



**KINGS RIVER FISHERIES MANAGEMENT PROGRAM
ANNUAL TECHNICAL REPORT
2006-2007**



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Note: Photo on the cover of the report is of 4-year old James Long enjoying an afternoon fishing on the Kings River.

EXECUTIVE SUMMARY

The Kings River Water Association (KRWA), Kings River Conservation District (KRCD), and California Department of Fish and Game (CDFG) have jointly implemented habitat and trout population enhancement projects, and conducted a series of monitoring programs in the lower Kings River and Pine Flat Reservoir. These habitat enhancement projects have been implemented over the past seven years in response to the Kings River Fisheries Management Program (FMP) Framework Agreement, which was approved on May 28, 1999. The Framework Agreement includes a number of actions designed to protect and enhance fishery habitat within the lower Kings River and in Pine Flat Reservoir. The Technical Steering Committee (TSC) is responsible for implementing the actions authorized under the agreement and approved by the Executive Policy Committee (ExCom). The scope of activities undertaken as part of the FMP between May 2006 and May 2007 described in this annual technical report includes: a compilation and synthesis of information regarding habitat enhancements, trout population enhancements, and monitoring activities conducted as part of the FMP.

Hydrologic conditions and Pine Flat Reservoir operations and flows within the lower river during 2006-2007 are characterized by high seasonal variability characteristic of the Kings River watershed and water supply operations. Findings and recommendations regarding hydrology and operations include:

- Pine Flat Reservoir operations were successful in maintaining the temperature control pool in the reservoir above the minimum level specified in the Framework Agreement;
- The reservoir releases were characterized by relatively high stream flows during the irrigation season, which were substantially reduced during the non-irrigation season. Average daily stream flows, measured passing over Fresno Weir, were in compliance with the minimum stream flow requirements contained in the Framework Agreement for all 365 days comprising the 2006-2007 program year.
- A real-time telemetry system provided information on flow at Fresno Weir that is available for monitoring and managing conditions within the lower river as part of the fishery program;
- Enhanced Exhibit D flows were provided by KRWA Member Units voluntarily at a rate of 250 cfs (level representing a wet hydrologic year) at Fresno Weir for the second year in a row in the fall and winter of 2006-2007.
- Average daily stream flows, measured at Fresno Weir, were in compliance with the minimum stream flow requirements contained in the Framework Agreement for 359 days comprising the 2006-2007 program year. Of the six days on non-compliance, three were due to operational errors while the uncontrolled flows of Mill Creek dropped off from an earlier rain event. One day was due to unseasonably cold weather (recorded high temperature for January 13, 2007 at Pine Flat was 44 degrees F), resulting in additional water being pumped from the river by farmers along the riparian corridor for protection

of their crops. Two days were due to a flow variance that was approved by the Executive Policy Committee for necessary work to be performed in the river, and for safety purposes of those performing the work. There were only 8 days in which the target of 250 cfs at Fresno Weir was reached exactly. In every single instance other than these 14 days, the flow requirement at Fresno Weir was exceeded, meaning that the flow was at 251 cfs or more for every other day during the low flow period. In total, the KRWA member units contributed an additional 24,800 acre-feet of water to ensure that Exhibit D flow schedules were met;

- The turbine bypass was utilized during the season for dissolved oxygen management. The turbine bypass provides additional flexibility in managing the cold water pool within Pine Flat Reservoir and the temperature of water released into the lower river to support suitable habitat conditions for trout as part of the FMP; and
- In December of 2006, the KRWA member units signed internal agreements that will govern Exhibit D contributions in the future. Prior to signing these agreements, the KRWA member units have provided Exhibit D flows under draft agreements during the 2005-2006 and 2006-2007 water years. The TSC supports and applauds the activities of the KRWA in completing these essential agreements.

