Reinitiation of Formal Consultation

Biological Opinion of the Effects of Long-term Operation of the Central Valley Project and State Water Project as Modified by Implementing the Preferred Alternative in the Draft Environmental Impact Statement/Environmental Impact Report for the Trinity River Mainstem Fishery Restoration Program

Request for Consultation on the Implementation of this Alternative on the Threatened Northern Spotted Owl, Northern Spotted Owl Critical Habitat, and the Endangered Bald Eagle within the Trinity River Basin, and Where Applicable, Central Valley Reservoirs

Consultation Conducted by:
U.S. Fish and Wildlife Service,
Sacramento Fish and Wildlife Office

October 12, 2000

United States Department of the Interior

FISH AND WILDLIFE SERVICE
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IN REPLY REFER TO:
1-1-00-F-0125

October 12, 2000

Memorandum

To: Regional Director, U.S. Bureau of Reclamation, Sacramento, California

Manager, California-Nevada Operations Office, Sacramento, California

From: Field Supervisor, Sacramento Field Office, Sacramento, California

Subjects: (1) Reinitiation of Formal Consultation on the Effects of Long-term Operation of the Central Valley Project and State Water Project as Modified by Implementing the Preferred Alternative in the Draft Environmental Impact Statement/Environmental Impact Report for the Trinity River Mainstem Fishery Restoration Program. (2) Request for Consultation on the Implementation of this Alternative on the Threatened Northern Spotted Owl, Northern Spotted Owl Critical Habitat, and the Endangered Bald Eagle within the Trinity River Basin and where applicable, Central Valley reservoirs.

This responds to your request of June 6, 2000, to reinitiate formal consultation with the U.S. Fish and Wildlife Service (Service) pursuant to section 7(a)(2) of the Endangered Species Act of 1973, as amended (Act), on the effects of the long-term operation (OCAP) of the Central Valley Project (CVP) and State Water Project (SWP) as modified by implementing the preferred alternative (also referred to as the Flow Evaluation Alternative) in the Draft Environmental Impact Statement/Environmental Impact Report for the Trinity River Mainstem Fishery Restoration Program (DEIS/EIR) on the delta smelt *(Hypomesus transpacificus)*, Sacramento splittail *(Pogonichthys macrolepidotus)*, and bald eagle *(Haliaeetus leucocephalus)*. The delta smelt was federally listed as a threatened species on March 5, 1993 (Service 1993a). On December 19, 1994, a final rule designating critical habitat for the delta smelt was published (Service 1994c). The Sacramento Splittail was federally listed as threatened February 8, 1999 (Service 1999). The bald eagle was listed as endangered February 14, 1978. The Service originally issued several biological opinions on the CVP OCAP on May 26, 1993

(1-1-93-F-0032), February 4, 1994 (1-1-94-F-0002) and finally March 6, 1995 (1-1-94-F-0070) all which pertained to delta smelt and Sacramento splittail. The Service also issued a biological opinion on CVP operations and the effects on the bald eagle on February 12, 1993 (1-1-93-F-0010).

Additionally, Reclamation has requested that the Service consult pursuant to section 7(a)(2) of the Act as amended relative to the effects of the Preferred Alternative and related actions on the bald eagle and the northern spotted owl (*Strix occidentalis caurina*) within the Trinity River basin. The northern spotted owl was listed as threatened June 26, 1990, and critical habitat was designated for the northern spotted owl May 6, 1991. The reference biological opinions on CVP/SWP operations describe the basic operation of the projects as well as the fundamentals of the conservation measures and overall effects of those actions and should be referred to for the original discussion of effects and basis for non-jeopardy determinations.

Reclamation has determined that the proposed action will not likely adversely affect bald eagles and northern spotted owls in the Trinity River Basin or result in adverse modification or destruction of critical habitat for the northern spotted owl. Provided that all of the avoidance and minimization measures identified in the biological assessment (Service, 2000) are followed the Sacramento Fish and Wildlife Office concurs in this determination. Additionally, should monitoring information arise that identifies that an individual action may affect the bald eagle or the northern spotted owl to a manner or extent not previously considered the Service or other appropriate Federal agency will reinitiate consultation pursuant to section 7 of the Act. Therefore, no further consideration, other than a description of the avoidance and minimization measures, of the bald eagle or the northern spotted owl in the Trinity River Basin will occur in this biological opinion. Reclamation has also requested to reinitiate the February 12, 1993, biological opinion concerning the affects of reservoir operations on bald eagles in Central Valley reservoirs. The Service has determined that the implementation of the Preferred Alternative will not affect the bald eagles in Central Valley reservoirs to a manner or extent not already analyzed in the original February 12, 1993 biological opinion and therefore it will not be addressed further in this biological opinion.

INTRODUCTION

This biological opinion represents the Service's opinion on the effects of implementing the Preferred Alternative identified in the DEIS/EIR in accordance with section 7 of the Act. The proposed actions under the Preferred Alternative are necessary to fulfill the following legislative and legal commitments to restore and maintain the fishery resources of the Trinity River:

1. Public Law 84-386 authorized construction of the Trinity River Division, but also provided for the protection of the fish and wildlife resources of the Trinity River, specifically directing the Secretary of the Interior to ensure that sufficient in-basin flows needed for the maintenance and propagation of fish and wildlife are to take

precedence over diversion of Trinity River water into the Central Valley (Opinion of the Solicitor *Proposed Contract with Grasslands Water District,* December 7, 1979).

2. Public Law 102-575 (CVPIA), § 3402, in which Congress stated an intent "... to protect, restore, and enhance fish, wildlife and associated habitats in the Central Valley and Trinity River Basins..." and "... to address impacts of the Central Valley Project on fish, wildlife, and associated habitats". CVPIA provides for "the restoration and maintenance of the Trinity River fishery" and was passed "in order to meet Federal trust responsibilities" regarding tribal fishery resources, and to promote the fishery restoration goals" of Public Law 98-541, as amended. Those goals are to restore the fish and wildlife populations in the Trinity River basin to the levels approximating those which existed prior to the start of construction of the Trinity River Division and to maintain those levels. In addition, the effectiveness of the restoration "is to be measured not only by returning adult anadromous fish spawners, but by the ability of dependent tribal, commercial, and sports fisheries to participate, through enhanced in-river and ocean harvest opportunities, in the benefits of restoration." Public Law 104-143 § 2, 110 Stat. 1338 (May 15, 1996).

3. In addition, the Secretary is charged by law with the protection and conservation of endangered species (16 U.S.C. §§ 1531 et seq). Most Trinity River salmonid populations are either listed, proposed for listing or under status review for listing under the federal Endangered Species Act.

4. The Indian reserved fishing rights in the Trinity River were quantified in 1993 by an Opinion of the Solicitor, *Fishing Rights of the Yurok and Hoopa Tribes,* M-36975 (October 4, 1993) Department of the Interior; and implemented in a related Magnuson Fishery Conservation and Management Act (16 U.S.C. §§ 1801 et seq.) interpretative rule, 58 Fed. Reg. 68063 (December 23, 1993). The tribal fishing rights have been upheld in Parravano v. Babbitt, 861 F. Supp. 914, 837 F. Supp.1034 (N.D. Calif.), aff'd 70 F.3d 539 (9th Cir. 1995), cert. denied 518 U.S. 1016 (1996).

The Preferred Alternative consists of 6 components: 1) an increased flow regime; 2) a channel rehabilitation program (mechanical restoration); 3) a coarse and fine sediment augmentation program; 4) infrastructure modifications; 5) upslope watershed restoration; and 6) an adaptive management program. Full implementation of the proposed action will be phased in over several years. This phased in approach is necessary because the planning, design, and construction of infrastructure modifications and the first phase of the channel rehabilitation projects will take approximately 2 and 3 years, respectively, depending on funding availability. The U. S. Bureau of Reclamation (Reclamation) is seeking section 7 compliance for the increased flow regime as

that flow regime relates to the Trinity River and other CVP operations. Additionally, Reclamation and the Service are requesting programmatic section 7 compliance for the remaining five components. Although Reclamation and the Service are acting as the nexus for completing the ESA consultation process for the implementation of the increased flow regime component of the Preferred Alternative, other agencies may have the responsibility for implementation of the remaining five components. Site-specific environmental documentation and ESA consultation will be required for the remaining components by the appropriate Federal Lead Agency consistent with the outcome of this biological opinion regardless of which agency takes lead responsibility.

This consultation relates to the effects of the Preferred Alternative only. Any and all project components in prior opinions remain in full force and effect unless modified through this biological opinion. The DEIS/EIR evaluates alternatives at the 2020 level of development. The modeling assumed that there would be approximately 400 thousand acre feet (TAF) of deliveries to State Water Project (SWP) contractors south of the Delta and approximately an additional 300 TAF of deliveries made to Central Valley Project (CVP) contractors north of the Delta by the year 2020 (Personal communication, Tull, 2000). Reclamation, California Department of Water Resources, and the Service are engaged in numerous programs to address the long-term delivery of water through the SWP and CVP. These include but are not limited to CalFED Bay-Delta Program, CVPIA implementation, long-term contract renewal, amendments and modifications of the Coordinated Operations Agreement, as well as site specific programs and projects. All of these programs and projects are subject to future consultation pursuant to section 7 of the Act to determine their effects on listed species and therefore are not addressed here.

CONSULTATION HISTORY

This biological opinion is based on information provided in: 1) the 1994 Biological Assessment on the effects of the Central Valley Project and State Water Project on Delta Smelt and Sacramento Splittail (DWR, 1994); 2) The DEIS/EIR on the Trinity River Mainstem Fishery Restoration Program with appendices; 3) the Biological Assessment for the DEIS/EIR on the Trinity River Mainstem Fishery Restoration Program; 4) the annualized data from the model runs used to develop the DEIS/EIR; and 5) other information contained in Service files.

BIOLOGICAL OPINION

Action Area

The action area is defined in 50 CFR 402.14(g)(3) as the immediate area involved in the action and the entire area where effects to listed species extend as a direct and indirect effect of the action. The action area for this proposed action includes all areas and facilities in the CVP including Shasta and Keswick reservoirs and their operations, the mainstem Sacramento River, the Folsom Reservoir and Lake Natoma and their operations, the American River, the

Sacramento/San Joaquin Delta, Suisun Bay, New Melones Reservoir, the Stanislaus River, Millerton Reservoir and its operations, the mainstem San Joaquin River, Trinity and Lewiston reservoirs and their operations, and the mainstem Trinity River.

Description of the Proposed Action

The proposed action is the implementation of the Preferred Alternative and any consequential modifications of the operation of the CVP consistent with implementation of the Preferred Alternative in the DEIS/EIR. A detailed description of facilities along with the historic and proposed operations of CVP are described in DWR and Reclamation (1994). The proposed operations have been further modified by the objectives outlined in the Principles for Agreement and the SWRCB draft Water Quality Control Plan (WQCP) with exceptions noted in the following section which was the subject of the March 6, 1995 biological opinion (Service, 1995). Operations also include those actions that implement management decisions agreed upon in the August 2, 1994, Framework Agreement (Fourteen-Agency 1994). Additional information on CVP and SWP facilities and operations can be found in Reclamation (1992), DWR and Reclamation (1993), NMFS (1993) and Service (1993b).

The proposed modifications that the Preferred Alternative would implement include the following:

The Preferred Alternative is based on recommendations in the Trinity River Flow Evaluation Study (TRFES) (U.S. Fish and Wildlife Service and Hoopa Valley Tribe, 1999). The alternative would restore the Trinity River ecosystem necessary for the restoration and maintenance of the fishery through managed flows combined with mechanical rehabilitation projects. Flows would be higher than the No Action Alternative in all water-year classes. Flow volumes and timing are designed to address both habitat and temperature needs for all riverine life stages of salmonids within the Trinity River. Peak flows are designed to support the physical processes necessary to maintain habitat in an alluvial river.

The Preferred Alternative also includes an adaptive management program. The adaptive management program would operate within the bounds of the TRFES recommendations. The Preferred Alternative adaptive management program would combine assessment and management by using conceptual and numerical models and the scientific method to develop and test management choices. The adaptive management program would assess the effects of reservoir operations, instream flows, and mechanical habitat manipulations on biotic resources of the Trinity River. Specifically, the program would (1) define objectives in measurable terms; (2) develop hypotheses, build models, compare options, and design system manipulations and monitoring programs; (3) propose modifications to operations that protect, conserve, and enhance biotic resources of the Trinity River; and (4) implement monitoring and research programs to examine how selected management actions meet resource management objectives for restoration of the Trinity River.

As described in the TRFES, the adaptive management program would be administered by a Trinity Management Council composed of fishery agency representatives from Federal, Tribal and County entities overseen by the Secretary of the Interior. The council would serve as a policy group that reviews, modifies, accepts, or remands recommendations forwarded to an executive director made by a technical modeling and analysis team. Also included in the process would be a scientific advisory board, a stakeholder's group, and external peer reviewers. For a complete description of the adaptive management program refer to the DEIS/EIR.

The adaptive management program could result in minor modifications to the Flow Evaluation hydrographs described in this DEIS/EIR. Any modifications will be performed in accordance with applicable laws. All mechanical ground-disturbing actions originating from the adaptive management program, regardless of whether they are described in this document, would be subject to site-specific environmental review.

Water Management. Annual releases would vary by water-year class as shown in Table 1. The release pattern for each water-year class was developed to address the needs of each of the life stages of the anadromous fish present in the Trinity River, including the ability of the river to move sediment and reshape itself (i.e., fluvial geomorphic process). Flow releases are different for each water-year class because different geomorphic processes are addressed in different water-years, as was the case prior to dam construction. Four primary components were identified and are addressed by the release patterns:

- **Summer/fall temperature control flows (July 1 through mid-October)**—These were developed in response to summer and early fall conditions when warm water temperatures are a concern for holding and spawning spring chinook salmon. North Coast Regional Water Quality Control Board criteria follow: from July 1 to September 14, temperatures no greater than 60 degrees Fahrenheit (°F) at Douglas City; from September 15 to September 30, temperatures no greater than 56°F at Douglas City; and from October 1 to December 31, temperatures no greater than 56°F at the confluence with the North Fork. Generally, flows of 450 cubic-feet-per-second (cfs) would be required during these periods to meet these temperatures.

TABLE 1

Annual Flows and Peak Releases for the Flow Evaluation Alternative

Water-year Class	Acre-feet	Peak Flow
Critically dry	369,000	1,500
Dry	453,000	4,500
Normal	636,000	6,000
Wet	701,000	8,500
Extremely wet	815,000	11,000

Peak flow releases and timing: 11,000 cubic feet per second/5 days in May (extremely wet water-year class* only) * Water year classifications for the Trinity River Basin and the Sacramento River Basin are defined differently and therefore a wet or dry year within the Trinity Basin may or may not equate to a wet or dry year within the Sacramento Basin.

- **Salmonid spawning/rearing flows (mid-October through late April/mid-May depending on water-year class)**—These flows were developed to provide suitable spawning and rearing habitat for chinook and coho salmon and steelhead. Flows of 300 cfs would be released during this period, since effective spawning has been observed at this flow level. In addition, such flows would provide habitat, minimize the potential for denaturing of redds, and protect early life stages of salmonids.

- **Fluvial geomorphic/salmonid smolt temperature control flows(late April/mid-May through June 30)**—These were developed to provide fluvial geomorphic processes and suitable temperature and flow conditions for outmigrating salmonid smolts. Peak flows of 11,000 cfs would be released for 5 days beginning May 24 during extremely wet water years to assist in geomorphic processes such as mobilizing sediment, scouring the riverbed, reshaping the channel, and removing encroaching vegetation. The peak levels would vary for each water-year class, down to a minimum of 1,500 cfs in critically dry years. During such years, these flows would not be sufficient to recontour the channel, but would help prevent the germination of unwanted vegetation.

- **Ramping rates (all times of year)** - Refers to the rate at which flow releases are either increased (ramped up) or decreased(ramped down). The ramping rates were developed to mimic natural ramping rates for the Trinity River.

Water Operations. The timing of diversions through the Clear Creek Tunnel would be shifted from spring/summer to the summer and early fall periods to maintain suitable release temperatures for the in river fishery resources of the Trinity River. Summer/fall is a critical period for holding/spawning spring chinook salmon, migrating/spawning fall chinook salmon, and holding summer steelhead. Shifting exports to the summer/early fall maintains cold water reserves in Trinity Reservoir for use in the Trinity River, versus exporting this water earlier to assist cold water maintenance in the Sacramento River. Additionally, exporting water through the Clear Creek Tunnel during summer/ early fall results in water moving quickly through Lewiston Reservoir, thereby not allowing the water (which is eventually released from Lewiston Dam) to warm. The Preferred Alternative assumes that Trinity Reservoir would be operated to maintain a minimum carryover storage of 600TAF between water years. The increased carryover provides cooler water for dam releases for the benefit of the in-river fishery resources of the Trinity River.

Watershed Protection. Watershed protection practices under this alternative would be the same as the No Action Alternative. The following programs and ordinances, relating to overall watershed protection in the Trinity River Basin, would continue. However, the Service has concluded that implementation of these programs, as described, are not likely to adversely affect the bald eagle and the northern spotted owl provided the avoidance and minimization measures described later are implemented. Therefore, the following programs and ordinances are not covered by this biological opinion and, if subsequent effects are identified, will need to obtain site specific compliance under the Act through section 7 or section 10:

- Watershed protection under the jurisdiction of U.S. Forest Service (USFS) and BLM would continue, including implementation of existing land management plans and the Record of Decision on the President's Northwest Forest Plan (U.S. Department of Agriculture and U.S. Department of the Interior, 1994).

- Trinity County's Decomposed Granite Grading Ordinance (No. 379) would be enforced for lands and projects under its jurisdiction.

- California Forest Practice Rules that regulate activities on private lands within the Trinity River Basin, which require erosion control measures that in turn minimize sediment inputs into the river, would be enforced by California Department of Forestry and Fire Protection.

- Implementation of the South Fork Trinity River Action Plan would continue. The Plan includes: watershed restoration to reduce sediment sources, upgrading inefficient irrigation systems and dedicating the saved water to instream fishery flows, cattle exclusion fencing to decrease sediment inputs and improve water quality, and riparian plantings to help decrease water temperatures and conserve streambanks.

- BLM would continue to acquire sensitive lands in the Grass Valley Creek watershed and along the Trinity River mainstem corridor.

Fish Habitat Management. Forty-seven mechanical rehabilitation projects would be constructed because the flow schedule associated with this alternative is too low to remove the existing riparian berms along the river. Once portions of the berms are mechanically removed, high flows and gravel transport would naturally create and maintain dynamic alluvial features and floodplain riparian communities. Consequently, no mechanical maintenance would be planned for the proposed or existing channel rehabilitation projects.

The proposed mechanical rehabilitation projects would involve the following:

- A total of 47 mechanical rehabilitation projects, as noted on Fig 2-4 in the DEIS/EIR, would be constructed between the Lewiston Dam and the confluence with the North Fork Trinity River. The sites would encompass approximately 665 acres. Construction would be scheduled between July 15 and September 15 to minimize impacts to fall chinook, coho, and steelhead.

- Of these 47 mechanical rehabilitation projects, 44 would be channel rehabilitation projects, and the remaining three would be side-channel projects. Twenty-four of the channel projects would be built in the first 3 years, with the remainder to be completed contingent upon an evaluation by the adaptive management program. A typical mainstem rehabilitation project would be approximately 150 feet wide (measured from the water's edge) and 500-5,000 feet long. A typical side-channel improvement would be 80 feet wide and 800 feet long.

- A typical project would take 6 weeks to construct and would require the use of front-end loaders, bulldozers, screens, and trucks.

