freshwater flow into the San Francisco Estuary. Estuary 25:1275-1290.

Kjelson, M. A., P. F. Raquel, and F. W. Fisher. 1982. Life history of fall-run juvenile Chinook salmon, *Oncorhynchus tshawytscha*, in the Sacramento-San Joaquin estuary, California. *In* V.S. Kennedy (editor), Estuarine comparisons, pages 213-393. Academic Press, New York, New York.

Kondolf, G.M., J C. Vick, and T.M. Ramirez. 1996a. Salmon spawning habitat rehabilitation in the Merced, Tuolumne, and Stanislaus Rivers, California: an evaluation of project planning and performance. University of California Water Resources Center Report No. 90, ISBN 1-887192-04-2, 147 pages.

Kondolf, G.M., J.C. Vick, and T.M. Ramirez. 1996b. Salmon spawning habitat on the Merced River, California: An evaluation of project planning and performance. Transactions of the American Fisheries Society 125:899-912.

Kondolf, G.M., A. Falzone, and K.S. Schneider. 2001. Reconnaissance-level assessment of channel change and spawning habitat on the Stanislaus River below Goodwin Dam. Berkeley, California.

Lamb, C. 2004. Water Forum, Feds Vie Over River Flow. Sacramento Business Journal. September 3, 2004.

Lindley, S. T., R. Schick, A. Agrawal, M. Goslin, T. Pearson, E. Mora, J.J. Anderson, B. May, S. Greene, C. Hanson, A. Low, D. McEwan, R.B. MacFarlane, C. Swanson, and J. G. Williams. 2006. Historical population structure of Central Valley steelhead and its alteration by dams. San Francisco Estuary and Watershed Science 4(1)(3):1-19. http://repositories.cdlib.org/jmie/sfews/vol4/iss1/art3

Lister, D. B. and H. S. Genoe. 1970. Stream habitat utilization by cohabiting underyearlings of Chinook (*Oncorhynchus tshawytscha*) and coho (*O. kisutch*) salmon in the Big Qualicum River, British Columbia. Journal of the Fisheries Research Board of Canada 27:1215-1224.

McCullough, D. A. 1999. A Review and Synthesis of Effects of Alterations to the Water Temperature Regime on Freshwater Life Stages of Salmonids, With Special Reference to Chinook Salmon. Report No. EPA 910-R-99-010. Seattle, WA: EPA, Region 10.

Mesick, C. 2001. The effects of San Joaquin river flows and delta exports rates during October on the number of adult San Joaquin Chinook salmon that stray. Pages 139-161 *in* R.L. Brown, editor. Contributions to the Biology of Central Valley Salmonids, Volume 2. California Department of Fish and Game, Fish Bulletin 179.

Mills, T. J. and F. Fisher. 1994. Central Valley anadromous sport fish annual run-size, harvest, and population estimates, 1967 through 1991. August 1994 draft. California Department of Fish and Game, Inland Fisheries Technical Report. Sacramento, California.

Myers, J.M., R.G. Kope, G.J. Bryant, D. Teel, L.J. Lierheimer, T.C. Wainwright, W.S. Grant, F.W. Waknitz, K. Neely, S.T. Lindley, and R.S. Waples. 1998. Status review of Chinook salmon from Washington, Idaho, Oregon, and California. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-NWFSC-35. 443 pages.

National Oceanic and Atmospheric Administration. 2007. Ocean Salmon Fisheries Review, Stock Assessment and Fishery Evaluation.

Pacific Fishery Management Council. 1999. Description and identification of essential fish habitat, adverse impacts and recommended conservation measures for salmon. Amendment 14 to the Pacific Coast Salmon Plan, Appendix A. Pacific Fisheries Management Council, Portland, Oregon.

Reiser, D. W. and T. C. Bjornn. 1979. Influence of forest and rangeland management on anadromous fish habitat in western North America: Habitat requirements of anadromous salmonids. U.S. Department of Agriculture, Forest Service General Technical Report PNW-96. Pacific Northwest Forest and Range Experimental Station, Portland, Oregon. 54 pages.