Results of water quality monitoring within Pine Flat Reservoir and the lower Kings River during 2006-2007 have shown:

- Pine Flat Reservoir becomes stratified during late spring, summer, and fall showing a characteristic pattern of warmer water near the surface (epilimnion) and colder water with reduced dissolved oxygen concentrations near the bottom of the reservoir (hypolimnion). The reservoir destratifies in the late-fall and winter due to water temperature becoming uniform throughout the water column;
- The temperature of water released from the reservoir into the lower river can be regulated and managed, to some extent, through selective operation of different outlet works, including the turbine bypass, which initiated operations during 2003. However, the ability to manage water temperatures is limited and constrained by the availability of cold water and release points during various seasonal periods within the reservoir, hydroelectric generation, requirements for irrigation releases, and other factors;
- Aeration and mixing of water released from the reservoir have proven to be effective in maintaining suitable dissolved oxygen concentrations within the lower river during periods when the power plant was in operation. Mean monthly dissolved oxygen concentrations, as measured at the ACOE Bridge, during 2006-2007 exceeded 7.0 mg/L.
- Water temperatures within the lower river showed a seasonal pattern with the coldest temperatures occurring during the late winter and temperatures generally increasing during the summer and early fall;

- Water temperature showed a characteristic longitudinal gradient downstream of Pine Flat Dam. During summer months the coldest temperatures were located immediately downstream of the dam and temperatures generally increased with distance downstream from the dam. During the fall and winter, when atmospheric temperatures are cool, a reverse temperature gradient was observed with temperatures decreasing as a function of distance downstream from Pine Flat Dam;
- Results of temperature monitoring, and results from the fishery monitoring program, provided no evidence that either dissolved oxygen concentrations or water temperature conditions within the lower river resulted in mortality to trout or other fish species during 2006-2007;
- Results of the 2006-2007 water temperature and dissolved oxygen monitoring are being used by the TSC to refine water quality monitoring as part of the FMP and as a basis for evaluating alternative operational strategies, including operations of the turbine bypass, to address water quality issues affecting habitat conditions for trout in the future;

The FMP continued habitat enhancement efforts on the lower Kings River during 2006-2007 by the following actions:

- Placed approximately 2800 large (3 to 6 feet in diameter) boulders in the Kings River for habitat improvement and stockpiled an additional 2900 boulders;
- The second enhanced Exhibit D releases in the history of the program were provided for by KRWA member units in accordance with the levels representing a wet hydrologic year of the Exhibit D flow schedule (250 cfs at Fresno Weir, for water year exceeding 2,100,000 acre feet);
- In December of 2006, the KRWA member units signed internal agreements that will govern Exhibit D contributions in the future. Prior to signing these agreements, the KRWA member units provided Exhibit D flows voluntarily under draft agreements during the 2005-2006 and 2006-2007 water years; and
- Fish habitat improvement work in Pine Flat Reservoir completed during this report period occurred between Deer Creek, Island Park and Sycamore Cove. Personnel from the ACOE took the lead in overseeing that these projects were completed. We support and applaud the efforts of the ACOE.

The stocking of trout in State waters is the responsibility of the California Department of Fish and Game. During the 2006-2007 reporting period, the allotted numbers of catchable and sub-catchable size rainbow trout were stocked in the Kings River between Pine Flat Dam and Fresno Weir. In addition, trout eggs were transferred to the lower Kings River for incubation and hatching. Catchable size rainbow trout were also planted in Pine Flat Reservoir and Avocado Lake. A brief summary of 2006-2007 stocking includes:

- Whitlock Vibert Boxes (WVB) were used during this reporting period to hatch eyed rainbow trout eggs, inside the streamside incubators;
- The streamside incubators located downstream of Pine Flat Recreation Area and adjacent to the lower end of the Thorburn Spawning and Rearing Channel, were used extensively during the 2006-2007 program year. 200,000 eggs were planted in December of 2006, 100,000 eggs in March of 2007, and 66,000 triploid eggs in May of 2007. The fry were distributed to the adjacent section of river;
- On October 16th, 2006, 2,100 pounds (25,830 trout) of sub-catchable rainbow trout (4-6 inches in length) were stocked in the lower Kings River as part of the put-and-grow program. These fish were provided by the CDFG at no cost to the FMP;
- On December 12th, 2006, the San Joaquin Hatchery planted 138,244 Rainbow trout fingerlings (323 pounds) in the lower river. There currently is no annual allotment for RT fingerlings on the Kings River. These fish were in excess of the production needs of the hatchery and the Kings was selected as a suitable destination;
- A total of 29,037 pounds of catchable sized trout (35,827 fish) were stocked in the lower Kings River during this reporting period. This increase (61%) over the proposed allotment was due to the “Trophy Trout” program implemented on the Kings River. Beginning December 2005, large trout were planted in the put-and-take section as well as the catch-and-release section. This program continued into the 2006-2007 program year. The trout in the program averaged over 7 pounds each overall, with the larger fish weighing in over 10 pounds during the December through March. The program will continue a minimum of one more year for evaluation;
- No sub-catchable trout were planted in Pine Flat Reservoir during the reporting period;
- Between November 1st, 2006 and March 5th, 2007, 25,000 pounds (42,500 trout) were planted in Pine Flat Reservoir. The catchable trout averaged around ½ pound each at the time they were stocked in the reservoir;
- The most recent planting of Chinook salmon fingerling was April 30th, 2007, which was 59,940 fingerlings weighing 780 pounds; and
- In 2006-2007 reporting period, the San Joaquin Hatchery planted 7,200 hundred pounds (12,270 trout) of catchable size rainbow trout in Avocado Lake.

As part of the FMP habitat and fishery monitoring was conducted within the lower river and Pine Flat Reservoir. Results of the 2006-2007 monitoring program have shown:

- During the 2006-2007 study period, electrofishing surveys were conducted one time, in November, 2006. Six of the seven permanent sampling sites, ranging from 200 to 500 yards in length, were sampled using backpack electrofisher. The numbers of wild trout

captured in 2006 were slightly higher than the numbers captured in 2004 and 2005. As in past years, the most abundant fish were the Sacramento sucker (*Catostomus occidentalis*) and riffle sculpin (*Cottus gulosus*);

- In November 2006 and February 2007, KRCD staff collected insect samples from six sites on the lower Kings River. The results of the laboratory analysis were not available for publication in the 2006-2007 Annual Technical Report;
- Transmitters were implanted and 3 groups of tagged fish were released in the Kings River for study;
- As per the Fisheries Management Program's 2004 Water Quality Monitoring Report, sampling occurred during the 2006-2007 program year at Fresno Weir. The sampling included monthly measurements for general parameters such as temperature, pH, turbidity, alkalinity, and hardness, as well as for basic metals and organophosphates. Results will be analyzed once all samples are collected. Water quality monitoring will continue into the 2007-2008 program year according to the Water Quality Monitoring Report; and
- The Fourth annual Technical Report was completed in February 2007.
- There were 30 permitted bass tournaments with complete data sets at Pine Flat Reservoir during the 2006-2007 program year. The number of participants was 1,000 and the average size of bass returned for Weigh-In was 1.38 pounds.

Public education and outreach activities during 2006-2007 included:

- An issue of Kings River Fisheries News newsletter was published and distributed in the early summer of 2006 with the assistance of the Public Advisory Group;
- KRWA has developed a real-time telemetry system for monitoring water temperature and streamflow at Fresno Weir. During the summer and fall of 2004 information developed from monitoring being conducted on the lower Kings River was compiled in weekly reports and distributed by KRWA to members of the PAG and other interested parties to provide current information on environmental conditions occurring within the lower river that would affect habitat quality for trout. Weekly reports were distributed electronically to inform managers and other interested parties regarding conditions currently occurring within the lower river. The water temperature and flow monitoring and reporting provided a valuable tool for disseminating real-time information. The TSC has recommended that the real-time monitoring and dissemination of weekly reports, when appropriate, be continued as part of the FMP;
- The PAG developed a web page to inform the public, fishing groups, and government agencies about the FMP. The web page also presents angling opportunities and information related to the Kings River. The web page is available at <http://www.kingsriverfisheries.org>;

- An Ad-Hoc committee as approved by the Ex-Com began meeting in April of 2007 on development of public outreach materials for the Fisheries Management Program;
- During the program year, several educational tours were conducted at the Thorburn Spawning and Rearing Channel; and
- The PAG worked extensively with the 2007 Kings River Day event, to provide valuable historical, operational, scientific and recreational opportunities to hundreds of 6th graders. The event was successfully held on May 18, 2007. This annual event has become an important part of the outreach function of the PAG, and comments from students, teachers, and administrators have been very positive.