Coarse and Fine Sediment Management. Two sites (River Miles 110.2 and 111.9) require immediate course sediment supplementation for spawning purposes. The first source of gravel will be the 2,000 yd^3 of screened gravel stored at the Old Lewiston Bridge. Additional gravel may be obtained at dredge tailings downstream of Lewiston. Dredge tailings on the south bank near Lewiston (RM 108.5) and on the south bank at Gold Bar (RM 106.3) are the nearest sources. A secondary benefit realized by utilizing these sources will be the conversion of these areas to functioning flood plains with riparian vegetation.

Additional gravel supplementation will occur annually at these sites. Further, in order to meet downstream course sediment budget deficits, gravel will also be deposited on an annual basis into a large standing wave at the Lewiston gaging station (RM 110.9). Gravel supplementation will occur here during and after peak flow releases for distribution downstream and for the

replacement of gravel transported from the immediate area. The timing and amount of coarse gravel supplementation will vary temporally based on water year type.

Spawning gravel placement would average about 10,300 yd^3 annually, with an estimated range from 0 cubic yards in critically dry water years to 49,100 yd^3 in extremely wet water years (actual amounts would be determined by ongoing monitoring). The estimates assume that there would be no need for additional gravel placement as a result of Safety of Dam releases.

The following measures will be followed to reduce any potential impacts to ESA listed species due to the coarse sediment augmentation program:

- The FWS will coordinate with the NMFS regarding surveys for coho salmon presence prior to implementation of the project. The NMFS and the FWS will also coordinate work windows for these projects, as needed. Surveys for nesting owls and eagles will occur in suitable habitat within a 0.5 mile radius of a project site prior to beginning work activities utilizing motorized equipment or chain saws. If a nesting owl is detected within a 0.25 mile, scheduled work activities will not occur from February 1 through July 9; if a nesting eagle is detected within a 0.5 mile, scheduled work activities will not occur from January 1 through August 31.

- All mechanical equipment used shall be free of grease, oil, or other external petroleum products or lubricants. Equipment shall be thoroughly checked for leaks and any necessary repairs shall be completed prior to commencing work activities. Equipment with rubber tires will be used to place gravel inriver at all three sites.

Fish Population Management. Population management under this alternative would be the same as the No Action Alternative. Fishing would continue under current harvest plans approved by the Klamath Fishery Management Council and the Pacific Fishery Management Council. Fisheries that do not have comprehensive management plans would continue to be managed by the responsible agencies or tribes.

Infrastructure Modifications. Increasing releases from 6,000 to 11,000 cfs for restoration purposes will impact four bridges and inundate private properties downstream to a minimal extent in most cases to almost total inundation for a limited number of parcels. From Lewiston Dam to the confluence with Rush Creek (~5 river miles), releases of 11,000 cfs actually exceed the 100-year Federal Emergency Management Agency (FEMA) flood event of 8,500 cfs, which is based upon a 1976 Flood Study by the Army Corps of Engineers (USACE, 1976). Downstream of Rush Creek, 11,000 cfs would result in a river flow less than the 100-year event

as designated by FEMA. FEMA requires that any replacement bridge not increase the risk of damage to existing structures nor increase the Base Flood Elevation (most probable 100-year flood) more than one-foot.

Bridge Replacement

Four bridges in Trinity County (Salt Flat, Bucktail, Poker Bar, and "Treadwell" on Steelbridge Road) will be replaced in order to accommodate 11,000 cfs releases and associated tributary accretion in May. None of these bridges meets currently recommended design standards for water conveyance and debris clearance at the maximum prescribed flows, and the foundations of each appear to be inadequate to withstand the scouring action of the maximum prescribed flows.

The existing Salt Flat Bridge on Salt Flat Road, off of Goose Ranch Road west of Lewiston at river mile 107, is a privately owned structure serving 27 parcels. The bridge is a single lane, 270-foot-long structure, 10-foot-wide, four-span railway car bridge. The river channel at this site is split at low flow. The left arm is a side channel constructed by Reclamation for fish spawning and habitat purposes.

The existing bridge at Bucktail on Browns Mountain Road, located about .25 miles northeast of Lewiston Road at river mile 105, is a single span, 76-foot-long, 32 foot-wide, steel girder structure with pile-supported concrete abutments which is county owned, and services about 60 parcels. The replacement of Bucktail bridge includes significant local channel improvements to accommodate a bridge of acceptable capacity. The required channel improvements consist of removal and grading a portion of the right floodplain to accommodate the longer length required in a new bridge. The excavation will extend approximately 600-feet upstream and 150-feet downstream of the existing structure.

The existing bridge at Poker Bar on Bridge Road, is located 1.5 miles from State Highway 299, about halfway between the towns of Lewiston and Douglas City at river mile 102. The bridge consists of two privately owned, single-span, railway car structures crossing two main channels (left and right) of the Trinity River and serves 77 parcels. The structure over the right channel is 87-foot-long, 18-foot-wide, and constructed with twin side-by-side railway cars. The car beams are supported on four steel "H"-piles at each abutment. The existing structure over the left channel is 52-foot-long, 20-foot-wide and is also constructed with two side-by-side railroad cars supported on steel "H" piles at each abutment. A concrete retaining wall and two concrete filled, riveted steel caissons are present in front of each of the abutments.

The existing Treadwell bridge is located off Steelbridge Road about 3 miles upstream (east) of Douglas City. It is a privately owned, single-lane bridge and serves 9 parcels. The structure is a four-span, 201-foot-long, 12-foot wide, railway car bridge supported on concrete piers and abutments. Foundation type is unknown at both abutments and at each of the piers. The right

abutment is established in fill encroaching on the river flood plain. The left abutment is established in the bank along the left edge of the channel.

Pre-construction efforts will include procurement of design services, permitting, surveys, design and geotechnical investigations (USBR, 2000). The initial project (first year) will be to perform exploratory drilling at each of the anticipated bridge pier locations to determine depth to bedrock. Actual construction of bridges would occur in the second year. Total project time ranges from 17 to 28 months and depends on the construction window (the period of time equipment is allowed to work within the Trinity River wetted perimeter due to biological constraints). Given the time range of 17 to 28 months, projects that begin in summer 2001 (in pre-construction phase) would be completed by late 2002 to late 2003.

The following measures will be followed to reduce any potential impacts to ESA listed species:

- The FWS will coordinate with the NMFS regarding surveys for coho salmon presence prior to implementation of the project. The NMFS and the FWS will also coordinate work windows for these projects, as needed. Surveys for nesting owls and eagles will occur in suitable habitat within a 0.5 mile radius of a project site prior to beginning work activities utilizing motorized equipment or chain saws. If a nesting owl is detected within a 0.25 mile, scheduled work activities will not occur from February 1 through July 9; if a nesting eagle is detected within a 0.5 mile, scheduled work activities will not occur from January 1 through August 31.

- All mechanical equipment used shall be free of grease, oil, or other external petroleum products or lubricants. Equipment shall be thoroughly checked for leaks and any necessary repairs shall be completed prior to commencing work activities.

- No herbicides or pesticides shall be used.

- All possible measures will be taken to minimize any increased sedimentation/turbidity in the mainstem from mechanical disturbance, such as leaving a small berm at the edge of the channel to trap any sediments until all other work is completed. Turbidity and other Clean Water Act standards as identified by the Water Quality Control Plan for the North Coast Region, will be monitored and maintained. If standards are not met, construction activities will cease until such a time that operations or alternatives can be completed within compliance.

House/Property Relocations

Structures at risk include at least one home, a number of mobile homes and trailers, various outbuildings and portions of access roads. Other improvements such as campgrounds, satellite dishes, garden and animal enclosures, mining operations and water systems would also be affected (USBR, 2000). Inundated lands upstream of Rush Creek and outside of the designated FEMA 100-year floodplain would be purchased or otherwise flood proofed/mitigated. Lands downstream of Rush Creek within the FEMA 100-year floodplain will be mitigated on a case by case basis based on potential damages from implementing the proposed action. Impacted landowners will be contacted, and right-of-entry agreements negotiated to allow control surveys of structures. These activities do not require instream activities or mitigation for streambed disturbances.

The amount of time for home and structure relocation from initial identification and surveys to final actions is expected to be 18 months. Projects that begin in summer 2001 with structure identification and landowner contacts should be completed by summer 2002 to early 2003.

Operational Flexibility. As noted in Reclamation's memo of June 6, 2000, reinitiating consultation, Delta operations would be managed to avoid changes to the environmental baseline in the Delta (as indicated by the location of X2 in February through June (refer to Service, 1995). A process either concurrent with or in parallel to the CVPIA B2 Interagency Team would be used to evaluate potential changes to Delta conditions. Then, if necessary, management actions would be developed to maintain Delta conditions. Such a process would be established and implemented as early in the water year as possible to maximize operational flexibility and identify water management tools for all CVP environmental purposes. If impacts greater then those considered in this opinion are identified reinitiation of consultation would be required.

The biological assessment (Service, 2000) which addresses the effects of the Preferred Alternative on bald eagles and northern spotted owls outlines a number of minimization and avoidance measures that would be implemented. These action are summarized as follows:

- Surveys for nesting owls and eagles shall occur in suitable habitat within a 0.5 mile radius of a project site prior to beginning work activities utilizing motorized equipment or chain saws. If a nesting owl is detected within a 0.25 mile, scheduled work activities will not occur from February 1 through July 9; if a nesting eagle is detected within a 0.5 mile, scheduled work activities will not occur from January 1 through August 31.

- All mechanical equipment used shall be free of grease, oil, or other external petroleum products or lubricants. Equipment shall be thoroughly checked for leaks and any necessary repairs shall be completed prior to commencing work activities.

- No herbicides or pesticides shall be used.

- All possible measures shall be taken to minimize any increased sedimentation/turbidity in the mainstem from mechanical disturbance, such as leaving a small berm at the edge of the channel to trap sediments until all other work is completed.

- Turbidity and other Clean Water Act standards as identified by the Water Quality Control Plan for the North Coast Region, will be monitored and maintained. If standards are not met, construction activities will cease until such a time that operations or alternatives can be completed within compliance.

As described in the Biological Assessment, the following additional measure shall be followed to reduce any potential impacts to ESA listed species due to the coarse sediment augmentation program and dredging:

- All mechanical equipment used shall be free of grease, oil, or other external petroleum products or lubricants. Equipment shall be thoroughly checked for leaks and any necessary repairs shall be completed prior to commencing work activities. Equipment with rubber tires will be used to place gravel in-river at all three sites.

Status of the Species:

Delta smelt

The delta smelt was listed as a threatened species on March 5, 1993 (58 **FR** 12854). The final rule designating critical habitat for delta smelt was published December 19, 1994 (59 **FR** 65255). These final rules describe in detail the factors that have contributed to this species' decline. Please refer to final rules 58 **FR** 12854 and 59 FR 65255, the Final Recovery plan for the Sacramento/San Joaquin Delta Native Fishes (Service, 1995), and DWR and Reclamation (1994) for additional information on the biology and ecology of the delta smelt.

Species Description and Life History. The delta smelt is a slender-bodied fish with a steely blue sheen on the sides and seems almost translucent (Moyle 1976). The delta smelt, which has a lifespan of one year, has an average length of 60 to 70 mm (about 2 to 3 inches). It is an euryhaline species (tolerant of a wide salinity range) that spawns in fresh water and has been collected from estuarine waters up to 14 parts per thousand (ppt) salinity (Moyle *et al.* 1992). For a large part of its annual life span, this species is associated with the freshwater edge of the mixing zone (saltwater-freshwater interface, also called X2), where the salinity is approximately 2 ppt (Ganssle 1966, Moyle *et al.* 1992, Sweetnam and Stevens 1993).

The delta smelt is adapted to living in the highly productive San Francisco Bay/Delta Estuary (Estuary) where salinity varies spatially and temporally according to tidal cycles and the amount of freshwater inflow. Despite this tremendously variable environment, the historic Estuary probably offered relatively constant suitable habitat conditions for delta smelt, because they could move upstream or downstream with the mixing zone.

Shortly before spawning, adult delta smelt migrate upstream from the brackish-water habitat associated with the mixing zone in numerous river channels and tidally-influenced backwater sloughs (Radtke 1966, Moyle 1976, Wang 1991). Females with nearly mature eggs were taken at the Central Valley Project (CVP) Tracy Pumping Plant between late December 1990 and April 1991 (Wang 1991). Spawning locations vary widely from year to year (Department and Reclamation 1993). Sampling of larval delta smelt in the Delta suggests spawning has occurred in the Sacramento River; Barker, Lindsey, Cache, Georgiana, Prospect, Beaver, Hog, and Sycamore sloughs; in the San Joaquin River off Bradford Island including Fisherman's Cut; False River along the shore zone between Frank's and Webb tracts; and possibly other areas (Wang 1991). Delta smelt also may spawn north of Suisun Bay in Montezuma and Suisun sloughs and their tributaries.

Delta smelt spawn in shallow, fresh, or slightly brackish water upstream of the mixing zone (Wang 1991). Most spawning occurs in tidally-influenced backwater sloughs and channel edgewaters (Moyle 1976, Wang 1986, 1991, Moyle *et al.* 1992). Although delta smelt spawning behavior has not been observed in the wild (Moyle *et al.* 1992), the adhesive, demersal eggs are thought to attach to substrates such as cattails, tules, tree roots, and submerged branches (Moyle 1976, Wang 1991).

The spawning season varies from year to year and may occur from late winter (December) to early summer (July). Moyle (1976) collected gravid adults from December to April, although ripe delta smelt were most common in February and March. A recent study of delta smelt eggs and larvae (Wang and Brown 1994 as cited in Department and Reclamation 1994) confirmed that spawning occurs from February through June, with a peak in April and May. Spawning has been reported to occur at about 7° to 15° C. Results from a University of California at Davis (UCD) study (Swanson and Cech 1995) indicate that although delta smelt tolerate a wide range of temperatures (<8° C to >25° C), warmer water temperatures restrict their distribution more than colder water temperatures.

Laboratory observations indicate that delta smelt are broadcast spawners that spawn in a current, usually at night (Lindberg 1992 and Mager 1993 as cited in Department and Reclamation 1994). Eggs form an adhesive foot that appears to stick to most surfaces. In these laboratory studies, eggs attached singly to the substrate, with few eggs found on vertical plants and sides of a culture tank (Lindberg 1993 as cited in Department and Reclamation 1994).

Eggs hatched in 9 to 14 days at temperatures from 13° to 16° C during laboratory observations in 1992 (Mager 1992 as cited in Sweetnam and Stevens 1993). In this study, larvae began feeding on phytoplankton on day four, rotifers on day six, and *Artemia nauplii* at day 14. In laboratory studies, yolk-sac fry were found to be positively phototaxic, swimming to the lightest corner of the incubator, and negatively buoyant, actively swimming to the surface. Post-yolk-sac fry were more evenly distributed throughout the water column (Lindberg 1992 as cited in Department and Reclamation 1994). After hatching, larvae and juveniles move downstream toward the mixing zone where they are retained by the vertical circulation of fresh and salt waters (Stevens *et al.* 1990). Pelagic larvae and juveniles feed on zooplankton. When the mixing zone is located in Suisun Bay where there is extensive shallow-water habitat within the euphotic zone (depths less than four meters), high densities of phytoplankton and zooplankton may accumulate (Arthur and Ball 1978, 1979, 1980). Estuarine environments produce an abundance of fish and zooplankton as a result of plentiful food and shallow, productive habitat.

Delta smelt swimming behavior. Observations of delta smelt swimming in the swimming flume and in a large tank show that these fish are unsteady, intermittent, slow-speed swimmers (Swanson and Cech 1995). At low velocities in the swimming flume during spontaneous, unrestricted swimming in a 1-meter tank, delta smelt consistently swam with a "stroke and glide" behavior. This type of swimming is very efficient; Weihs (1974) predicted energy savings of about 50 percent for "stroke and glide" swimming compared to steady swimming. However, the maximum speed delta smelt are able to achieve using this preferred mode of swimming, or gait, is less than 3 body lengths per second, and the fish did not readily or spontaneously swim at this or higher speeds (Swanson and Cech 1995). Juvenile delta smelt proved stronger swimmers than adults. Forced swimming at these speeds in a swimming flume was apparently stressful; the fish were prone to swimming failure and extremely vulnerable to impingement. Unlike fish for which these types of measurements have been made in the past, delta smelt swimming performance was limited by behavioral rather than physiological or metabolic constraints *(e.g.,* metabolic scope for activity; Brett 1976).

Historic and Current Distribution. Delta smelt are endemic to Suisun Bay upstream of San Francisco Bay through the Delta in Contra Costa, Sacramento, San Joaquin, and Solano counties, California. Historically, the delta smelt is thought to have occurred from Suisun Bay upstream to at least the city of Sacramento on the Sacramento River and Mossdale on the San Joaquin River (Moyle *et al.* 1992, Sweetnam and Stevens 1993). Delta smelt have been detected as far upstream as Verona on the mainstem Sacramento River. These fish were detected in the Service's beach seine survey in October of 1994.

Sacramento splittail

The final rule to list the Sacramento splittail was published on February 8, 1999 (64 **FR** 5963). For further information on the splittail refer to the final rule.

Species Description and Life History. Splittail were first described in 1854 by W.O. Ayres as *Leuciscus macrolepidotus* and by S.F. Baird and C. Girard as *Pogonichthys inaeqilobus*. Although Ayres' species description is accepted, the species was assigned to the genus Pogonichthys in recognition of the distinctive characteristics exhibited by the two California splittail species *P. ciscoides* and *P. macrolepidotus* (Hopkirk 1973). *Pogonichthys ciscoides*, endemic to Clear Lake, Lake County, California, has been extinct since the early 1970s. The splittail represents the only extant species in its genus in California.

The name splittail refers to the distinctive tail of the fish. Pogon-ichthys means bearded fish, referring to the small barbels on the mouth of the fish, unusual in North American cyprinids. Macro-lepidotus means large-scaled. The splittail is a large cyprinid fish that can exceed 40 centimeters (16 inches) in length (Moyle 1976). Adults are characterized by an elongated body, distinct nuchal hump, and small, blunt head, usually with barbels at the corners of the slightly subterminal mouth. The enlarged dorsal lobe of the caudal fin distinguishes the splittail from other minnows in the Central Valley of California. Splittail are dull, silvery-gold on the sides and olive-gray dorsally. During spawning season, pectoral, pelvic, and caudal fins are tinged with an orange-red color. Males develop small white nuptial tubercles on the head. Breeding tubercles also appear on the base of the fins (Moyle in prep).

In recent times, dams and diversions have increasingly prevented splittail from upstream access to the large rivers, and the species is now restricted to a small portion of its former range (Moyle and Yoshiyama 1992). However, during wet years, they migrate up the Sacramento River as far as the Red Bluff diversion dam in Tehama County, and into the lowermost reaches of the Feather and American Rivers (Moyle in prep, Jones and Stokes 1993, Charles Hanson, State Water Contractors, *in litt.* 1993). Small numbers of splittail have recently been found in the upper Sacramento and San Joaquin rivers and their tributaries (Baxter 1994). Recent surveys of San Joaquin Valley streams found splittail in the San Joaquin River below its confluence with the Merced River, mainly following wet winters (Moyle in prep). Splittail have also been recorded using the Sutter and Yolo Bypasses for spawning areas during wet winters (Sommer *et al.* 1997). Successful spawning has been recorded in the lower Tuolumne River during wet years in the 1980s, as well as in 1995. Both adults and juveniles were observed at Modesto, 11 km upriver from the mouth of the river (Moyle in prep). However, all of the sightings reported above were during wet years when splittail were able to exploit more spawning habitat. Except for very wet years, the species is for the most part now confined to the Delta, Suisun Bay, Suisun Marsh, and Napa Marsh. In the Delta, they are most abundant in the north and west portions when populations are low, but are more evenly distributed throughout the Delta following years of successful reproduction (Sommer *et al.* 1997).