Reiser, D.W. and R.G. White. 1983. Effects of Complete Redd Dewatering on Salmonid Egg-Hatching Success and Development of Juveniles. Transactions of the American Fisheries Society **112**: 532-540.

Reynolds, F.L., T.J. Mills, R. Benthin, and A. Low. 1993. Restoring Central Valley streams: A plan for action. California Department of Fish and Game, Sacramento, California. 129 pages.

San Joaquin River Group Authority. 2007. 2006 Annual Technical Report: On implementation and monitoring of the San Joaquin River Agreement and the Vernalis Adaptive Management Plan. January 2007. 137 pages.

San Joaquin River Group Authority. 2008. 2007 Annual technical report on implementation and monitoring of the San Joaquin River Agreement and the Vernalis Adaptive Management Plan. Prepared for the California Water Resources Control Board incompliance with D-1641. 128 pages.

Surface Water Resources, Inc. 2001. Aquatic Resources of the lower American River: Baseline Report. Draft Report. Prepared for the Lower American River Fisheries And Instream Habitat (FISH) Working Group. Funded by CALFED, Water Forum, SAFCA, and the City of Sacramento.

Tehama-Colusa Canal Authority. 2008. Fish Passage Improvement Project at the Red Bluff Diversion Dam. Environmental Impact Statement/Environmental Impact Report. Prepared by CH2MHill. May.

U.S. Bureau of Reclamation. 2002. Lower American River Flow Fluctuation Study Report. Function Analysis Workshop August 12-16, 2002. November 2002.

U.S. Bureau of Reclamation. 2008. Biological assessment for the long-term operations of the Central Valley Project and State Water Project. August. Transmitted through an October 1, 2008, cover letter to NMFS.

U.S. Bureau of Reclamation. 2008a. Supplemental EFH assessment. Submitted via e-mail from Donna Garcia, U.S. Bureau of Reclamation, to Garwin Yip, National Marine Fisheries Service. October 22. 81 pages.

U.S. Fish and Wildlife Service. 1998. Central Valley Project Improvement Act tributary production enhancement report. Draft report to Congress on the feasibility, cost, and desirability of implementing measures pursuant to subsections 3406(e)(3) and (e)(6) of the Central Valley Project Improvement Act. U.S. Fish and Wildlife Service, Central Valley Fish and Wildlife Restoration Program Office, Sacramento, California.

U.S. Fish and Wildlife Service. 2007. Central Valley Steelhead and Late Fall-Run Chinook Salmon Redd Surveys on Clear Creek, California December 2007. Prepared by Sarah Giovannetti and Matthew Brown. Red Bluff, CA. 20 pg.

U.S. Fish and Wildlife Service. 2007a. Flow-habitat relationships for spring-run Chinook salmon and steelhead/rainbow trout spawning in Clear Creek between Whiskeytown Dam and Clear Creek Road. CVPIA 3406(b)(1)(B) flow investigation report August 15, 2007. Energy Planning and Instream Flow Branch. Sacramento, CA. 125 pages.

Vogel, D.A. 2004. Juvenile Chinook Salmon Radio-Telemetry Studies in the Northern and Central Sacramento-San Joaquin Delta 2002-2003. Draft Report. Natural Resource Scientists, Inc. Red Bluff, California. Report to the National Fish and Wildlife Foundation. January 2004. 44 pages.

Yoshiyama, R.M., F.W. Fisher and P.B. Moyle. 2001. Historical and present distribution of Chinook salmon in the Central Valley Drainage of California. *In*: Contributions to the Biology of Central Valley Salmonids, Vol. 1, Randall Brown (ed.).

Water Forum. 2005. Impacts on Lower American River Salmonids and Recommendations Associated with Folsom Reservoir Operations to Meet Delta Water Quality Objectives and Demands (Draft Report). Prepared by Surface Water Resources, Inc. January. Available at www.waterforum.org.