1.0 INTRODUCTION

The Kings River Water Association (KRWA), Kings River Conservation District (KRCD), and California Department of Fish and Game (CDFG) have jointly implemented habitat and trout population enhancement projects, and conducted a series of monitoring programs in the lower Kings River (Figure 1-1) and Pine Flat Reservoir. These habitat enhancement projects have been implemented over the past seven years in response to the Kings River Fisheries Management Program (FMP) Framework Agreement, which was approved on May 28, 1999. The Framework Agreement includes a number of actions designed to protect and enhance fishery habitat within the lower Kings River and in Pine Flat Reservoir. The Technical Steering Committee (TSC) is responsible for implementing the actions authorized under the agreement and approved by the Executive Policy Committee (ExCom). The scope of activities undertaken as part of the FMP between May 2006 and May 2007 described in this annual technical report includes:

- Monitoring hydrology and operations including inflow to Pine Flat Reservoir, reservoir storage, reservoir releases, operation of remote sensing telemetry systems, turbine bypass operation, and activities to implement enhanced winter flows for fishery habitat as outlined in Exhibits C and D of the Framework Agreement;
- Monitoring water quality including water temperature and dissolved oxygen within Pine Flat Reservoir and the lower Kings River, compliance with dissolved oxygen requirements within the lower river, and planning and monitoring water temperature conditions at the completion of the irrigation season;
- Habitat enhancement projects including boulder acquisition and placement in the river, spawning gravel stockpiling and placement, operation and maintenance of the Thorburn Spawning and Rearing Channel, and riparian habitat protection;
- Fish stocking has occurred as part of the program within the lower river and Pine Flat Reservoir including Whitlock-Vibert box egg incubation, streamside egg incubators, routine stocking of sub-adult and catchable size trout, all done by the CDFG at no cost to the program (except for a small maintenance cost associated with streamside incubators);
- Monitoring activities associated with the FMP included electrofishing surveys within the lower river to develop annual fish population indices, monitoring of fish use within areas associated with habitat enhancement projects such as coves and jetties, monitoring within the Thorburn Spawning and Rearing Channel, water quality monitoring within the lower river, and macroinvertebrate surveys. Monitoring within Pine Flat Reservoir included the compilation of bass tournament records;
- Public education and outreach included summer hydrology and water temperature monitoring reports, internet web page development, news releases, issuance of a news letter on the FMP, and angler access improvements; and