Splittail are relatively long-lived, frequently reaching 5 to 7 years of age. An analysis of hard parts of the splittail indicate that larger fish may be 8 to 10 years old (Moyle in prep). Females are highly fecund, with the largest females producing over 250,000 eggs (Daniels and Moyle 1983). Populations fluctuate annually depending on spawning success, which is highly

correlated with freshwater outflow and the availability of shallow-water habitat with submerged vegetation (Daniels and Moyle 1983). Fish usually reach sexual maturity by the end of their second year. The onset of spawning is associated with rising water levels, increasing water temperatures, and increasing day length. Peak spawning occurs from the months of March through May, although records of spawning exist for late January to early July (Wang 1986). In some years, most spawning may take place within a limited period of time. For instance, in 1995, a year of extraordinarily successful spawning, most splittail spawned over a short period in April, even though larval splittail were captured from February through early July (Moyle in prep). Within each spawning season older fish reproduce first, followed by younger individuals (Caywood 1974). Spawning occurs over flooded vegetation in tidal freshwater and euryhaline habitats of estuarine marshes and sloughs and slow-moving reaches of large rivers. Larvae remain in shallow, weedy areas close to spawning sites for 10 to 14 days and move into deeper water as they mature and swimming ability increases (Wang 1986 and Sommer *et al.* 1997).

Splittail are benthic foragers. In Suisun Marsh, they feed primarily on opossum shrimp (*Neomysis mercedis*, and presumably, the exotic *Acanthomysis* spp. as well), benthic amphipods (*Corophium*), and harpactacoid copepods, although detrital material makes up a large percentage of their stomach contents (Daniels and Moyle 1983). In the Delta, clams, crustaceans, insect larvae, and other invertebrates also are found in the diet. Predators include striped bass (*Morone saxatilis*) and other piscivores (Moyle 1976).

In recent years, splittail have been found most often in slow moving sections of rivers and sloughs and dead-end sloughs (Moyle *et al.* 1992, Daniels and Moyle 1983). Reports from the 1950's, however, mention Sacramento River spawning migrations and catches of splittail during fast tides in Suisun Bay (Caywood 1974). Because they require flooded vegetation for spawning and rearing, splittail are frequently found in areas subject to flooding. Historically, the major flood basins distributed throughout the Sacramento and San Joaquin valleys provided spawning and rearing habitat. These flood basins have all been reclaimed or modified for flood control purposes (e.g., Yolo and Sutter bypasses). Although primarily a freshwater species, splittail can tolerate salinities as high as 10 to 18 parts ppt (Moyle 1976, Moyle and Yoshiyama 1992). The Department's survey data from 1979 through 1994 indicate that the highest abundances occurred in shallow areas of Suisun and Grizzly bays.

Recent research indicates that splittail will use the Yolo and Sutter bypasses during the winter and spring months for foraging and spawning (Sommer *et al.* 1997). However, the Yolo bypass may only be used by splittail during wet winters, when water from Sacramento River over-tops the Fremont Weir and spills over the Sacramento Weir into the bypass. In 1998, the Yolo and Sutter bypasses provided good habitat for fish, particularly splittail, when they were flooded for several weeks in March and April. In order to provide spawning habitat for splittail, water must remain on the bypasses until fish have completed spawning, and larvae are able to swim out on their own, during the draining process.

Historical and Current Distribution. Splittail are endemic to California's Central Valley, where they were once widely distributed (Moyle 1976). Historically, splittail were found as far north as Redding on the Sacramento River (at the Battle Creek Fish Hatchery in Shasta County), as far south as the present-day site of Friant Dam on the San Joaquin River, and up the tributaries of the Sacramento River as far as the current Oroville Dam site on the Feather River and Folsom Dam site on the American River (Rutter 1908). Recreational anglers in Sacramento reported catches of 50 or more splittail per day prior to the damming of these rivers (Caywood 1974). Splittail were captured in the past in southern San Francisco Bay and at the mouth of Coyote Creek in Santa Clara County, but they are no longer present there (Moyle in prep). The species was part of the Central Valley Native American diet (Caywood 1974).

Evironmental Baseline

The environmental baseline used in this analysis includes past and ongoing impacts of all Federal, State, Tribal, and private actions and other human activities in the vicinity of the project that have impacted, or are impacting the listed species. The action area of the proposed project is generally all Central Valley streams, the Sacramento/San Joaquin Delta, and the Trinity River Basin.

Delta smelt

The March 6, 1995, and the February 12, 1993, (delta smelt and winter-run, respectively) biological opinions on the effects of long-term operation of the CVP and the SWP coupled with the October 13, 1981, Corps export pumping guidance, and the November 2, 1994, biological opinion on the Environmental Protection Agency's proposed Water Quality Standards for the San Francisco Bay/Sacramento-San Joaquin Rivers and Delta have, in conjunction with the 1995 Water Quality Control Plan and a statutory mandate pursuant to Section 3406(b)2 of the CVP Improvement Act to manage 800 TAF of water for fish and wildlife purposes, established the current environmental baseline for delta smelt and splittail. Part of this environmental baseline requires Delta outflows between February 1 to June 30 to transport larval and juvenile delta smelt out of the "zone of influence" of the CVP and SWP export pumps and maintain the location of X2 at or downstream of three distinct points: the confluence of the Sacramento and San Joaquin rivers, Chipps Island, and Roe Island. The length of time X2 must be positioned at these set locations in each month is determined by a formula that considers the previous month's inflow to the Delta and a "Level of Development" factor, denoted by a particular year.

Compliance with the salinity criteria at Roe and Chipps islands can be achieved in any one of the following three ways: (1) the daily salinity value meets the requirement, (2) the system is operated on that day so as to meet the "flow equivalent," or (3) by using a 14-day moving average. The use of the 14-day moving average allows the mean location to be achieved despite the varying strength of tidal currents during the lunar cycle because any 14 day period would

include the full range of spring and neap tidal conditions. Meeting the confluence standard can be achieved by meeting either implementation scheme 1 or 3 above.

Delta modeling conducted by a variety of individuals and agencies for the March 6, 1995, biological opinion analyzed approximately 73 years of hydrologic data from the Sacramento/San Joaquin rivers and Delta. The analysis showed the average position of X2 would be either downstream of the targeted compliance point or would meet the compliance point through an increase in the number of days, over and above the minimum required, in many of the years. This compliance point has been maintained mainly because the export facilities have not had the ability to capture all of the unimpaired run-off and, thus, have been well below the Export-Inflow Ratio providing better environmental conditions than the minimum required by existing regulations. Therefore, the Service was able to provide the CVP and SWP with a non-jeopardy biological opinion on the long-term operation of their projects. Additionally, the Service anticipated that the estuarine conditions for delta smelt would be improved by (1) the signing of the Framework Agreement leading to the Bay-Delta Accord that would require the CVP and SWP to make an equitable contribution to meet the revised water quality standards, (2) the obligation of Federal agencies carrying out programs for the conservation (recovery) of listed species as imposed by section 7 of the Act, and (3) the scheduled renewal or reopening of water contracts and licenses that would provide an additional opportunity to implement Recovery Plan objectives. Collectively, these actions would result in phased improvement to water quality-based habitat requirements.

Due to subsequent wet years, the regulatory requirements have been met every year since 1995. The CVP/SWP were able to meet the compliance point for X2. The CVP/SWP, because of favorable hydrologic conditions, did not need to manage the system to the E/I ratio all of the time. If these beneficial environmental parameters are maintained over time, it is likely that the species would be heading toward recovery. However, these benefits are offset by new projects that are being proposed which are described later. Therefore, rather than improving the environmental baseline with these good water years, it has simply been maintained. Table 2 identifies the number of required days X2 was to be at specific compliance locations and the actual number of days X2 was at or downstream of the required location. These data are based on preliminary data provided by the California Department of Water Resources, Operations Division. This analysis is consistent with how the Service evaluated the original project for which it issued the March 6, 1995 biological opinion (Service, 1995).

TABLE 2

Number of days X2 was required at specific compliance stations and the actual number of days achieved shown by year

Year	Location	# of required days Starting Feb. 1	# of actual days at*** or downstream
1995			
	Confluence	150	Essentially all year
	Chips Is.	150	Essentially all year
	Roe Is.	130	138
1996			
	Confluence	150	249
	Chips Is.	150	161
	Roe Is.	65	126
1997			
	Confluence	150	225
	Chips Is.	110	124
	Roe Is.	49	52
1998			
	Confluence	150	Essentially all year
	Chips Is.	150	262
	Roe Is.	115	167
1999			
	Confluence	150	203
	Chips Is.	143	159
	Roe Is.	51	73
2000			
	Confluence	150	100**
	Chips Is.	150*	100**
	Roe Is.	57*	60**

* Estimated for 2000
** As of May 10, 2000
*** These are estimated days based on electrical conductivity at Port Chicago, Mallard Slough, and Collinsville

Adult delta smelt spawn in central Delta sloughs from February through August in shallow water areas having submersed aquatic plants and other suitable substrates and refugia. These shallow water areas have been identified in the Delta Native Fishes Recovery Plan (Recovery Plan) (Service 1995) as essential to the long-term survival and recovery of delta smelt and other resident fish. A "no net loss" strategy of delta smelt population and habitat is proposed in this Recovery Plan.

Delta smelt are adapted to living in the highly productive Estuary where salinity varies spatially and temporally according to tidal cycles and the amount of freshwater inflow. Despite this tremendously variable environment, the historical Estuary probably offered relatively consistent spring transport flows that moved delta smelt juveniles and larvae downstream to the mixing zone. Since the 1850s, however, the amount and extent of suitable habitat for the delta smelt has declined dramatically. The advent in 1853 of hydraulic mining in the Sacramento and San Joaquin rivers led to increased siltation and alteration of the circulation patterns of the Estuary (Nichols *et al.* 1986, Monroe and Kelly 1992). The reclamation of Merritt Island for agricultural purposes, in the same year, marked the beginning of the present-day cumulative loss of 94 percent of the Estuary's tidal marshes (Nichols *et al.* 1986, Monroe and Kelly 1992).

In addition to the degradation and loss of estuarine habitat, the delta smelt have been increasingly subject to entrainment, upstream or reverse flows of waters in the Delta and San Joaquin River, and constriction of low salinity habitat to deep-water river channels of the interior Delta (Moyle *et al.* 1992). These adverse conditions are primarily a result of drought and the steadily increasing proportion of river flow being diverted from the Delta by the CVP and SWP (Monroe and Kelly 1992). There is a correlation between the proportion of delta smelt that reside in Suisun Bay and overall abundance. This relationship indicates that the summer townet index increased dramatically when outflow was between 34,000 and 48,000 cfs which placed X2 between Chipps and Roe islands. Placement of X2 downstream of the Confluence, Chipps and Roe islands provides delta smelt with low salinity and protection from entrainment, allowing for productive rearing habitat that increases both smelt abundance and distribution.

The results of seven surveys conducted by the Interagency Ecological Program (IEP) corroborate the dramatic decline in delta smelt attributable to baseline conditions. Existing operations were meant to provide sufficient Delta outflows from February 1 through June 30 to transport larval and juvenile delta smelt out of the "zone of influence" of the CVP and SWP pumps, and provide them low salinity, productive rearing habitat. This zone of influence has been delineated by Water Resources's Particle Tracking Model and expands or contracts with CVP and SWP combined pumping increases or decreases, respectively (Department and Reclamation 1993). Tidal action may enhance the hydraulic effects of exports which in turn may effect larvae and juveniles as far west as the Confluence.

According to seven abundance indices which provide information on the status of the delta smelt, this species was consistently at low population levels through the 1980s (Stevens *et al.* 1990). These same indices also showed a pronounced decline from historical levels of abundance (Stevens *et al.* 1990).

Specifically, the summer townet abundance index constitutes one of the more representative indices because the data have been collected over a wide geographic area (from San Pablo Bay upstream through most of the Delta) for the longest period of time (since 1959). The summer townet abundance index measures the abundance and distribution of juvenile delta smelt and

provides data on the recruitment potential of the species. Since 1983, (except for 1986, 1993, and 1994), this index has remained at consistently lower levels than previously found. These consistently lower levels correlate with the 1983 to 1992 mean location of X2 upstream of the Confluence, Chipps and Roe islands.

The second longest running survey (since 1967), the fall midwater trawl survey (FMWT), measures the abundance and distribution of late juveniles and adult delta smelt in a large geographic area from San Pablo Bay upstream to Rio Vista on the Sacramento River and Stockton on the San Joaquin River (Stevens *et al.* 1990). The fall midwater trawl indicates the abundance of the adult population just prior to upstream spawning migration. The index that is calculated from the FMWT survey uses numbers of sampled fish multiplied by a factor related to the volume of the area sampled. Until recently, except for 1991, this index has declined irregularly over the past 20 years (CDFG unpublished data, 1999). Since 1983, the delta smelt population has exhibited more low fall midwater trawl abundance indices, for more consecutive years, than previously recorded. The 1994 FMWT index of 101.7 was a continuation of this trend. This occurred despite the high 1994 summer townet index for reasons unknown. The 1995 summer townet was a low index value of 319 but resulted in a high FMWT index of 898.7 reflecting the benefits of large transport and habitat maintenance flows due to an extremely wet year.

The FMWT abundance index (128.3) for 1996 represented the fourth lowest on record. For 1997, the abundance index (360.8) almost tripled over last years results. In 1998, the summer townet index was 3.3 and the fall index was 417.6, which was up slightly from the 1997 index. Recovery criteria, including both abundance and distribution criteria based on numbers derived from the FMWT, have not been met to date. This limited data indicates that delta smelt may not be moving toward recovery.

The Service issued a non-jeopardy biological opinion (1-1-95-F-110) for the Delta Wetlands Project after significant negotiations and changes to the proposed project description. The original project description significantly degraded the estuarine conditions by adversely affecting Delta hydrology and causing incremental up-stream shifts of X2. The Delta Wetlands Project, as modified, includes conditions to minimize up-stream shifts of X2 and adverse effects to Delta hydrology within the action area. The Service issued a draft jeopardy biological opinion for the Interim South Delta Program as the original project significantly degraded the estuarine conditions by adversely affecting Delta hydrology and causing incremental up-stream shifts of X2. The Service has also issued a biological opinion for the issuance of a water contract to the County of Sacramento for 35,000 acre feet of water to be diverted from the American River. The opinion for Sacramento County evaluated a phased approach to delivery of new water with very small increments of water to be delivered for the first few years and that the larger amount would be fully evaluated in the context of a broader section 7 consultation when OCAP is reinitiated at the long-term contract renewal phase of CVPIA. Additionally, the Service just completed a consultation with Reclamation concerning additional supplies to Contra Costa Water District

(CCWD) under their existing contracts consistent with CCWD's Future Water Supply Program. The outcome of this opinion specifically states that additional supplies over and above those which were authorized in the original biological opinions for the Los Vaqueros Project would not be authorized until a new biological opinion on OCAP was completed or Reclamation reinitiated consultation.

Regarding the operation of the existing consultation for the Los Vaqueros Project, during May and June of 1999, over 100,000 delta smelt were incidentally taken at the State and Federal export facilities. However, none were found to have entered CCWD's intake at Old River during this same period. Pursuant to the operations plan in the Los Vaqueros biological opinion, there were no diversions during two weeks of the period in question; however, when diversions resumed, no smelt were found to pass through the screen in the monitoring program.

Delta smelt remained in the Delta for an extended period of time during the spring of 1999. It was hypothesized that it was a result of cooler water temperatures. The final summer townet index for 1999 was 11.9, an increase from the 1998 index of 3.3. However, this is still below the pre-decline average of 20.4 (1959-1981, no sampling 66-68). The FMWT index for 1999 is 864 which is a moderate level.

Other projects, which have not under gone section 7 consultation, have been proposed and include East Bay Municipal Utility District amended contract renewal, development of a long-term contract with El Dorado County Water Agency, numerous Warren Act contracts, funding or facilitation of infrastructure improvements that will allow for additional withdrawals from CVP supplies with CVP facilities, or through other mechanisms. These projects likely would result in a deterioration of the environmental baseline, causing X2 to incrementally move up-stream if these projects proceed as proposed. Degradation of the environmental baseline may significantly affect recovery and survival of delta smelt

Sacramento splittail

The decline in splittail abundance has taken place during a period of increased human-induced changes to the seasonal hydrology of the Delta, especially the increased exports of freshwater from the Delta and increased diversions of water to storage. These changes include alterations in the temporal, spatial, and relative ratios of water diverted from the system. These hydrological effects, coupled with severe drought years, introduced, non-native aquatic species, the loss of shallow-water habitat to reclamation activities, and other human-caused actions, have reduced the splittail's capacity to recover from natural seasonal fluctuations in hydrology for which it was adapted.

Analyses of survey data collected from 1967 to 1993 (Meng 1993, Meng and Moyle 1995), further analyses by the Service using data from 1967 through 1997 (Service, 1999), CDFG,

University of California at Davis, and biologists from several different studies reveals the following trends:

1. Overall, splittail abundance indices have declined. Meng and Moyle (1995) demonstrated that on average, splittail have declined in abundance by 60 percent through 1993. These data were updated by the CDFG to include the most current data available. The Service conducted the statistical analysis using the updated information. The results were similar. These updated data demonstrate that on average, splittail have declined significantly in abundance by 50 percent since 1984. The greatest declines (over 80 percent) were found from studies that sampled the shallow Suisun Bay area, the center of the range of the species (Meng and Moyle 1995). The updated information also shows a significant decline (43 percent) for the studies that sampled the shallow Suisun Bay area. The Bay study that began in 1980 in the lower Estuary, at the outermost edge of splittail range, showed the least percent decline (20 percent) (CDFG, unpublished data) through 1993. The Bay study analysis completed on the updated data also showed the smallest decline for study (6 percent). The number of splittail young taken at State and Federal pumping facilities (per acre-foot of water pumped), as of 1993, had declined 64 percent since 1984. With the updated data, the number of splittail young taken at State and Federal pumping facilities demonstrated a 97 percent increase. This percent increase is due to the unusually high salvage that occurred during 1995.

   Splittail populations are estimated to be 35 to 60 percent of what they were in the 1940s, and these estimates may be conservative (Moyle in prep). Department midwater trawl data indicate a decline from the mid-1960s to the late 1970s, followed by a resurgence, with yearly fluctuations, through the mid-1980s. From the mid-1980s through 1994, splittail numbers have declined in the Delta, with some small increases in various years. This decline is also demonstrated in the updated Department data.

2. Overall splittail abundances vary widely between years. Sommer *et al.* 1997 also found that splittail recruitment success fluctuates widely from year to year and over long periods of time. During dry years abundance is typically low. During the dry years of 1980, 1984, 1987, and 1988 through 1992, splittail abundance indices for young-of-the-year were low, indicating poor spawning success. Additionally, all year class abundances were low during these years. In 1994, the fourth driest year on record, all splittail indices were extremely low.

   Wet years are assumed to provide essential habitat for splittail and allow populations to rebound from dry years. Successful reproduction in splittail is often highly correlated with wet years. Large pulses of young fish were observed

in wet years 1982, 1983, 1986, and 1995. In 1995, one of the wettest years in recent history, an increase in all indices was recorded, as in 1986, which was another wet year following a dry year. However, young of the year taken per unit effort (for example, either the number of fish per net that is towed or the number of fish per volume of water sampled) has actually declined in wet years, from a high of 12.3 in 1978 to 0.3 in 1993. The updated data from CDFG demonstrate this same decline in wet years, from 37.3 in 1978 to 0.6 in 1993. The abundance indices of splittail during the years of 1995, 1996, and 1997 were 44.5, 2.1, and 2.6, respectively. In 1995, a very wet year, splittail abundances were high. However in 1996 and 1997, both wet years, abundance indices were low. A large splittail year class was produced in 1998, a wet year. However, overall splittail declines remain high (82 percent/43 percent with updated data) in the shallow-water Suisun Bay area, the center of its distribution.

3. A strong relationship exists between young-of-the-year abundance and outflow (i.e., river outflow into San Francisco Bay after water exports are removed). As outflow increases, annual abundance of young-of-the-year splittail increases. Changes in outflow account for 55 to 72 percent of the changes seen in young-of-the-year splittail abundance, depending on which survey data are analyzed.

4. Splittail are most abundant in shallow areas of Suisun and Grizzly bays where they generally prefer low-salinity habitats. Salinities in Suisun and Grizzly bays increase when, as a result of water exports or drought conditions, the mixing zone (the freshwater-saltwater interface) shifts upstream.

5. Concentration of splittail in shallow areas suggests that they are particularly vulnerable to reclamation activities, such as dredging, diking, and filling of wetlands. The above data indicate that splittail abundances vary widely in response to environmental conditions, but the general population numbers are declining.

Changes in water diversions are most likely at the SWP. For the most part, the Federal pumping plant has operated at capacity for many years (pumping at rates up to 4,600 cfs), so increased exports at this plant are unlikely. However, the SWP pumping plant and the State Aqueduct have considerable unused capacity. The SWP currently pumps at rates up to 6,400 cfs and plans to increase pumping rates by more than 50 percent. Local private water diversions are relatively stable and export up to 5,000 cfs from about 1,800 diversions scattered throughout the Delta. The DWR (1992) reported past and projected SWP deliveries from Delta sources during the years of 1962 to 2035. In the 1980s, deliveries ranged from 1.5 million acre-feet to 2.8 million acre-feet. By 2010, deliveries of up to 4.2 million acre-feet are planned.

If the exceedingly high take (millions of fish) at the export facilities that occurred in 1995 continues to occur in other wet years, the species may be precluded from recovery. In a good year such as 1995, splittail spawn in prolific numbers. These good years are needed to maintain the population of splittail in the Delta. However, the high take that occurs during these years, offsets the benefits that a strong year class may provide.

Those projects discussed in the Delta Smelt Environmental Baseline section have also under gone section 7 consultation for their effects to splittail. Additional future deliveries made south of the Delta through SWP or CVP facilities, additional supplies provided to contractors or new water supply contracts that effect carryover storage in reservoirs, facilities that are developed to divert additional instream flows, or other water development projects that result in losses of instream flows, greater entrainment of splittail, or reduce the areal extent of flood plain inundation for splittail spawning will degrade the environmental baseline for splittail such an extent that it may preclude recovery for the splittail.

Effects of the Proposed Action

General

The proposed action is the implementation of the Trinity River Restoration Program which affects operation of the CVP and SWP. A detailed description of facilities and historic and proposed operations of CVP and SWP are described in DWR and Reclamation (1994) and in the March 6, 1995 biological opinion (Service, 1995). The proposed operations have been further modified by the objectives outlined in the Principles for Agreement and the SWRCB draft WQCP with exceptions noted in the following section. The proposed operations also include those actions that implement management decisions agreed upon in the August 2, 1994, Framework Agreement (Fourteen-Agency 1994). Additional information on CVP and SWP facilities and operations can be found in Reclamation (1992), DWR and Reclamation (1993), NMFS (1993), and Service (1993b).

The DEIS/EIR states that the Preferred Alternative would, compared to the No Action Alternative, operate the Trinity River Division (TRD) to release more Trinity Reservoir water to the Trinity River for fishery restoration. The pattern of exports to the Central Valley would be shifted to later in the summer in order to maintain reservoir storage to help meet Trinity River instream temperature requirements for threatened coho, and chinook and steelhead salmon. (The movement of exports through Lewiston Reservoir helps minimize warming in the reservoir and the resultant release temperatures into the Trinity River). Compared to the No Action Alternative, the Preferred Alternative generally has a larger spring peak releases. Peak Trinity River flows during extremely wet years would increase from 2,000 to 11,000 cfs (a 5-fold increase); during critically dry years, releases would be reduced from 2,000 to 1,500 cfs (a reduction of 25 percent). The long-term average annual instream release would increase by 240,000 af (75 percent) compared to the No Action Alternative.

Compared to the No Action Alternative, the Preferred Alternative would reduce long-term average annual exports from the TRD to the Sacramento Basin by about 240,000 af (28 percent). Dry-period annual exports would be reduced by 160,000 af (30 percent). Under the Preferred Alternative, the prescribed minimum storage in Trinity Reservoir would be 600,000 af. Dry-period storage would average 5 percent more than No Action, reflecting the greater carryover storage level. In spite of this increase in required minimum carryover storage, average end-of-water-year carryover storage would decrease by 50,000 af (4 percent). Whiskeytown Reservoir water levels would be generally unaffected, including during the dry period.

Shasta Reservoir storage would be only slightly impacted due to reduced TRD exports in the long-term average, while dry period effects would be more substantial. In the Preferred Alternative, long-term average end-of-water-year storage is only slightly less than the No Action Alternative (60,000 af decrease, or 2 percent), while dry-period levels drop 130,000 af (8 percent). The Biological Opinion issued by NMFS for winter-run chinook salmon prescribed an end-of-water year minimum storage criterion of 1.9 million acre feet (maf). The minimum carry over criterion is met with the same frequency under the Preferred Alternative as under No Action (12 percent for both alternatives).

Long-term average annual CVP deliveries decrease by 90,000 af (2 percent) compared to No Action. Reductions during the dry period average 160,000 af (4 percent). Annual Delta exports through the Tracy Pumping Plant are reduced by 60,000 af (2 percent) over the entire long-term period and 90,000 af (4 percent) during the dry period. Annual Delta inflow would decrease by 220,000 af (1 percent) over the long-term period and 90,000 af (1 percent) during the dry period. Average annual Delta outflow would decrease by 150,000 af (1 percent) over the long-term period, but would be similar to No Action for the dry period.

Delta Smelt and Sacramento Splittail

The DEIS/EIR and associated appendices identify that, because of these changes in the diversion pattern from the TRD to the Sacramento River, there will be effects of implementing the Preferred Alternative for Delta native fishes. The DEIS/EIR evaluated several alternatives, including existing conditions, no action, cumulative conditions and several project alternatives. All of the project alternatives that were evaluated include all the assumptions of the no action alternative at the 2020 build out. It is important to note some of the assumptions for these alternatives to put the effects of the Preferred Alternative in proper context. First, the existing conditions alternative is essentially the existing conditions alternative in the CVPIA Programmatic Environmental Impact Statement (PEIS). This alternative evaluates conditions with 1995 level of development in place with existing environmental requirements and delivery capability. Second, the no action alternative is essentially the no action alternative in the CVPIA PEIS and evaluates the conditions as they might be at the 2020 level of development. The no action alternative assumes an additional 400 TAF of delivery within the SWP, mainly south of the Delta and 300 TAF of additional water delivery within the CVP mainly to urban interests

north of the Delta (personal communication Tull, 2000). The project alternatives superimpose the effects of their actions on the no action alternative. The cumulative conditions analysis is a reflection of the implementation of other State, Federal, and local actions that are reasonably foreseeable. These include the implementation of the rest of the CVPIA other than the Trinity River decision at hand. This was done to isolate the effects of the Trinity River Decision from the remainder of the CVPIA, which was dealt with in the CVPIA PEIS. In order to segregate the incremental effect of the Preferred Alternative against the no action alternative the effects discussion that occurs below, is based in part on the model results, and assumes that the effects of the no action above existing conditions have been subtracted from the Preferred Alternative. This portrays the effect of the Preferred Alternative as if it were implemented against the existing condition.

In the Central Valley, the allowable ratio of Delta inflows to exports, agreed upon in the Delta Accord, were not exceeded for any year simulated. However, during June, and to a lesser degree, April and May, Delta reductions in outflows were greater than 10 percent for up to 9 percent of the years simulated (Table 3). Those reductions in Delta outflows may be significant and may adversely affect habitat for Delta species. As is noted in Table 3, the 9 percent of the years where June had a reduction of outflow of 10 percent or more equates to 6 years out of the 68 years modeled. These reductions in outflow translate into 4 years in a shift upstream in X2 of 1 kilometer (km) or more with a maximum shift of 1.5 km. Another 12 years (approximately 18 percent) had detectable

TABLE 3

Percent of Years with Delta Outflows at Least 10 Percent Less than the Baseline Compared to No Action

Month	Maximum Flow	Preferred Alternative	Percent Inflow	State Permit
February	4	0	1	0
March	1	0	0	0
April	1	1	0	0
May	4	1	3	0
June	9	9	3	0

reductions in outflow which translated into upstream shifts in X2 although 5 of those years were within the error of the model (+ or - 3%). All of these June impacts occurred in either wet or above normal years as defined under the 40-30-30 water year classification.

Further evaluation of the remaining months of the Preferred Alternative indicates that of the 68 years modeled:

- 32 Februarys resulted in reductions in outflow that translated into upstream movement of X2. The maximum movement of X2 for February was 1km and that occurred in 2 years. Approximately 9 (13 percent) of the detectable X2 movements were outside the error of the model.

- 28 Marches resulted in reductions in outflow that translated into upstream movement of X2. The maximum movement of X2 for March was 0.6km and that occurred in 1 year. Approximately 3 (4 percent) of the detectable X2 movements were outside the error of the model.

- 16 Aprils resulted in reductions in outflow that translated into upstream movement of X2. The maximum movement of X2 for April was 1.6km and that occurred in 1 year. Approximately 2 (3 percent) of the detectable X2 movements were outside the error of the model.

- 24 Mays resulted in reductions in outflow that translated into upstream movement of X2. The maximum movement of X2 for May was 1km and that occurred in 2 years. Approximately 6 (9 percent) of the detectable X2 movements were outside the error of the model.

The analysis indicates that at no time did the situation arise where a particular standard such as Chipps Island or Roe Island would not have been met as a result of the Preferred Alternative that otherwise would have been.

Reclamation and the Service in the Biological Assessment, and confirmed in the discussion above, have concluded that adverse effects to delta smelt and Sacramento splittail will occur as a result of implementation of the Preferred Alternative. However, as is stated in the request for reinitiation of section 7 consultation by Reclamation, CVP operations in the Delta would continue to be managed to avoid or minimize the changes to environmental conditions in the Delta. Reclamation has proposed that a team similar to the CVPIA B2 Interagency Team be used to evaluate and recommend changes in operations should adverse impacts be identified. Therefore, based on these commitments, the Service has concluded that the effects to delta smelt and Sacramento splittail will not be jeopardized by implementing the Preferred Alternative. Additionally, the Service has concluded that there will not be an adverse modification or destruction of critical habitat for the delta smelt.

CUMULATIVE EFFECTS

Cumulative effects include the effects of future State, Tribal, local, or private actions affecting listed species and their critical habitat that are reasonably certain to occur in the area considered in this biological opinion. Future Federal actions not related to this proposed action are not considered in determining the cumulative effects, but are subject to separate consultation requirements pursuant to section 7 of the Act.

Delta Smelt and Sacramento Splittail. Cumulative effects on the delta smelt, splittail, or delta smelt designated critical habitat include any continuing or future non-Federal diversions of water that may entrain adult or larval fish or that may decrease outflows incrementally, thus shifting the position of the delta smelt's preferred habitat upstream. Water diversions through intakes serving numerous small, private agricultural lands and duck clubs in the Delta, upstream of the Delta, and in Suisun Bay contribute to these cumulative effects. These diversions also include municipal and industrial uses, as well as providing water for power plants.

Additional cumulative effects result from the impacts of point and non-point source chemical contaminant discharges. These contaminants include selenium and numerous pesticides and herbicides associated with discharges related to agricultural and urban activities. Implicated as potential sources of mortality for delta smelt and splittail, these contaminants may adversely affect delta smelt and splittail reproductive success and survival rates. Spawning habitat may also be affected if submersed aquatic plants used as substrates for adhesive egg attachment are lost due to toxic substances. State or local levee maintenance may also destroy or adversely modify critical habitat by disturbing spawning or rearing habitat and resuspending contaminants into the water.

The introduction of exotic species may occur when levees are breached or when separate creeks or river systems are reconnected during various projects. Several exotic species may adversely affect the delta smelt and splittail, including the Asian clam (*Potamocorbula amurensis*) and three non-native species of euryhaline copepods. The Asian clam could potentially play an important role in affecting the phytoplankton dynamics. The exotic copepods may displace native species and at least one species of copepods (*Sinocalanus doerri*) is difficult for larval fishes to catch because of its fast swimming and effective escape response. Reduced feeding efficiency and ingestion rates weaken and slow the growth of young and make them more vulnerable to starvation and predation.

Other cumulative effects include: wave action in water channels caused by boats may degrade riparian and wetland habitat and erode banks; the dumping of domestic and industrial garbage may present hazards to the fish because they could become trapped in the debris, injure themselves, or ingest the debris; golf courses may reduce habitat and introduce pesticides and herbicides into the environment; oil and gas development and production remove habitat and may introduce pollutants into the delta; agricultural uses on levees may reduce riparian and

wetland habitats; residential or agricultural land use can fragment and reduce wildlife habitat and corridors; unscreened agricultural diversions throughout the delta divert all life stages of the fish (Service 1995); and grazing activities may degrade or reduce suitable habitat.

Conclusion

After reviewing the current status of the delta smelt, splittail, the environmental baseline, and the cumulative effects, it is the Service's biological opinion that the proposed action is not likely to jeopardize the continued existence of these species, or result in the destruction or adverse modification of critical habitat for delta smelt.

INCIDENTAL TAKE STATEMENT

Section 9 of the Act and Federal regulation pursuant to section 4(d) of the Act prohibit the take of endangered and threatened species, respectively, without special exemption. Take is defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. Harass is defined by the Service as an intentional or negligent act or omission which creates the likelihood of injury to a listed species by annoying it to such an extent as to significantly disrupt normal behavioral patterns which include, but are not limited to, breeding, feeding, or sheltering. Harm is defined by the Service to include significant habitat modification or degradation that results in death or injury to listed species by impairing behavioral patterns including breeding, feeding, or sheltering. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of section 7(b)(4) and section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the Act provided that such taking is in compliance with this Incidental Take Statement.

The measures described below are non-discretionary, and must be implemented by the Reclamation so that they become binding conditions of any grant or permit issued to the applicant, as appropriate, in order for the exemption in section 7(o)(2) to apply. Reclamation has a continuing duty to regulate the activity covered by this incidental take statement. If Reclamation (1) fails to require the applicant to adhere to the terms and conditions of the incidental take statement through enforceable terms that are added to the permit or grant document, and/or (2) fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of section 7(o)(2) may lapse.

This incidental take statement **does not** authorize any incidental take associated with the increased delivery of water that was identified in the No-action Alternative modeling results by either the SWP or CVP over and above that which was analyzed in the original March 6, 1995 biological opinion. If increases in water contracts, construction of infrastructure, funding or facilitating project or non-project water through SWP or CVP facilities, or changes in operations

of the SWP or CVP may effect environmental conditions in the Delta in a manner or to and extent not previously considered as part of this consultation, reinitiation of section7 concerning on the long-term operations of the SWP and CVP will be required.

In summary, upon implementation of the following reasonable and prudent measures, incidental take associated with implementation of the Preferred Alternative which will result in an average annual reduction of 240TAF of Trinity River water from being diverted into the Sacramento River Basin will result in incidental take of delta smelt and Sacramento splittail.

Delta Smelt and Sacramento Splittail

The level of take for delta smelt and Sacramento splittail is difficult to quantify in terms of numbers of individuals because of the variation in population size and distribution. However, upon implementation of the following reasonable and prudent measures it is anticipated that no more delta smelt or Sacramento splittail will be subject to incidental take than described in the March 6, 1995 biological opinion (Service, 1995) and will become exempt from the prohibitions described under section 9 of the Act for the proposed project. Delta smelt and Sacramento splittail may be harmed, harassed, injured, or killed by direct entrainment in association with the proposed project and will be exempted under section 9 of the Act. No other forms of take are authorized under this opinion.

Effect of the Take

The Service has determined that this level of anticipated take is not likely to result in jeopardy to delta smelt, Sacramento splittail, or destruction or adverse modification of critical habitat of delta smelt. The Sacramento splittail does not have designated critical habitat, so no critical habitat for this specie will be destroyed or modified.

Reasonable and Prudent Measures

The following reasonable and prudent measures are necessary and appropriate to minimize the impacts of the Preferred Alternative:

- Reclamation shall minimize the effects of reoperating the CVP resulting from the implementation of the Preferred Alternative within the Trinity River Basin on listed fish in the Delta.

In order to be exempt from the prohibitions of section 9 of the Act, Reclamation must ensure compliance with the following terms and conditions, which implement the reasonable and prudent measures described above. These terms and conditions are non-discretionary.

To implement Reasonable and prudent Measure number one Reclamation must implement the following:

- If Reclamation in its annual operations planning process detects that implementation of the Preferred Alternative will result in an upstream (eastward) movement of X2 in any month between February 1 through June 30 of 0.5 km, Reclamation shall incorporate within its operating plan measures that can and will be implemented to minimize or eliminate such upstream movements.

Reporting Requirements

Reclamation or the Service shall require personnel to report immediately any information about take or suspected take of listed species Reclamation or the Service shall immediately notify the appropriate Service office within one working day of any such information. Notification must include the date, time, and precise location of the incident/specimen, and any other pertinent information. For non-fish species Reclamation or the Service shall submit locality information to the Service and Department, using completed California Native Species Field Survey Forms or their equivalent, no more than 90 calendar days after completing the last field visit of the project site. Each form shall have an accompanying scale map of the site such as a photocopy of a portion of the appropriate 7.5 minute U.S. Geological Survey map and shall provide at least the following information: township, range, and quarter section; name of the 7.5' or 15' quadrangle; dates (day, month, year) of field work; number of individuals and life stage (where appropriate) encountered; and a description of the habitat by community-vegetation type. The Service contact shall be the Division Chief, Endangered Species Division at (916) 414-6620. Any killed fish specimens that have been taken shall be properly preserved in accordance with Natural History Museum of Los Angeles County policy of accessioning (10% formalin in quart jar or freezing). Information concerning how the fish was taken, length of the interval between death and preservation, the water temperature and outflow/tide conditions, and any other relevant information shall be written on 100% rag content paper with permanent ink and included in the container with the specimen. Preserved specimens shall be delivered to the Service's Division of Law Enforcement at 2800 Cottage Way, Room W-2928, Sacramento, California 95825-1846, phone (916) 414-6660.

CONSERVATION RECOMMENDATIONS

Sections 2 (c) and 7(a)(1) of the Act direct Federal agencies to use their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species and the ecosystems upon which they depend. Conservation recommendations are Service suggestions regarding discretionary agency activities to promote the recovery of listed species. Therefore, the Service recommends the following additional action to promote the

recovery of federally listed species and their habitats.

- Reclamation should assist in the implementation of the recovery plans for the species discussed in this biological opinion.

In order for the Service to be kept informed of actions that either minimize or avoid adverse effects or that benefit listed species or their habitats, the Service requests notification of the implementation of any conservation recommendations.

REINITIATION - CLOSING STATEMENT

This concludes both informal and formal consultation on the proposed implementation of the Trinity River Mainstem Fishery Restoration Program. As provided in 50 CFR 402.16, re-initiation of formal consultation is required where discretionary Federal agency involvement or control over the action has been maintained (or is authorized by law) and if: (1) the amount or extent of incidental take is exceeded; (2) new information reveals effects of the proposed action may affect listed species or critical habitat in a manner or to an extent not considered in this opinion; (3) the agency action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in this opinion; or (4) a new species or critical habitat is designated that may be affected by the proposed action. In instances where the amount or extent of incidental take is exceeded, any operations causing such take must cease pending re-initiation.

If you have any questions regarding this biological opinion, please contact Michael Thabault of my staff at (916) 414-6600.

Wayne S. White

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Chapter 5
Attachments

Attachment 1

Sacramento River Flow Below Freeport (PROSIM)

Run Date 12- 9- 98
Sacramento River flow below Freeport
NA3_P27M = PROSIM99;CVPIA PEIS NAA;C09A;BDPA;1993 WRBO;L2 REFS
Equation is +flow 17
Report is in ascending order by year

Units are in CFS

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1922	11615.4	11405	16867.6	17043.1	31037.4	28152.6	20804.8	41586.9	34504.5	16308.2	19145.1	14998.7	263469
1923	10500.5	15249.9	26996.8	29888.8	15827.1	14586.5	22987.9	15430.1	14981.7	20416.7	18140	16513	221519
1924	12196.2	10631.7	17212.3	16164.5	15932.7	11715.8	6408.9	7396.3	6492.1	6698.5	6399.5	6475.8	123724
1925	7843.2	7240.2	11707.6	11136.4	47757.2	23073.1	21427.2	13426	14215.6	17420.9	14361	14864.1	204473
1926	9817	9075.5	11675.4	17269.1	35393.7	15097.3	18014.9	16304.3	13214.3	12836.7	8715	11565.2	178978
1927	8513.2	22651.9	22241.7	34992.4	73073	40247.9	44197	24008.7	16302.8	18417.6	20297.3	15183.9	340127
1928	10024.9	21587.6	15509.9	24642.1	23988.3	66689.9	25834.7	19635	14020.8	17452.4	18549.5	15124.3	273059
1929	10490.5	11550.7	16604.3	16970.4	15423.3	11951.6	7023.3	8651.4	8893.8	9796.5	9247.7	8137.7	134741
1930	7506.7	6976.1	15610.4	20440.4	16500.5	27466	11876	10737.4	9752.1	12190.8	11309.9	14796.6	165163
1931	8276	8531.3	12240.9	13942.5	13153.2	10337.2	8777.6	8105.5	6817.8	6917.2	6822.4	6886.4	110808
1932	5916.3	6318.6	17210.4	19436.5	13607.4	10796	9069.5	11480.5	13578.9	11878.2	10893.3	12618.1	142804
1933	7864.3	7368	12017.7	14235	12717.9	12492.6	10808.1	8465.7	9473.2	8553.8	8320.2	8441.3	120758
1934	7010.8	6397.5	13560.8	17158.6	13547.7	11287.9	9934.2	7697.6	9262.4	7280.8	7436	7058.7	117633
1935	6101.8	10662.5	9482.6	25261.2	12402	23998.9	42048.8	31023.1	15328.3	16430	19230.5	15675.4	227645
1936	11653.5	10859.7	16917.4	34979.6	55552.6	29441.8	19631.7	14581.5	14418.3	18634.2	18809	15565.7	261045
1937	9839.8	10675	16574.2	13574.9	29892.1	38121	20894.9	17765.6	14536.3	14886.9	18887.1	15629	221277
1938	9945	23180.6	41602	28121.2	68662.7	69657.7	52311.4	48934.6	36059.5	17629.1	16782.1	15274.9	428161
1939	16454.7	13556.7	15437.8	14674.4	13567.3	13013.9	9521.1	9152.2	10461.3	12692.4	10321.3	12404.1	151257
1940	8461.6	8828.9	11726.1	29520.6	56871.9	66662.6	50955.4	17861.8	13028.7	17772.5	18464.2	14582.5	314737
1941	9243.4	11205.5	40827.2	61052.5	69455.8	57637.8	51775.4	38723.8	21053	15351.5	15300.2	14997.1	406623
1942	15051.5	14975.7	52676.2	57287.1	73689.1	24000.1	41716.6	35234.8	27515.6	15720.5	15698.8	13951.8	387518
1943	14443.1	19690.5	28992.2	58213.6	46764.1	57745.6	27460.5	18481.5	11883.9	15637.7	19611	15224.4	334148
1944	10513	11484.6	16511.9	16602.4	24403.2	20425.2	10996.7	10684.2	14001.1	16566.5	12399	14316.6	178905
1945	8494.3	14772.3	17880.2	13857.9	46171.2	26782.6	12030.6	12127.1	16682	17930.2	18050.5	15394.4	220173
1946	9156.4	15806.3	51021.4	45535.3	28155.6	17172	12812.4	15133.4	16444	18656.8	17771.1	15149.7	262814
1947	10314.1	11302	15890.7	15583.3	17708.9	18786.9	15610	9578.4	11662.8	11481.7	8884.3	10746.2	157549
1948	9086.1	10353.4	8642.5	16045.1	11563.5	16097.4	29464.2	30098.5	21858.1	20764.7	17237.6	14214.5	205425
1949	10962.7	11692.7	16951	15614.6	12474.9	40035	13011.4	14070.2	15221.3	15477.6	12538.4	14017.8	192067
1950	9634.8	9842.1	10538.1	19905.2	32906.7	21890	18519.1	16664.6	16321.6	19042.1	16994.9	14079.8	206339
1951	11815.5	39070.5	62385.7	53917.1	53210.5	31880.9	17254.1	17221.2	14159.8	19680	19601.2	16548.6	356745
1952	10015.5	17856.9	40931.7	58671.9	59357.9	50258.5	53301.1	52028.5	39967.6	22031.3	19308.6	16177	439907
1953	14637.6	13406.3	39782.5	62759.4	24935.8	22471.4	16792.4	24623.9	28019.3	17135.8	18281.9	15060.8	297907
1954	14755.6	20028.2	15079.5	33582.6	51069.7	45657.8	38982.3	23745.2	14693.2	18326	19212.6	15102.2	310235
1955	10637.1	17456.5	24904.7	18889.3	15852.7	11902.9	9866.4	11717.8	16269.3	14777.1	11737.2	13426.2	177437
1956	9196.8	10996.7	60948.3	70922.8	60619.8	35218	20009.8	39126.4	23606.9	17762.8	17943.1	16048.6	382400
1957	17920.1	12052.5	11702.6	16602.9	34242.7	42939.6	20024.6	16127.2	16752.9	19170	19585.6	16126.2	243247
1958	19574.2	16845.5	24277.5	37361	73963	62274.4	60919.1	40564.6	37554.5	19337.4	18850.7	18782.4	430304
1959	14537.5	12090.9	12342.8	37902	44735.1	21492.6	12635	14531.1	14509.8	15756.7	18080.6	14203.1	232817
1960	11958	11242.5	17670.7	16064.4	27621.2	20241.1	16220.7	11095.4	12781.8	15591.5	11869	12197.3	184554
1961	9291.4	13109	15566.9	11799.5	32958.2	18533.6	14859.7	12088.2	13153.5	13338.3	11171	11337.8	177207
1962	8993.8	8932.8	15581.4	10974	46529.9	30768.7	14472	17925.8	14426.6	15574.1	17964.1	14458.2	216601
1963	30551.1	16558.7	27603.4	15791.3	56260.7	29144.6	62091	27184.5	15423.6	18824.3	20183.9	14990.2	334607
1964	16004.3	28021.6	13963.6	26035.3	15557.8	11557.3	11940.9	12656.7	13833.5	15023.1	10879.9	12168	187642
1965	8843.3	15196.4	62905	68251	31732.9	21462.2	43661	23854.3	13583.1	15102.9	19049	12539.5	336181
1966	8871	22570.2	15727.8	31931.8	23859.6	23999.7	15152.7	17969.1	14393.3	15543.3	17572.1	13863.4	221454
1967	11357.2	17907.9	36328.8	38124.1	46627.2	46589.7	37388	41521.7	41311.9	19873.7	18218.8	16449.1	371698
1968	15248.1	13185.1	15198.3	29805	52994.3	35541.2	15428.5	13450	14467.1	17062.8	18248.3	15909.6	256538
1969	12092.9	12470.5	25620.8	68720.4	69703.6	42811.1	41632.9	40411.2	26265.6	16948.6	17374.6	17797.3	391849
1970	16305.3	14268.8	49768.9	70029.2	62255.7	35204.1	13417.9	11612.5	14522.3	19963.9	19596.9	15780.6	342726
1971	9903.5	25719.5	48474.5	43574.6	30392.6	39155.6	21361.1	26771	23759.3	18331.5	19836.1	16022.3	323302
1972	14178.5	12598.5	22137.3	21670.7	21627.9	32409	14981.3	14201.9	14541.4	18112.8	17434.3	14586.4	218480
1973	11859	22891.1	24939.3	55935.8	60045.8	45309.5	16794.9	15432.3	15717.4	19381.6	19430.7	16182.1	323920
1974	12675.7	50389.6	55493.8	68812.2	41062.3	66791.2	55458.6	23370.3	22911.8	21118.3	19787.4	19123.4	456995
1975	14568	13397.8	17170.4	16625.3	51942.3	58294.6	22533.5	29662.1	26869.4	18238	18631.5	17228.3	305161
1976	19544.1	15709.8	14890.6	13691.2	13308.7	14537.2	9396.2	9705.5	9655	13872.3	10856.5	11993.5	157161
1977	7361.5	6818.2	7329.7	11327.3	15068.4	11408.4	7319	6851.3	6824.8	7111.4	6418.6	6724.6	100563
1978	5316	6019.6	13340.8	48424	45971.7	53800.6	36412.2	19198.1	15072.8	11890.5	18848.3	13113.1	287408
1979	9482	11418.1	16296	21765.3	35334.3	30377.2	15371.5	13630.8	19471.8	18174.8	18910.4	16581.9	226814
1980	10665.7	16708.3	19161.5	62884.1	73919.1	43405.1	18246.1	14016.8	13075	13819.6	16597.7	12765.7	315265
1981	10139.6	9805.6	16723.1	27514.9	26167	28974.9	13111.8	10018.2	12733.1	14304.8	12993.6	13921.7	196408
1982	9043.7	37857.7	64799.2	58419.5	69538.7	57976.8	71892.2	33153.8	22971.6	18678.5	19567.5	20006.1	483905
1983	21568.9	33513.6	55121.5	57377.8	76533.5	66861.9	52813.5	50166.3	48195.4	25547	21353.7	26017.2	535070
1984	18325.9	53134.7	71257.8	49464.8	33237.7	31940.2	16123.7	11162.1	16108.8	19110.4	19427.3	15465.3	354759
1985	11449.5	31038.2	24837.8	16483.9	14791.4	14034.5	12532.7	14402.2	13226	15399.9	10541.1	12818.9	191556
1986	8546.7	9917.9	15495.5	19680	82720.3	70503.6	20728	12173.3	11658	12941.3	19340.1	14832.3	298537
1987	10730.2	8811.1	16907	17405	19067.6	22969.3	12962.6	9994.1	12757.5	11573.2	9346.7	8885.7	161410
1988	7745.2	7590.4	15795.1	24306.4	11976.5	11219.4	9178.1	9170.5	9724.1	10608.6	9058.4	9301.5	135674
1989	7266.1	9954.1	9522.6	11687.7	9755.7	43369.4	21451.9	14772.6	15031.6	15385.6	12629.1	12844.2	183671
1990	9578.9	7628.2	9417.3	18192.1	15065.4	12167.5	15934	11920.1	12225.2	13289.1	10960.2	9994.5	146372
Avg.	11441.8	15624.1	24761.3	31341	37098.8	32185.8	23863.4	19598.1	17249.4	15863.1	15555.3	14076.3	258658

Run Date 2-10- 99
Sacramento River flow below Freeport
TRN_RM2K = PROSIM99;TRINITY R EIS/EIR MAX FLOW #2;C09A;BDPA;1993 WRBO;L2 REFS
Equation is +flow 17
Report is in ascending order by year

Units are in CFS

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1922	10944.6	10280.3	16215.2	16544.6	30452.7	27353.2	20854.5	40588.9	34010	15400.6	18097.4	14934	255676
1923	10191.2	13338.8	26823.9	28946.4	15786.2	14613.1	23203.4	14449.7	15204.4	18718.5	17404.9	16502	215183
1924	9820	9025.6	14556.4	16164.5	16236.3	13339.9	6249.5	7319.8	6483.8	6633.1	6392.1	6475.3	118696
1925	7720.7	7072.9	11621.2	11101.6	47594.9	23047	20814.5	12441.2	10408.6	14740.3	13550	14516.7	194630
1926	9128.7	8844.5	12263.6	17439.8	35516.9	14858.3	17484.4	13210.8	8663.2	9305.3	8396	12435.6	167547
1927	8650.4	22623.8	17332.4	32488.3	73416.9	40426.6	44133.8	23008.7	16302.8	18405.3	20298.8	15164.5	332252
1928	9842.4	15045.6	14948.6	24423.3	23804.5	66176.9	26002	19370.8	10787.3	14825.2	15637.7	12422.3	253287
1929	9127.7	11012.6	14131.4	16970.4	15397.6	11896.4	6892.5	8225.2	8526.3	7147.1	7436.6	7767.8	124532
1930	6631.6	6407.7	15662.3	20693.4	16422.8	27613.1	11410	10401.8	9561.8	12028.8	10984.3	14723.2	162541
1931	8289.9	8916.6	11670.9	13886.5	12994.5	10313.5	9289.8	8101.6	6816.4	6970.8	6644.2	6704.7	110599
1932	5849.1	6254.1	17156.3	19389.7	13368.8	10819.4	8621.2	11312.2	13203.3	11130.4	13502.9	12949.4	143557
1933	7936	8165.4	13529.8	14204.8	12653	12233.9	11928.1	7782.7	8891.1	6777.1	7239.2	7314.6	118656
1934	6677.8	6272.7	13459.2	16963.1	13388.7	11179.5	9976	7626.2	9369.2	7384.2	7308.4	6690.2	116295
1935	6323.3	10668.8	9155.5	24997.8	12166.9	23848.3	40669.9	31161.5	12416.1	12136.2	16652.8	13601.2	213798
1936	9517.5	8546.5	14416.8	34155.9	55437	29324.6	20029.1	13131.4	13251	16103.7	17290.1	14477.8	245681
1937	8556.5	8190.1	14651.1	13075.3	30847.6	38047	21313.3	17354.3	13527.3	13585.6	16968	14809.3	210926
1938	9613.7	22956.1	45425.7	29613.8	68624.3	69655.6	52186.5	48388.5	34410.8	15302.5	14522.4	14908.3	425608
1939	12087.8	13295.7	14924	14263.3	13203.3	13175.7	9385.7	8818.7	8710.2	10487	9980	13612.5	141944
1940	7782.5	8790.1	12846.2	26887.6	49166.2	66630.1	50971.1	18016	12237.6	14279.5	16558.6	14267.1	298433
1941	8736.4	10600.4	38489.5	61010.8	69431.8	57287.9	50598	36628.4	17753	13655.8	13027	14395.8	391615
1942	11582.6	12928.7	51033.9	56204.2	73438.2	24000.1	41651.7	33109.2	24756.5	13410.2	13504.1	13951.8	369571
1943	11217.1	17584.2	27933.6	58367.4	46515.3	57152.1	27395.8	18039.4	11883.9	13876.6	19611	15245.3	324822
1944	10178	10092	16569.2	16602.4	24007.7	20333.6	11222.1	9557	12055.9	11571	12436.8	13785.6	168411
1945	7699.9	14345.5	16107.8	12951.9	42095.2	26435.8	11882.9	12228.7	16680.6	16736.6	17047	14497.3	208709
1946	8584.7	12946.8	51217.6	45506.9	28537.8	15568.7	12079.2	15126	16535.1	14512.3	15947	12655.4	249218
1947	8789.9	10021.7	15935.9	15579.4	17511.8	18685	13415.6	8803.4	8164.1	8598	8759.5	11567.5	145832
1948	9205.3	10314.8	8603.1	14914.5	12239.1	16057.7	26578.5	29996.6	21920.2	18351.8	17780.4	14174.3	200136
1949	9670.3	9654.8	15812	15614.6	12586.4	40796.9	12729.6	11103.1	10871.4	11411	11099.5	13774	175124
1950	7773.9	8558.7	10335.1	22031.1	32823.8	21807.5	17706.9	16742.6	16359.1	15729.8	17037.2	14037.5	200943
1951	10763.1	41424.8	62664.3	53880.8	53112.3	31809.1	16765.4	16265.6	12815.4	15551.5	18498.8	16356.3	349907
1952	10229.2	14948.1	40836.7	58803.6	59112.8	49666.5	51948.5	50448.8	37714.8	19753.5	16772.4	15679.8	425915
1953	11305.4	12574.4	39422.7	61936.9	24935.8	22471.4	15441.6	23623.9	25397.3	16059	20068.6	16084.5	289322
1954	9886.3	15501.1	16691.8	27098.4	50013.8	44376.6	37374.4	24346	13830.2	15823.2	16591	12993.9	284527
1955	9422.3	13296.8	24130.7	18460.8	15845.8	12261	8984.9	10439.4	9903.6	9094.1	8339.5	11824.8	152004
1956	7650.1	10572	64629.8	70920.3	60537	35114.1	19435	37334	21315.4	15094.7	19134.8	12784.5	374522
1957	13265.7	11961.2	15520.4	17006.5	29115.3	42196.1	19205.5	15609.2	15642.2	18081.6	18851.3	15485	231940
1958	17131.9	15319.8	22455.4	34922.1	73797.3	61796.3	60346.3	37476.9	34254.5	17758.9	17127.6	15959.9	408347
1959	11115.9	11867.3	12169.7	37160.3	44151.6	19526.1	12620.2	14491.3	12372.9	13077.8	15376.8	13480.5	217411
1960	9695.5	9593.5	14840.2	16049.2	27499.3	18236.7	13884.4	10846.7	8407.3	11203.3	11443	11735.1	163434
1961	7294.8	13867.2	21727.3	12612	33159.1	18282.3	11289.3	9885.4	9023.5	9162.5	11250.1	11319.8	168873
1962	8399.3	10125.6	20110.9	11309.6	46661.9	30860.8	14377.5	17915.5	13423.2	13675.4	16284.2	13194.8	216339
1963	29268.4	15782.3	26438.1	15711	56965.8	28960.3	62013.5	26184.5	15423.6	18432.4	20219.8	15002.9	330403
1964	11211.2	24820.3	15914.4	25472.3	15557.8	11611.4	11641.6	11361.3	9881.4	10751.3	8823.2	12701.3	169748
1965	7204.2	14219.4	61019.8	68223.8	31597.3	21331.6	43383.3	23856.4	13562.9	14307.7	19035	12522.1	330264
1966	8797.8	17779.9	13712.9	31260.5	23859.6	22762.4	15152	17633.5	13385.4	12870	15134.2	12329.1	204677
1967	9978.2	13632.2	35103.5	36295.2	46554.6	46494.9	37227.6	40560.8	38580	17547.1	16186.7	15068.9	353230
1968	11613.8	12541.8	14838.9	29160.6	51223.4	35339.7	15002.3	13450	14024.2	14732.3	16825.4	13849	242601
1969	10543.8	10380.9	22202.6	67140.3	69660.1	42713.4	41474.4	39670.7	23812.7	14425.8	15193.7	16923.2	374142
1970	12734.9	14246.5	48530.8	70635.9	61841	35204.1	13502.6	11612.5	14522.1	19941.4	19598.7	15780.4	338151
1971	9903.5	17001.5	44588.2	43558.5	31269.5	37410.9	21831.3	24345.9	22053	18908.4	19761.1	16022	306654
1972	10192.4	12099.4	17841.3	19176.7	21425.4	29093.1	15651.9	14183.4	14540.7	17270.6	14281.4	12093.5	197850
1973	9650.6	18327.6	24424	53556.2	60127.9	45222.7	16652	14948.7	14057.7	17830	18450.6	15619.4	308868
1974	10357.8	46934.1	53997.9	68656.2	40949.7	66225	55101.5	20670.7	19611.8	19376.1	18098.8	16365.5	436345
1975	11361.5	13397.8	16825.3	16349.1	52041.9	58120.8	22533.5	27328	23569.4	15812.7	16624.6	15722.8	289687
1976	15817.6	15179.9	14986.9	15995	13301.2	13287.4	9112.2	8734.9	9857.9	10093.3	8642.7	11014.1	146023
1977	6988.2	6797.9	8643.6	10577.2	14962	9871	8067.6	6851.3	6825.6	7111.4	6428.4	6698.7	99823
1978	5596.7	5900.4	13248.5	46325.7	38920.3	53298.2	36412.2	18198.1	15072.8	11194.2	17269.3	13113.1	274550
1979	9482	10545.2	14341	21442.6	34911.4	30378.8	15585.9	12129.1	18736.1	14935.7	17866.1	13899.4	214253
1980	9733	16202.4	18762	62172.7	73308	43367.9	18316.3	13516.8	12583.1	10885.2	16472	12811.3	308131
1981	9632.7	8917.4	16723.1	21903.5	25331	28545	13654.7	8444.8	8573.4	10521.6	11172.7	13866.7	177287
1982	9019.9	40033.5	64283.7	58081.2	68478.7	57265.2	71804	33153.8	21011.2	15424.1	17307.8	19625.2	475488
1983	17031.8	32894.7	54344.8	55946.6	76330.7	67751.8	52208.7	48347	47288.5	24634.2	19974.2	18764.8	515518
1984	15119.1	51931.7	71155.4	48567	33237.7	31077.8	16123.7	11162.1	16124.3	19105.3	19427.6	15465.3	348497
1985	9142.3	27114.1	23165.3	16698.4	14559.4	13195.2	12029.3	11294.4	9263.4	11450.5	10238.8	12301.2	170452
1986	7454.6	9383.5	15348.1	18435.5	82849.3	70484.7	20728	12173.3	11658	11627.2	19337.6	14829.8	294310
1987	10772.1	8886.6	16907	17405	19067.2	22959.2	10582.2	8722.3	8600	8334.1	6863.3	7431.6	146531
1988	6427.1	6456.8	15651.8	24113.8	11562.6	8025.7	9188.2	8266.6	9210.8	9238.5	7755.2	8913.2	124810
1989	7711.6	9901.3	9338.3	11475.7	9752.2	42255.7	21915.2	12117.7	9914.4	11335.4	10467.5	13213.2	169398
1990	9845.4	7870.1	9457	18315.1	14650.9	12098.9	12708.1	8701.4	11513.9	11724.3	9773	10511.9	137170
Avg.	9954.8	14391.1	24345.3	30779.8	36636.3	31791.7	23448.6	18671.7	15610.4	13672	14465	13358.3	247125

Run Date 4- 1- 99
Sacramento River flow below Freeport
TRN_RECD = PROSIM99;TRINITY R EIS/EIR EXIST. CONDITIONS;C09A;BDPA;1993 WRBO;L2 R
Equation is +flow 17
Report is in ascending order by year

Units are in CFS

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1922	10311	10120.1	15279.4	16553	30387.3	27300.9	21052	45265.1	34871.9	14068.6	14725.3	14462	254397
1923	11933.2	15538.4	32518.9	30261.8	20487.4	14557.5	21815.4	15686.6	13302.4	15029.7	17673.1	14029.5	222834
1924	10565.9	10592.1	17459.8	16476.5	15555	9447.5	6801.6	7797	7750.5	8811.4	6795	8420.9	126473
1925	7646.1	7319.4	11175	11180.8	48883	31130.9	19967	14146.2	14551	17591	14165.6	14893.2	212649
1926	10269.8	9346.5	10367.7	16802.5	34903.4	15516.9	18216.7	16187.2	13487.4	15585.1	10153.4	12155.4	182992
1927	9098.2	21487.8	21467.1	35149.2	73770.1	40561.8	44242.6	24386.6	16619.6	15053.6	15247.6	12102	329186
1928	10377.7	25329.9	15186.6	25594.5	26363.7	67695.2	25967.2	19434.7	13601.7	16245.9	18364.1	15044.3	279206
1929	10624.2	11658.1	16780	17167.7	15492.4	11781.1	6993.4	8593.6	10885.8	13513.2	10632.8	10170.2	144292
1930	8245.5	7198.8	15543	20421.7	16540.2	27083	12463.5	10863.7	11330	12751.8	10863.9	14013.6	167319
1931	8313	8279.4	10812.2	14027.1	13621.2	10743.7	9030.2	8102.7	7025.2	7346.8	7263	7023.4	111588
1932	6177	6282	16584.8	19513.6	14741.4	11047.3	9630	12292.7	14341.8	12477.4	11756.1	13930.9	148775
1933	8430.1	7204.4	11941.6	13472.5	13025.9	12213.3	11842.9	8614.7	9319.9	8928.1	8669.6	8611.1	122274
1934	7101	6568.8	12874.8	17345.7	14160.3	12113.7	10251.2	7920.6	9443.9	7682.8	7525.9	8801.6	121790
1935	6175	10073.1	9245.6	25067.9	12309.7	23599.7	42219.9	31189.4	14416.5	14319.2	16986.8	13813.3	219416
1936	10821.7	10415.9	17428	35236.6	56122.5	33321.9	19778.7	14826.1	14738.8	13412.4	13649.8	13090.3	252843
1937	9715.6	9936.2	17145.6	14000.7	31600.7	38110.9	21000.4	16333	12632.9	11456.2	15188.6	12836	209957
1938	10049.8	23290.2	53905.7	33164	71232	69836.7	52481.4	49445.1	37943.9	18578.1	17699.8	16083.7	453710
1939	16541.5	13641.2	15245.8	14432.4	13371	12787.5	9169.3	9180.1	12611.7	14899.5	12302	13104.3	157286
1940	9638.8	8188	13211.4	29383.2	55606.5	66803.3	50856.1	17874.8	11989.1	17516.8	18142.2	14443.5	313654
1941	9226.5	11068.3	40464.5	62049.6	69582.2	57738.1	51757.3	39024.5	21979.1	16168.7	16670	15989.2	411718
1942	15173.2	14832.8	52406.9	57441.2	73833.5	23771	41803.2	35578.5	28420.8	16837.4	16786.9	14928.8	391814
1943	14822.2	19432.4	28504.1	58258.1	46824.7	57839	27310.1	17126.5	12200.6	13586.3	15862.2	12269.7	324036
1944	11098.6	11997.1	11375.9	16668.1	29899.2	22028	9826.7	9749.5	12669.7	16634.9	14514.5	13711.7	180174
1945	10222.3	14125.2	19455.8	13538.4	48620.1	26557	12608	11866.3	14036.3	13879.3	16853.8	13099.6	214962
1946	9537	17140.3	54904.3	47231.2	23798.7	21344.7	13090.9	15466.8	14161	14845.6	17634.5	14542	263697
1947	10121.8	11230.3	16382.5	15834.9	17755.6	18705.8	16245.9	10550.4	14563.4	17562.4	14741.1	14276	177970
1948	10477.3	11208.2	10133.7	14695.6	16362.8	16319.6	25070.8	30168.5	22499.3	20821.6	19020.2	17555	214333
1949	12110.5	11075.3	17460.8	15871.3	12324.4	38740.3	12996.5	13104.9	15090.3	15237.8	12420.1	13924.7	190357
1950	9296.8	9516.6	9587.2	20790.2	32698.3	21725.9	18684.5	16597.4	16095.4	19788.8	17547.3	14489.1	206817
1951	11866.9	42474.7	61644.9	54063.3	53294.8	32037.7	17431.5	17328.5	13560	18278.3	19665.6	15371.6	357018
1952	9935.2	17381.9	43229.1	59698.9	59444.6	50371.4	53444.5	52469.8	40446.9	22887.1	20196.5	17126.3	446632
1953	15008.3	13253.1	39394	62915.5	25057.3	22326.5	16722.9	24903.4	28590.1	17962.8	18342.4	16610.4	301087
1954	15193.6	19817.2	14835.7	33477	51042.6	45706.2	39082.8	23592.3	13787.5	17206.8	19212.1	15293.7	308248
1955	10599.8	16900.1	24416.2	19206.4	16162.8	11906.2	9673.7	11674.8	16405.4	16083.9	14084.3	14417.7	182331
1956	9872.2	10887.4	62125.7	71091.9	60667.2	35552.3	20012.1	39393.2	24314.3	18598.9	18857.7	16930.2	388303
1957	17997.9	12238.1	11841.2	15338	34845.7	43084.1	19476.7	16520.2	14467.1	18110.9	18945.4	15155.8	238021
1958	20142.3	17093.6	24690.2	37945.3	73466.2	62448.1	60987.4	40969.6	38248.7	20323.9	19986.3	19737.4	436039
1959	14911.8	12306.8	12215.9	37687	44764.7	20824.9	12414	14472	14281.1	15754.2	18572.5	13851.5	232057
1960	10619.3	9979.5	17848.5	16389.1	27675.8	20613	15289.8	11173.5	13993.3	18507.4	15379.3	15008.8	192477
1961	10485.8	11342.1	14972	11364.4	32587.2	18146	15588.6	13526.1	13992.9	15493.8	10519.8	12307.9	180326
1962	9018	9050.5	16308	11107.5	47137.6	31003.5	14542.9	17565.8	14476.6	15004.7	17403.4	14269.6	216888
1963	31462.4	16529.8	27400.7	15696.2	56985	29026.2	62184.3	27666.5	15843.9	15262.3	16444.7	16354.1	330856
1964	16842.1	32403.9	13286.8	28555.4	15631.5	13620.9	9376.6	11231.8	13710.5	19147.5	14285.7	13558.8	201651
1965	9836.7	13593.6	63027.5	68384.7	31771.3	21585.9	43394	24076.8	13816.8	15235.7	18360.5	11943.6	335027
1966	9515.1	25366.4	15502.7	31562.7	23786.7	24079.6	14572.4	18073.9	13236.7	14528.7	18099.4	14579.8	222904
1967	10431	18457.6	36259.4	41633	47473.8	46578.8	36967.7	41812.5	41904.8	21008.9	19347.4	17483.2	379358
1968	15601.2	13069.7	15011	29427.8	53011.9	35618.1	15326.3	13496.2	13906.1	15229.7	17562.6	14630.2	251891
1969	10471.2	12208.3	25445.9	70299.5	69811.6	42943.6	41641.6	40935.4	26889.9	17491.1	18659.1	18700	395497
1970	16462.3	14267.7	49447.7	70351.5	62290.8	35195.7	14406.3	12503.6	13629.3	17010.5	17509.6	13544.1	336619
1971	9659.4	24527.8	50150.5	45030.1	27621.9	44092.2	20603.9	27770.8	24503.9	18625.2	18835.5	17166.6	328588
1972	15657.8	13628.3	21592.4	21716.5	21573.4	32657.4	14456.2	14199.8	15163.9	16307.6	19221.5	15248.4	221423
1973	11595.9	21413.8	24577.5	56547.6	61564	45333.5	17044.1	15918.2	13293.8	16616.7	17553.1	14152.4	315611
1974	12854.9	56562.8	55688.3	68870	41202.7	66841.2	55705.1	23868.2	23695.4	21768.3	20715.8	20035.4	467808
1975	14678.8	13491	16590.6	16713.7	51848.9	58400.4	22271	30511.9	27606.5	18836.9	19712.4	18169.8	308832
1976	19376.4	15794.9	14855	13665.6	13680.6	14616.6	9255.3	9788.9	9807.1	11271.4	13124.7	12258.4	157495
1977	7485.2	6844.8	8643.4	11214.2	15151.1	11522.5	7761.1	6968.5	7263.7	7494.9	7147.9	7461.6	104959
1978	6634.4	5775.7	12543.9	47812.9	45869.3	54300.6	36141.9	19704.9	15425.9	13164.1	14786.7	16514.4	288675
1979	10415.5	11385.5	10711.3	24879.2	39383.8	30329.9	14999.3	14782.6	15607.3	13433.7	16814.9	13294	216037
1980	10445.6	16395	18681.5	68441.4	74054	43503.5	18302.3	14266.1	13472.1	14697.1	16021.2	13589.5	321869
1981	10517.9	9957.6	17510.4	28123.7	26027.8	29033.3	13942.9	10149.9	13187.1	18019.4	15014.7	14829.9	206315
1982	9244.5	35087.6	64731.6	58411.1	69800.3	57916.4	72244.4	33491.7	23992.3	19786.9	20630.8	20633.3	485971
1983	21502	33756.8	55250.1	57434.3	76768.4	67026.3	52927.1	50534.1	49034.1	26466.5	22186.1	26951.9	539838
1984	18728.2	52609.3	71498.9	49487.1	33260.8	32094.9	16462.6	12073.3	13958.6	15940.5	17844.8	13851.4	347810
1985	11427.9	36609	24777.8	14359.7	18000.4	17458	10798.1	12507.3	12867.2	17882.1	14256.2	14458.8	205402
1986	9305.9	10030.9	15210.1	18857.9	82983.3	70508.8	20886.9	12491.6	11998.6	11681.6	14562.9	13326.6	291845
1987	10799.7	9011.5	16314	16225.7	18861.6	23005.2	12135.8	10308.2	13455.8	14826.3	12004.5	12891.2	169839
1988	10414.3	7878.5	15190.1	24626.2	14731.7	11286.5	10476.1	11375.2	11078	11218.8	9457.2	10563.8	148296
1989	7259.1	9317.9	9172.2	11730.5	10084.2	41973.4	21553.3	17048.7	13694.8	16099.4	12171	13807.6	183912
1990	9446.6	7727.6	9667	17470.8	14328.3	11779.3	15385.2	10462	11659.5	12632.5	10445.1	11023.8	142028
Avg.	11707.9	15804.7	24885.6	31673.1	37588.1	32561.9	23754.5	19840.3	17287.7	15759.8	15562.3	14332.1	260758

Run Date 12-21- 98
Sacramento River flow below Freeport
TRN_RPIA = PROSIM99;TRINITY R EIS/EIR % INFLOW ALT;C09A;BDPA;1993 WRBO;L2 REFS
Equation is +flow 17
Report is in ascending order by year

Units are in CFS

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1922	11615.4	11405	16867.6	17043.1	31037.4	28152.6	20804.8	41080	34504.5	16065	19146.4	15000	262722
1923	10983.7	15249.9	27138.1	30228.1	15827.1	14586.5	22987.9	15430.1	14980.9	20416.7	18140	16513	222482
1924	12132.3	10631.7	17212.3	16164.5	15932.7	11807.9	6661.8	7654	6749.1	6763.9	6650.7	6727.2	125088
1925	7838.7	7264	11732.1	11165.1	47756.3	23080.8	21427.2	13426	14216.5	17420.9	14361	14637.2	204326
1926	9973.9	9302.5	11906.7	17338.7	35455.4	15131.3	18464.9	16166	13188.7	11649.9	8728.1	11525.2	178831
1927	8545.6	22668.9	23331.8	35067.7	73066.4	40452.2	44197	23508.7	16302.8	18410.8	20298.1	15172.7	341023
1928	9937.5	20937.1	15356.4	24428.6	23809.2	66283.3	25834.7	19673.1	14020.8	17449.8	18604.5	15120.6	271456
1929	10490.8	11550.9	16604.3	16970.4	15423.8	11952.2	7006.9	8626	8840.2	8358	9131.3	8150.4	133105
1930	7303.9	7025.9	15685.1	20389.9	16462.3	27448.5	11633.7	10736.8	9752.4	12191.4	11309.5	14795.4	164745
1931	8278.6	8536.2	12244.8	13942.5	13152.9	10337.2	8776.6	8105	6824.3	6917.2	6827.4	6887.9	110831
1932	5920.7	6322.3	17213.6	19439.2	13623.7	10796	9069.2	11480.5	13579.8	11842.1	10876.5	12653.6	142817
1933	7864.6	7284.1	12109.5	14235	12718	12490.4	11081.5	8441.7	9480	8553.8	8320.2	8466.1	121045
1934	7012.2	6398.6	13568.6	17169.4	13557.7	11551.4	10007.8	7958.2	9467.5	7411.7	7708.2	7314.6	119126
1935	6177.3	10721.4	9532.4	25309.4	12453.6	24035.4	42043.8	31022.7	15280.2	16384.9	19209.7	15582.9	227754
1936	11616.8	10843.5	16917.4	34979.5	55552.6	29441.8	19631.7	14581.5	14418.3	17770.3	18891.5	15557.1	260202
1937	9838	10674.1	16574.2	13574.7	29891.9	38121	20894.9	17762	14289	14399.8	18887.1	15629	220536
1938	9945	23179	42353.6	29720.3	68753.8	69657.7	52311.4	48662.5	34410.8	16801.4	15975.6	14908.3	426679
1939	15663.4	13295.7	14924	14263.3	13203.3	13013.9	9521.1	9152.6	10468.5	12692.4	10326	12512.5	149037
1940	8382.2	8811.8	11866.1	30332.1	56839.5	66662.6	50955.4	17854.5	13031.2	17772.5	18464.2	14582.5	315555
1941	9244.5	11206.1	39547	60875	69455.8	57325.9	50720	37171.7	20270.3	15351.5	15300.2	15502.1	401970
1942	15158.5	14672.7	52537.4	56719.6	73533	24000.1	41716.6	33609.2	25536.6	15720.5	15698.8	14581.5	383485
1943	14685.3	19631.5	28298.2	58417	46515.3	57202.7	27395.8	18546.7	11883.9	14032.5	19611	15238.1	331458
1944	10612.7	11484.6	16511.9	16602.4	24403.2	20425.2	11736.1	10429.9	14878.8	16505.1	12399	14317.3	180306
1945	8493.9	14771.5	18353.4	14227.9	45847.5	26782.6	12030.8	12127.5	16680.3	17471.3	18091	15394.4	220272
1946	9156.1	16413.1	51021.6	45535.3	28106.5	17152.4	12812.4	15133.4	16444.5	18666.6	17771.1	15149.7	263363
1947	10314.1	11302.8	15890.7	15583.3	17708.9	18785	15348.7	9563.3	11267.5	11126.3	8854.7	10396.3	156142
1948	9050.2	10332.3	8622.7	14841.4	10868.1	16081.6	29635.3	28988.8	21858.1	20764.7	18216.4	14219.7	203479
1949	10962.1	11739.5	16946.8	15614.6	12433.7	39677.3	13070.4	13552.4	14809.1	14846.1	11609.9	13200	188462
1950	9117.6	9702.8	9835.8	20423.4	32906.7	21890	18519.1	16668	16329.7	20812.5	17588.6	14545.7	208340
1951	11827.1	37544.3	62027.1	53917.1	53210.5	31880.9	17254.1	16745.7	14232.9	19680	19601.2	16548.6	354470
1952	10171	17808.3	40287.6	58628.8	59192.2	49748.3	52077.4	50714.1	38335.7	22031.3	19308.6	16874.2	435178
1953	14814.6	13406.3	39422.7	62759.4	24935.8	22471.4	15637.9	24123.9	25397.3	17135.8	19189.2	15376.5	294671
1954	14396.7	19969.2	15079.6	32312.7	50411	45168.3	38142.6	24019.4	14930.1	18326	19212.6	15102.3	307070
1955	10636.8	17456.5	24904.7	18889.3	15852.7	11906.5	9837	11718.1	15267.1	13940.1	10907.9	12234.2	173551
1956	8573.4	10515.3	61750.1	70923	60617.6	35211.8	19521.2	37698.8	21315.4	16577.3	17289.7	16164.5	376158
1957	18027.1	11961.2	15314.3	16686.3	30568.6	42251	20408.7	13859	17337.9	19148	19585.4	16133.5	241281
1958	18580.3	16584.6	24274.7	36859.5	74085.8	61859.6	60446.6	40564.6	36035.8	19337.4	18850.7	19287.4	426767
1959	14644.5	12087.1	12339.9	37087.4	44211	21620.4	12635	14531.1	14512.3	15757.1	18081.3	14203.8	231711
1960	11958.4	11242.6	17670.7	16064.4	27621.2	20241.1	15844	10704.3	12748.3	14998.5	10467.4	12152.5	181714
1961	9087.4	12735.4	15277.6	11722.3	32365.3	18497	15132.7	12088.4	13153.5	13335.6	11168.6	11251.2	175815
1962	8836.8	9310.1	15874.3	10966.6	45286	30769	14546.2	17925.8	14429.7	15598	18004.5	14485.6	216033
1963	29936.6	16558.7	27603.4	15791.3	56279.1	29144.6	62091	26684.5	15423.6	18547.6	20205.5	15002.9	333269
1964	14788.4	27962.6	13968.6	25543.8	15557.8	11563.4	11895.7	13100.3	13569.4	13566.2	10293.5	12391.9	184202
1965	8613.5	14976.7	63571.4	68250.5	31720.7	21449.3	43567.8	23884.6	13562.9	15116	19044.5	12533.7	336292
1966	8840.4	21990.1	15727.8	31529.4	23859.6	22859.8	15309.6	17969	14397	16159.8	17533	14373.3	220549
1967	11375.3	15901.2	36322.7	38041.3	46183.2	46589.7	37327.6	40873.4	38580	19029.7	17656.2	15842.5	363723
1968	15425.1	13126.1	14838.9	29160.6	52209.8	35335.9	15504.5	13450	14467.1	17062.8	18248.3	15909.6	254739
1969	12092.9	11959	25278.4	68715.2	69703.6	42811.1	41537.9	39987.7	23812.7	16720.7	17138.1	18158.3	387916
1970	16482.3	14246.5	49513.5	70029.2	61881.4	35204.1	13442.5	11612.5	14522.2	19957.3	19597.4	15780.5	342270
1971	9903.5	24771.7	48474.5	43574.6	30436.2	38670.4	21488.3	25418.6	22053	18908.6	19761.1	16022.2	319483
1972	13129.9	12284.6	19329.4	20671.8	21425.4	31111.3	15245	14201.9	14550.9	19548.5	17434.3	14586.5	213520
1973	11433	22355.3	24939.3	55935	59853.7	45309.5	16794.9	14948.7	15896.2	19381.5	19430.7	16182.1	322460
1974	13140.1	49676.5	55458.4	68812.2	41013.9	66368.3	55213.5	21170.7	20918.2	21118.3	19787.4	19401.5	452079
1975	14675	13397.8	16825.3	16349.1	52098.4	58157.1	22533.5	28069.5	23569.4	18238	18631.5	17925.4	300470
1976	19721.1	15650.8	14228.8	13243	13308.9	14551.6	9397.8	9707.4	9431.5	14082.4	10488.1	11690.5	155502
1977	7361.9	6806.7	7226.1	11196.5	15065	11420.7	7762.4	6851.3	6824.8	7111.4	6419.5	6724.8	100771
1978	5314	6020.3	13341.4	48521.5	45971.7	53460.9	36412.2	18698.1	15072.8	11202.3	18962	13113.1	286090
1979	9482	11418.1	16904.6	20024.3	34761.2	30377.2	15513.6	13493.3	19471.9	18180.8	18909.9	16581.9	225119
1980	10509.6	16684.2	19139.1	62625.9	73340.2	43405.1	18246.1	14016.8	13075	11578.7	17413.9	12765.7	312800
1981	10378.9	9805.6	16723.1	25143.3	25345.2	28644.2	13143	9509	12733.1	14312.2	12998.6	14461.9	193198
1982	9352.3	38059.3	64528.4	58426.3	69477	57386.2	71834.6	33153.8	21011.2	17639.4	18793.5	19625.2	479287
1983	20970.6	32894.7	55019.3	56555.5	76446.1	66861.9	52339.4	50166.3	48195.4	25547	21353.7	26522.2	532872
1984	18432.9	52774.8	71257.8	48790.3	33237.7	31077.8	16123.7	11162.1	16122.8	19105.7	19427.6	15465.3	352978
1985	11143.4	28288.8	24004.9	16698.4	14693	13844.5	12597.6	14056.5	13224.6	14493	10306.1	12864.3	186215
1986	8320.9	9764.8	15560	21930.3	82710.9	70503.1	20728	12173.3	11658	12693.4	19340.1	14832.3	300215
1987	10745.1	8823.4	16907	17405	19067.9	22963.3	12071.2	9477.2	12023.1	10696.9	8657.7	9002.8	157841
1988	7502.9	7352.9	15770.2	24990.3	11731.3	11150	8588	9006.4	9485.6	10308.9	8845	9328.4	134060
1989	7046.9	9734.8	9499.1	11662.5	9609.1	43353.8	21451.9	14773.7	15031.6	15385.6	12629.1	12844.2	183022
1990	9495	7557.5	9383.8	18142.9	15296.9	12167.5	15934	10857.1	11715.2	12370.8	10191.8	9922.5	143035
Avg.	11354.8	15432.2	24728.6	31234.6	36912.2	32053.5	23795.3	19279.4	16038.5	15630.4	15480.6	14115.2	256855

Run Date 2-25- 99
Sacramento River flow below Freeport
TRN_FES9 = PROSIM99;TRINITY R EIS/EIR FLOW EVAL STUDY;C09A;BDPA;1993 WRBO;L2 REF
Equation is +flow 17
Report is in ascending order by year

Units are in CFS

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1922	11615.4	11405	16867.6	17043.1	31037.4	28152.6	20804.8	41146.3	34504.5	16049.9	19146.5	15000.1	262773
1923	11467	15249.9	27153	30190.3	15793.6	14586.5	22987.9	15430.1	14981.1	20416.7	18140	16378.6	222775
1924	11836.5	10633.3	17212.3	16164.5	15931.6	11566.3	6410.4	7392.6	6487.5	6633.1	6398.3	6475.3	123142
1925	7843.8	7235.9	11703.3	11130	47767.5	22821.4	20611.6	12928.3	14393.8	16889.4	14365.8	15011.8	202703
1926	10667.2	9693.4	11894.3	17055.9	35193.7	15034.5	17745.2	15999.3	10720.8	9680.3	8588.4	11651.2	173924
1927	8539.1	22503.2	19273.7	34746.8	73140.8	40460.5	44197	23508.7	16302.8	18405.3	20298.8	15164.5	336541
1928	10131.9	20934.8	15356.4	24428.6	23809.2	66286.7	25834.7	19672.7	14020.8	16092.4	18556.9	15125.7	270251
1929	10490.2	11551.6	16604.3	16970.4	15423.6	11955.1	7143.4	8489.1	8904.2	9507.7	9260.7	8093.4	134394
1930	7565.8	6704	15570.5	20402.5	16447	27434.2	11330.1	10718.7	9619	12008.9	11079.9	14710.8	163592
1931	8330.6	8567.9	12191.5	13913.9	13069.9	10298.7	8749.9	8090.3	6870.6	6899.8	6845.5	6895.8	110724
1932	5943.8	6333.8	17224	19447	13717	10819.4	8621.2	11312.2	13228	11012.3	11328.3	13713.7	142701
1933	8036.4	7192.1	12946.8	14112.1	12571	12388	11082.5	7781.2	9044.1	6891.3	7579.4	8304.9	117930
1934	6774.9	6332.3	13516	17165.8	13538.6	11186	9970.4	7662.6	9343	7359.2	7120.4	7004.2	116974
1935	5950.6	10501.8	9327	25135	12288.4	23966	41755	31085.2	15256.1	16143.8	19223.9	15549.2	226182
1936	11602	10832.4	16917.4	33652.5	55368.7	29441.8	19631.7	14581.5	14418.3	16065.2	19063.8	15577.5	257153
1937	9842.3	10676.2	16574.2	13574.8	29400.2	37300.2	20894.9	17816.4	14525.5	14091.2	18887.1	15649.5	219233
1938	9949.3	23178.1	42583	29736.6	68558.6	69657.7	52311.4	48662.5	34410.8	16801.4	15975.6	14908.3	426733
1939	13835.1	13295.7	14924	14263.3	13203.3	13052.2	9590.8	9094.6	12122.1	12363.1	12383.4	12514.4	150642
1940	10823.3	8360.7	12488.9	25981.7	52636.1	66657.2	50955.4	17966.3	12951.3	17749.2	18424.5	14555.8	309550
1941	9233.7	11195.3	39732.1	60870	69455.8	57671	51715.4	37951.6	18275.3	15351.5	15300.2	14997.1	401749
1942	14978.5	14975.7	52676.2	57287.1	73689.1	24000.1	41716.6	33609.2	24756.9	15213.4	15134.2	13951.8	381989
1943	13950	19690.5	28992.2	58213.6	46764.1	57745.6	27395.8	18518.3	11883.9	13442.8	19611	15244.2	331452
1944	10854.4	11484.6	16511.9	16602.4	24559.8	20310.6	10968.2	10420.8	15051.5	14004.9	13190.4	14040.3	178000
1945	10067.9	15621.3	16186.9	12795	42750.4	26782.6	12006.6	12185.5	16686.4	19045.4	17842.3	15441.2	217412
1946	9167.4	13618.2	51011	45535.3	28405.6	17270.3	12812.4	15126	16426.9	16412.4	17500.6	14732.5	258019
1947	10074	11237	15892	15579.4	17714.6	18781.9	13911.4	9815.3	11844.2	10616.9	10063	10645.6	156176
1948	9984.1	10202.3	8274.4	14558.7	13184.5	16098.6	24253	28510.3	21826.7	20750.5	18204.7	14186.8	200034
1949	10945.1	11499.9	16967.9	15614.6	12524.2	39934.6	12696.2	12547.6	12637.3	12701.1	11430.5	13054.4	182553
1950	9228.7	9794.2	9860.7	21577.9	32906.7	21890	18519.1	16650.5	16320.5	18757.9	17101.1	14149	206756
1951	11853.9	36613	63637.3	53917.1	53210.5	31880.9	17254.1	16745.7	14682.3	18112.9	19748.8	16564.7	354221
1952	9969.2	15582.4	40431.4	58650.8	59192.2	49748.3	52077.4	50714.1	37714.8	22031.3	18635.9	15990.9	430739
1953	14564.6	13406.3	39782.5	62759.4	24935.8	22471.4	16632.4	24123.9	25397.3	16275.6	19644.8	15875.9	295870
1954	13689	17750.4	15667.4	32994.9	51069.7	45657.8	38880.8	23780.3	14930.1	18326	19212.6	15102.3	307061
1955	10638.5	15394.9	24904.7	18889.3	15852.7	11913.7	9832.2	11706.5	15420.9	10982.5	10268.3	12330.2	168134
1956	9306	10752.8	61769.6	70923.9	60614.4	35199.4	20233.9	37698.8	21315.4	16577.3	17289.7	15687.1	377368
1957	16954.5	12052.5	14156.8	16686	31435.3	42939.6	20089.1	15535.3	16903	18290.7	19680.4	16137.5	240861
1958	19057.5	15466.9	23279.2	36935.8	74024.4	62274.4	60870	39910.3	34254.5	19337.4	18850.7	18408.1	422669
1959	14464.5	12090.9	12342.8	37902	44735.1	21543.1	12635	14531.1	14510.8	15548.5	18109.5	14204.8	232618
1960	11959.1	11242.8	17670.7	16064.4	28339.3	18015.8	14974.2	11606.5	12049	12239	11469.4	12223.5	177854
1961	9829.4	11706.5	15216.3	12264.2	32861.7	18473.8	14471.4	11309.1	12020.2	10134.7	10429.2	11214.5	169931
1962	9506.3	7933.2	15497.8	10981.8	46665.7	30793	14480.3	17930.5	14440.8	15996.1	18527.1	14880	217633
1963	29850.6	16558.7	27603.4	15791.3	55721.1	29144.6	62091	26684.5	15423.6	18952.2	20173.9	15006.3	333001
1964	13422.3	26714.5	14425.6	26035.3	16557.8	11564.7	11855.6	12882.5	12902	12034.2	11894.6	12156.9	181446
1965	9687	15550	60049.5	68375.8	31714.7	21442.8	43661	23858.3	13562.9	15105.3	19037.5	12525.1	334570
1966	9052.9	22113.1	15727.8	31529.4	23859.6	22859.8	15309.4	17969	14395.2	14478.3	17737.4	14404.6	219437
1967	11397.9	14926.3	36322.7	38041.3	46391.3	46589.7	37388	40873.4	38580	19029.7	17656.2	15068.9	362266
1968	14861.7	13185.1	15198.3	29805	52994.3	35541.2	15399	13440.2	14459.7	15782.7	17950.3	15393.3	254011
1969	11731.3	11922.1	20893.3	68984.7	69703.6	42811.1	41632.9	39987.7	23812.7	15925.8	16693.7	17392.1	381491
1970	16232.3	14268.8	49768.9	70029.2	62255.7	35204.1	13424.4	11612.5	14522.3	19962.1	19597	15780.6	342658
1971	9903.5	21437.4	48474.5	43574.6	30612.1	38582.5	21511.7	25754.4	22053	18825.4	19757.6	15960.4	316447
1972	12101.6	12343.6	19849.1	21670.7	21627.9	32409	14999.8	14192.3	14535.8	18102.4	16912.7	14200.3	212945
1973	11815.4	18826.9	24215	55955.2	60480.8	45309.5	16794.9	14948.7	16106.7	17750.1	19599.1	16198.2	318000
1974	13621.7	49176.5	55477.5	68812.2	41062.3	66791.2	55402.3	21170.7	19611.8	21060.5	19787.4	17521.5	449496
1975	14495	13397.8	17170.4	16625.3	51942.3	58294.6	22533.5	28069.5	23569.4	18238	18496.8	16723.1	299556
1976	19471.1	15709.8	14890.6	13691.2	13294.7	14605	9075.1	9216.9	9264.2	13797.3	10094.1	12049.1	155159
1977	6805.1	6459.5	9852.8	11194.2	15072.5	11423.9	7190.8	6851.3	6827.1	7111.4	6419.8	6306.7	101515
1978	5629.3	5455.7	13181.4	47340.1	45971.7	53199.1	36412.2	18698.1	15072.8	11202.3	18977.8	13113.1	284253
1979	9889.4	11418.1	16904.6	20024.3	34430.1	30377.2	15658.1	13498.6	19468.1	16255	19109	16597.8	223630
1980	10114.1	16678.4	19133.7	62716.5	73744.9	43405.1	18246.1	14016.8	13075	12131.1	17417.5	12765.7	313445
1981	10620.5	9805.6	16723.1	24434.7	25345.2	28644.2	13204.3	9544.4	10672.6	11561.3	13182	13953.7	187692
1982	9035.4	39792.8	64713.8	58411.2	69531.3	57967.5	71877	33153.8	21011.2	17421.4	18793.5	19625.2	481334
1983	18745.7	33036.4	55121.5	57377.8	76533.5	66861.9	52747.9	49981.8	48195.4	25547	21353.7	26017.2	531520
1984	18252.9	53134.7	71257.8	49464.8	33237.7	31940.2	16123.7	11162.1	16108.8	19110.4	19427.3	15465.3	354686
1985	11609.9	28064.3	23628.7	16348.9	14682.1	13715.5	12606.5	13165.8	12822.4	11725.9	11464.4	12828.4	182663
1986	9383.3	10576.8	15552.8	18489	82708.7	70517	20728	12173.3	11658	12048.7	19335.4	14827.7	297999
1987	10772.1	8862	16907	17405	19095	22963.3	11603.4	8985.3	11599.2	9476.6	9860.9	9019	156549
1988	8657.9	7793	16160.4	24371.4	11734.5	9634.1	8477.4	8143.8	10183.9	12060.1	9140	9795.6	136152
1989	7641.9	9811.7	9483.7	11646.2	10696.5	42549.1	21577.7	15519.5	13397.3	10979	10773.5	13023.5	177100
1990	9801.4	7874.7	9618.4	18318.1	14642.1	12146	13470.1	11520.5	11348.7	14706.4	10954.6	11299.3	145700
Avg.	11393.1	15150.5	24624.6	31147.6	36933.8	32042.8	23624	19236.8	16604.2	14950.6	15529.1	14005.3	255243

Run Date 5- 4- 99
Sacramento River flow below Freeport
P99N_CI2 = PROSIM99;CVPIA PEIS R. CUMUL. IMP.;C09A;BDPA;1993 WRBO;L4 REFS;B2(US+
Equation is +flow 17
Report is in ascending order by year

Units are in CFS

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1922	11024.1	11694.6	18433.5	17908.4	28055	29629.9	23179.9	39804.9	33939.6	17369.8	19219.8	14364	264624
1923	12832.8	15640.4	25686.5	28997.2	17775.3	16630.3	22779.4	14832.7	16741.2	19163.3	18340.2	16099.1	225518
1924	10120.5	9889.7	14723.2	15997.1	16320.8	11236.7	5993.8	7236.2	6424.5	7140.4	6430.2	6575.6	118089
1925	7440.4	6796	11188.3	10713.3	48234.1	23578.8	22908.6	14127.6	16917.9	13639.6	12902.9	14288.6	202736
1926	8238.9	8538.6	11022.2	17846	36073	16894.6	18960.9	11899.9	10693.7	9444.1	8282.6	11312.1	169207
1927	9450.9	23439	19561.6	34468.6	73029.9	41395.5	41945.2	24409.9	16238.9	21760.5	20074.2	16614.1	342388
1928	12137.1	17812.6	16201.3	24190.3	24689	62080.8	27699.2	13360.5	15386.1	18230.8	19198	15073.4	266059
1929	10099.4	12103	16479.8	16831.8	16166.6	12724.5	6966.9	7974.5	9743.1	7967.2	7282.7	8562.1	132901
1930	6309.3	5762.9	15281.8	21628.1	17797.9	28518.1	12715.2	12336.7	8746.5	8625.6	12241.3	12759.1	162723
1931	7874.9	8409.5	9339	14441.6	12952.9	15898	7028.7	7662.1	6630.6	7307.1	6854.2	7235.1	111634
1932	5636.8	5690.2	16620.4	20254.9	13591.9	10991.6	9485.7	12743.5	13179.7	8270.6	13516.9	12193.3	142175
1933	8705.2	8256.8	12087.7	14402	12648.8	13292	10052.2	8609.1	8590.3	6805.9	6870.9	6990.5	117311
1934	6602.9	5935.3	13069.1	17583.7	14098.8	11483.7	10041.6	8170.4	8924	7372.6	6999.9	8193.3	118475
1935	5806.8	9838.1	8716.9	24686.6	13370.7	24349.5	39616.3	25972.5	17645.6	16297.9	15534.5	14731.5	216567
1936	10174.8	9705.2	15206.7	32685.4	55223.1	29576	19932.6	15511.8	15076.4	19024.7	17463	15911	255491
1937	9352.8	9137	15766.6	13417.1	29195.6	36146	21268.4	14231.1	16115.3	16177.8	16329.5	14261.9	211399
1938	8901.7	22976.1	39753.4	28520.1	69940.1	69213.9	51888	48395.6	33755.1	17181.7	16899.9	11889.6	419315
1939	13705.3	13782	16409.8	17283.7	14451	14721.7	10594.8	9535.5	9236.9	8366.3	10683	11609	150379
1940	8381.1	8286.5	10533.2	26375.1	55513.1	66335	51213.8	17797	13484.2	18566.4	17663.1	13924.8	308073
1941	9423.2	11315.2	32705.4	60758.9	69398.4	56846.7	50911.4	37551.1	19326.2	15166.6	17046.4	12569.5	393019
1942	13567.6	14802.8	51305.9	56844.9	73736.7	27628.6	40758.6	29981.7	24067.8	15653.7	19437.9	14010.4	381797
1943	12096.3	14723.3	26927	58498.1	47243.7	56435.7	27199.7	18614.2	12652.1	19279.4	19539.1	16041.7	329250
1944	11644.1	12228.5	16604.2	17558.7	25537	22856.3	9578.5	9928.4	13942.1	11171.4	13980.8	12605.8	177636
1945	8572.2	15189	17207.9	14565	40245.2	24808.5	14272.1	12480.3	17455.2	18851.4	16609.3	14472.3	214728
1946	10144.4	13901.7	44541.1	44967.6	25910.1	18781.9	12288.4	13312.9	17891.9	19752.9	17375.7	16324.3	255193
1947	9827.4	11828.8	15957.5	15625.8	18730.3	20373.3	13278.3	10260.9	8744.9	8898	9946.9	11092.6	154567
1948	9413.2	10804.7	9159.9	15609.9	15462.1	17326.5	25182	26975.3	22212.7	20982.2	17915.9	14219.9	205264
1949	11217.7	11622	17236.6	15646.3	13802.4	36853.5	14122.6	12083.5	12703.5	9681.7	12496.7	13038.2	180505
1950	9170.6	10531.9	11752.1	20012.1	32422.4	22448.7	18012.2	16301.8	18681.8	19662.4	19103.6	13584.1	211684
1951	10649.2	37925.2	58736.4	53261.1	53407.4	31059.7	14846.8	16747.1	13990	19738.8	19717.4	15705.2	345784
1952	11545.6	15562.6	37330.1	58361.6	59037.9	49031.5	51666.3	50446.9	37088	21405.1	17103.2	15021.6	423600
1953	12822.9	14362.2	39046.7	62164.6	28092.5	25372.4	16924	21937.8	23733.4	20539.6	19778.2	16316.7	301091
1954	13429.7	17113.8	15522.8	25940.1	50593.6	43985.5	38440.2	18677.9	15035.9	19839.2	19705.1	15500.4	293784
1955	11729.7	16227.2	24032.1	21714.9	16334.6	15759.1	10114.2	11910	14733.1	11298.6	9775.3	12185.9	175815
1956	8613.7	11224.6	58036.2	71901.6	59886.6	36590	21540.6	33422	20108.6	18096.2	20026.7	15182.4	374629
1957	12453.1	12660.2	16881.2	17169.1	24530.8	41796	16984.7	17938.1	17418.5	21227.8	19526.4	16794.4	235380
1958	18147.8	15878.9	23940.9	36553.2	72161.4	61748.5	60393.1	39311.3	33599.4	19224.8	18012.5	17462.8	416442
1959	14788.3	12797.1	14497	36750.5	43673.5	22484.3	10631.3	12502.1	14793.2	16840.9	18381.8	14589.7	232730
1960	9916.9	9370.4	14874.2	15948.2	28269.2	20816.8	12467.4	11935.2	9489.9	9807.9	11701.8	11829.5	166428
1961	8874.1	13483.1	17015.9	15084.1	31556.7	20216.3	11494.5	13249.8	9084.7	8752.7	10327.6	10992.3	170132
1962	8797	9932.4	17695.1	13149.8	44761.5	30557.1	11440.4	12733.7	16264.5	18584.8	19657.1	16912.6	220486
1963	28662.7	14777.1	26507.3	17074.8	58129.8	30702.9	60085.4	26585.4	16579.2	21702.3	19806	15864.6	336477
1964	13750.9	23229	14719.9	24658.7	17550.2	16198.3	9659.6	10912.3	12236.3	12108.2	10562.7	12294.6	177881
1965	8448.8	15584.5	63511.2	68034.7	34100.5	24311.6	36503.6	19229.2	14933.1	19234.7	19892	14146.8	337931
1966	10595	19360.2	14905.7	28696.8	24988	20433.9	12208.8	13529.2	14545.4	16769.3	14205.5	13777	204015
1967	9836.5	14867.8	35232.3	38948.6	47833.7	45325.5	38029.1	39856.7	37939.7	19255.8	16436.2	14570.5	358132
1968	14844	13228.7	16294.8	29900.8	51715.1	36318.1	10998.4	12193.4	14481.9	16702.7	18361.5	17068.5	252108
1969	10341.6	12710.2	22900.1	67756.3	69342	43386.2	40520.8	39771.9	23200.5	16753.1	15273.7	16275	378231
1970	13894.9	14581.7	48702	71800.8	62325.2	35417.3	10603.8	13434.5	13931.1	19072.8	19797.5	16452	340013
1971	10437	18171.4	47205	43213.1	30495.1	37401.4	21182.7	27561.5	21507	22400.7	19590.4	15938.3	315104
1972	11787.6	11894.7	17538.4	19817	21908.5	29194.1	11850.3	13559.2	14320.3	17573.6	19818.9	16621.2	205884
1973	12078.8	19419.6	22728.8	54124.6	60366.7	44696.3	19064.4	15061.3	18823.3	21602	19151.3	16135.7	323253
1974	12714.3	44591.2	53383.4	69599	40292.1	65205.3	54983.9	22086.5	19706.7	20848.1	18831.6	15446	437688
1975	14635.9	13980	17684.8	18133.5	49843.8	57296.8	25919.6	26659.1	22136.7	17888.7	18850.5	13995.8	297025
1976	18943.9	15575	17241.2	17244.4	13588.9	16884.3	8906.4	9717.7	8673.3	7385.2	14388.9	11066.6	159616
1977	6792.3	6449.9	6326.3	9623.2	12565.1	12702.6	7897.6	6935.3	10893.9	7369.3	7087	6926.2	101569
1978	6248.6	6091.8	14057.7	46425.5	41671.2	53126.4	35894.2	20146	15374.3	18331	19767.2	14624.4	291758
1979	10119.7	11925.7	17172.4	21891	29840.3	28748.3	17341.5	12700.8	19344.2	17591.2	16115.6	14318.4	217109
1980	11182.2	14498.6	18830.7	62588.8	73210.6	42239.7	19717.5	15836.8	13955.7	15603	19635.9	12126.5	319426
1981	11254.1	9758	16987.9	20770.8	25577.7	23978.1	16147	10997.5	8541.1	7970.3	13537.7	13516.5	179037
1982	9842.3	35826.5	66468.7	57846.3	69708.9	53709.2	70947.1	32718	20492	18218.7	17535.1	18911.4	472224
1983	17492.7	33557.2	54833.2	57090.1	76493.5	65958.3	52252.6	49438.9	47667.3	24867.6	20625	24937	525214
1984	18239.5	56670.9	71462.5	49327.2	35532.2	28791.3	15693.8	14493.3	16658.2	20608.4	19328.5	15787.4	362593
1985	11929.7	27741.6	23935.3	16192.5	17167.5	15494.6	11118.6	12044.6	11030.5	10176.3	11753.8	12824.9	181410
1986	8463.1	10650.4	16668.7	19552.6	83451.2	68740	22015.4	13644.5	11806.9	20756.9	19377.9	14909	310037
1987	11443.2	9673.1	17160.9	17250.3	19603	23523.8	9851	9649.5	8634.3	8565.1	7742	8291.7	151388
1988	8004.3	7341.9	16531.9	24876.1	13426.5	10476.1	8967.1	9347.8	8604.2	7472.7	8384.9	10459.9	133893
1989	7958.6	9892.1	9698.1	11754.2	11005.5	40191.1	23495.3	12860.3	12339.8	11099.1	10050.9	13242.9	173588
1990	11659.5	9709	10624.3	19496.8	15851.4	15562.8	11247.2	9401.4	10562.3	8849.5	10249.2	10817.2	144031
Avg.	11032.5	14912.1	24150.9	31159.5	36978.3	32239	23187.3	18598.3	16513.1	15361.5	15450.9	13773.7	253357

Run Date 1- 4- 99
Sacramento River flow below Freeport
TRN_RSP6 = PROSIM99;TRINITY R EIS/EIR STATE PERMIT ALT;C09A;BDPA;1993 WRBO;L2 RE
Equation is +flow 17
Report is in ascending order by year

Units are in CFS

Year	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Total
1922	11615.4	11405	16867.6	17043.1	31037.4	28152.6	20804.8	41586.9	34504.5	17376.8	19089.2	14993.5	264477
1923	11467	15249.9	27259	30228.1	15827.1	14586.5	22987.9	15430.1	14980.9	20431.9	18152.1	16462.9	223063
1924	11984.8	10638	17212.3	16164.5	15927.6	12208.5	6687.6	7663.4	6756.7	7461.5	6782.9	6729	126217
1925	7831.1	7265.3	11735.7	11176.3	47726.5	26806.5	22550.7	13926.1	14099.9	17348	14443.4	15748.5	210658
1926	10295	9498.6	12029.3	17371.1	35486.9	15152	18571.3	15404	12917.8	13400.3	8416.8	12044.6	180588
1927	8631.6	22767.9	21025.1	35598.7	73460.7	40498.2	44211.1	24044.1	16302.8	18416.3	20297.4	15181.7	340436
1928	12573.3	22682.6	15852.7	24792.1	24138.3	66900.6	25834.7	19588.8	14020.8	17417.2	18334.7	15123.6	277259
1929	10489.4	11550.3	16604.3	16970.4	15423.1	11957.7	7386.7	9244.1	11221.1	12864.2	9263.2	8465.1	141439
1930	7260.7	6643.1	15732.8	20546.6	16603.2	27760.3	12230.8	10743.5	10186.7	12872.5	10915.4	14394.1	165890
1931	8248.4	8533	11431.6	13764.2	13154	10407.4	10559.5	8382.7	7058.5	7121.3	7058.3	7130.4	112849
1932	6145.6	6341.6	17230.5	19459.2	13542.7	10824.1	9577	11960.2	14553.2	13049.8	11389.3	12807.7	146881
1933	8096.5	7631.4	11930.6	14179.6	12760.8	12463.6	13005.2	8487.1	11061.7	9838.4	8199.5	7597.4	125252
1934	6883.1	6338.6	13493.9	17012.5	13461.2	13466.9	10279.7	8228.6	9439.8	7843	7662.8	8099.5	122210
1935	6343.5	10675.3	9500.1	25283.5	12430.7	24033.2	42019.2	31030.1	15480.2	16409.5	19219.8	15635.8	228061
1936	11637.1	10852.3	16917.4	34978.7	55552.2	29441.8	19631.7	14581.5	14418.3	18624.6	18809.9	15563.6	261009
1937	9839.4	10674.8	16574.2	13573.9	29891.2	37844.3	20894.9	17785.2	14534.5	14717.6	18887.1	15629	220846
1938	9945	23174.6	45351.6	29720.3	68206.9	69658	52353.9	50162.4	37553.8	17629.1	16782.1	16008.1	436546
1939	16554.7	13606.7	15537.8	14754.4	13638.2	12987.1	9573.4	9634.2	10679.3	12737.6	10352.8	12933.3	152990
1940	7830.6	7804.4	11681.7	27452	58287.9	66672.7	50955.4	17855.8	12660.2	17774.3	18467.5	14586.4	312029
1941	9242.1	11869.1	41798.8	61145.8	69671.9	58431.3	51846.1	38723.8	21053	15351.5	15300.2	15606.4	410040
1942	15151.5	15025.7	52676.2	57354.2	73705.9	24000.1	41881.7	36409.2	27943.6	15720.5	15698.8	14493.7	390061
1943	14608.3	19740.5	29092.2	58279.8	46855.3	57820.1	27610.5	18431.9	11883.9	15684.6	19611	15224.2	334842
1944	11597.5	11709.8	16491.8	16602.4	24395.4	20423.7	9939.5	10232.2	14760.6	16073.9	12752.5	14071.5	179051
1945	9250.4	15629.4	18752.7	14201	45739.1	26294.7	11866.4	12168.6	16687	16436.1	18190.4	15406.3	220622
1946	9540	18664.1	51315.9	45535.3	27607.3	17077.1	12812.4	15140.7	16459.1	20485.9	18076.6	16107.6	268822
1947	10543.2	11609.7	15867.9	15587.1	17715.4	18793.4	16125	10374.6	12636.9	12960.6	9811.5	11924.8	163950
1948	9171.4	10470	8752.6	15815.7	12445.3	16203.7	29890.6	30653.1	21858.1	20764.7	18294.2	14219.7	208539
1949	10961.1	11712.9	16949.2	15614.6	12474.9	39821.2	13041.7	13144.6	14783.5	14806.2	11560.6	13015.4	187886
1950	9171.7	9747.3	9717.9	20985.6	32906.7	21890	18519.1	16656.6	16320.4	18701.6	17070.2	14130.4	205818
1951	13554.5	44348.5	63582.8	54708.6	54411.7	31880.9	17254.1	17780.5	14609.3	19680.9	19601.1	16550.3	367963
1952	10691.8	17839.1	41700.5	58790.7	60009.7	50335.7	53375.6	52166.1	40395.6	22031.3	19308.6	16786.4	443431
1953	14737.6	13406.3	39871.4	62759.4	24935.8	22471.4	17236.9	25598.2	28697.3	17135.8	17934.8	15849.2	300634
1954	15028.6	20078.2	14942.2	33969.9	51145.9	45741.4	39077.3	23710.5	14210.8	16325.9	19212.5	15102.2	310545
1955	10956.7	17456.5	24919.6	18889.2	15852.7	11884.5	9866.4	11751.1	16107.7	14776.5	11736.3	13711.6	177909
1956	8947.9	10893.2	62884	70927.1	60639.5	35613.6	21127.3	39482.5	24034.9	17762.8	18096.3	16623.8	387033
1957	18020.1	12102.5	11741.3	16250.4	35016.6	43027.5	19975.1	16201.4	16734.5	19170.8	19585.6	16125.9	243952
1958	21487.5	16921.3	24676.7	37507.2	73883.1	62312.2	60976.9	40564.6	37554.5	19337.4	18850.7	19391.7	433464
1959	14637.5	12140.9	12381.5	37902	44953.9	21464.4	12635	14531.1	14509.3	15756.6	18080.5	14203	233196
1960	11957.9	11242.5	17670.7	16064.4	27621.2	20435.7	16198.4	11078.4	12851.8	15581.8	11764.7	12650.5	185118
1961	8986.6	12930.2	20034.6	12892.9	33022.2	18552.6	13639.8	11992.6	13139.5	12823	9802.7	11472.4	179289
1962	8384.4	9118.5	17751.7	12148.1	46594.2	30762.9	14444.1	17930.5	14171.7	16014.8	18556.6	14896.8	220774
1963	33495.2	16558.7	27603.4	15791.3	57070.4	29144.6	62363.2	29468	15423.6	17788.3	20303.5	14715	339725
1964	16104.3	28071.6	13974.4	26777	15557.8	13121.1	11931	13070.1	13731.5	15817	11548.5	11851.8	191556
1965	8799.6	15166.7	62867.7	68255.9	31738.7	21468.7	43691	23821.6	13605.5	15084.6	19051.4	12542.9	336094
1966	10622.9	25881.5	16486.4	32211.6	23859.6	24285.1	15096.5	17969.1	14309.9	15083.3	17671.7	14314.6	227792
1967	11374.8	18551.1	36322.7	38104.2	47804	47179.9	37388	42527.8	41350.8	19873.7	18218.8	17058.4	375754
1968	15348.1	13235.1	15298.3	29955	52994.3	35638.5	15377.5	13440.2	14459.7	16103.9	17906.4	15391.1	255148
1969	11730	13168.1	25608	69011.9	69703.6	42811.1	41711.3	41728.5	26693.6	16948.6	17597.9	18395.6	395108
1970	16405.3	14318.8	49768.9	70029.2	62315.3	35204.1	13413.1	11612.5	14522.3	19965.1	19596.8	15780.6	342932
1971	10615.9	25728.9	48602.8	43883.8	30291.6	41090.8	20996.6	28627	24271.8	17939.2	19887.1	15492.7	327428
1972	14692.5	13746.5	22237.3	21820.7	21777.9	32409	14967.4	14201.9	14551.6	16473.6	17815.4	14616.3	219310
1973	11874.2	23161.1	24938.8	55928.3	60650.1	45390.4	16941.1	17732.3	16218	19381.5	19430.7	16182.1	327829
1974	15236.9	50373.2	55493.8	68812.2	41158.4	66791.2	55525	23970.7	22911.8	21118.3	19787.4	19732.8	460912
1975	14668	13443.2	17274.9	16708.8	51895	58442.9	22533.5	30837	26902.9	18238	18631.5	17837.6	307413
1976	19644.1	15759.8	14990.6	13771.2	13308.3	14521.3	9893.1	10201.6	10389.4	15248.2	9889.2	11866.8	159483
1977	7860.8	7254.2	7255.2	9442.7	15074.6	11442.8	7641.4	7119.3	6892.3	7176.9	6412.8	6731.4	100304
1978	6174.5	5833.1	13221.3	49898.3	45986.5	54060	36445.4	19282.3	15072.8	13035.4	18824.4	13113.1	290947
1979	10164.6	11418.1	15120.4	21442.6	35952.7	30377.2	15359.2	14612.4	19381.9	16857.4	19030.7	16581.9	226299
1980	11925.3	16750.6	20067.1	64672.5	73919.1	43405.1	18246.1	14016.8	13075	14252.7	16345.3	12765.7	319441
1981	12326.6	9805.6	16592.5	28692.9	26317	29124.9	13111.8	10007.7	12385.9	12599.9	12370.3	14034.4	197370
1982	8965	40873.2	65053.8	58481.4	69588.7	58046.3	71910	34272.8	23731.6	18678.5	19567.5	20722.6	489891
1983	21668.9	33563.6	55121.5	57482.6	76542.7	66861.9	52890.7	50166.3	48195.4	25547	21353.7	26626.5	536021
1984	18425.9	53162	71257.8	49544.6	33366.9	32109	16123.7	11162.1	16105.6	19111.4	19427.2	15465.3	355262
1985	13294.2	31586	24937.8	15287.4	14791.4	15870.7	12121.1	13285.8	13389.6	14936.4	10423.5	13501.4	193425
1986	8500.3	10049.7	15795.8	19401.4	82614.3	70607.9	20728	12173.3	11658	12126.9	19340.1	14832.3	297828
1987	10772.1	8860	16907	17405	19088.7	22971.5	13146.4	10127.3	12942.1	11836.7	9535.1	8963.7	162556
1988	7951.7	7797.5	16080.8	24885.8	11801.1	11237.2	9738	9082.1	11589.6	13033.4	8819.9	9843.5	141861
1989	7542.8	9908.6	9559.8	11721.1	10666.4	42866	21314.4	14587.3	14423.7	14689.8	10617.2	13412.1	181309
1990	9960.8	8171.9	9111.5	18554.3	14575.6	12191.1	15281.6	10842.8	13318.4	14798.2	10167.9	10740.5	147715
Avg.	11832.5	15944.8	25001.3	31477.9	37225.7	32401.9	23990.5	19861	17468.7	15977.7	15521.6	14287.1	260991

Attachment 2

Summary of Water Quality Data for the Spring Creek Debris Dam, January 3, 1996 through January 31, 2000