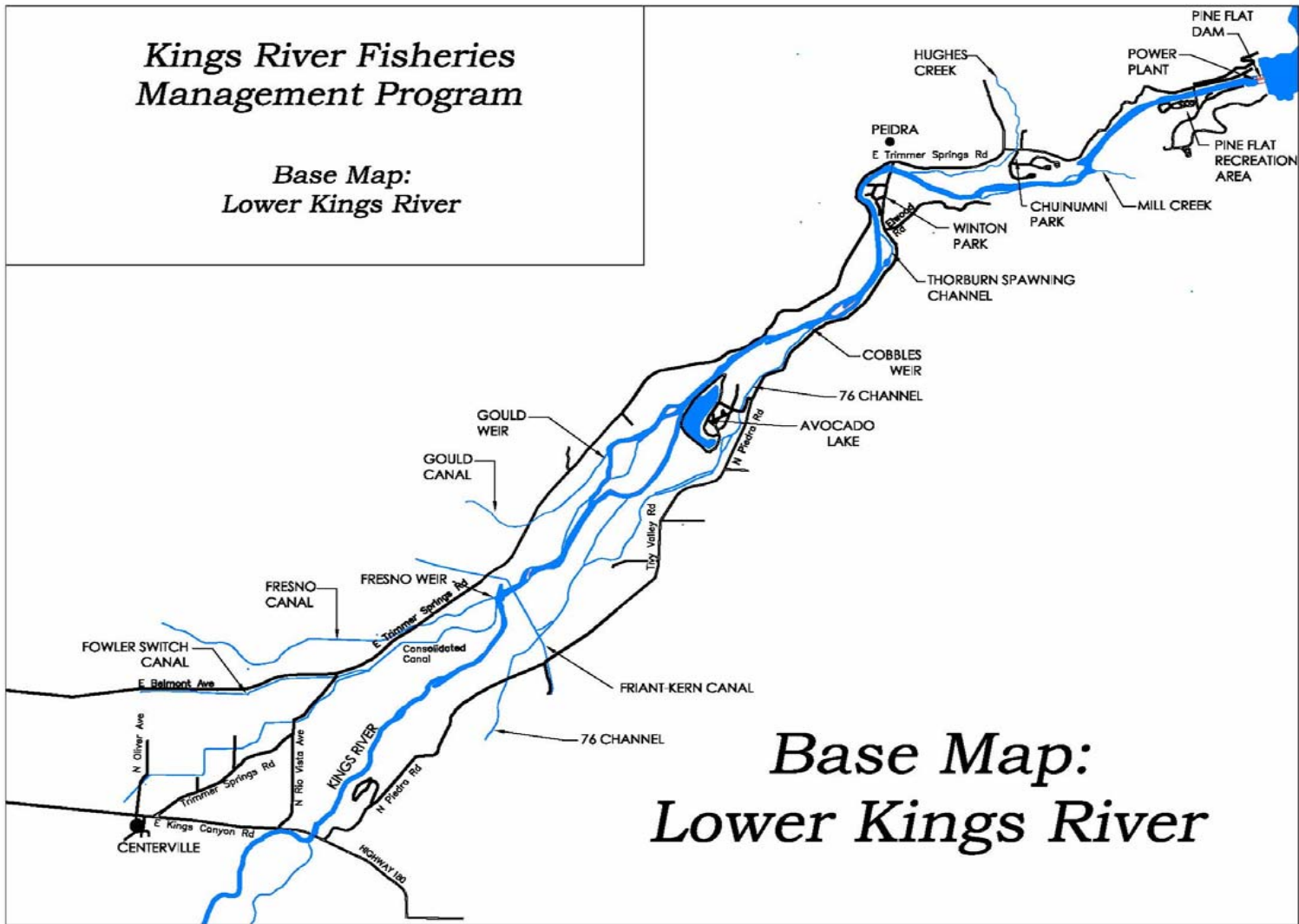


Figure 1-1. Map of the lower Kings River and key geographic locations.

- Maintenance activities included watering riparian vegetation planted along the Thorburn Channel, routine maintenance of the channel headgate, and repairs and maintenance of the streamside egg incubators.

The following report presents a compilation and synthesis of information regarding these habitat enhancements, trout population enhancements, and monitoring activities during 2006-2007. Since the Framework Agreement has been in place since 1999, the technical compilation and synthesis report also presents data from earlier projects and monitoring activities as part of the Framework Agreement. This technical report is designed to compile and summarize information available on the implementation and performance of the FMP and to convey information on the FMP to the ExCom, the Public Advisory Committee (PAG) and other interested parties. This annual technical report is intended to accompany the 5-Year Plan to describe and document results of the FMP to date, and to serve as the technical and scientific foundation for the identification of priority actions to be implemented as part of subsequent 5-Year Plans, to identify significant findings that would affect the fishery monitoring within Pine Flat Reservoir and the lower river, or the identification of specific management actions designed to enhance and improve habitat conditions for resident trout and other desirable fish species inhabiting the Kings River system.

One of the principle objectives of the annual report is to provide a project management structure for reviewing and prioritizing existing and proposed habitat enhancement activities, fish stocking, and implementation of other elements contained in the Framework Agreement. Results of the fishery and habitat monitoring program are intended to provide a technical and scientific framework for identifying design criteria and priorities for determining the appropriate scale and location of habitat enhancement projects, linkages among potential projects to maximize biological benefits and reduce cost, identify priorities for habitat enhancement project locations, and identify potential opportunities for expanding enhancement projects through funding augmentation from collaborative grant applications from state, federal, and private funding sources. In addition, one of the key objectives of the annual report is to help ensure coordination and communication among the parties involved in implementing various elements of the Framework Agreement, and to facilitate a process for reviewing and evaluating the performance of management actions in achieving the overall goals of the FMP. The annual report also provides a framework to present monitoring results used by the TSC to evaluate a variety of alternative approaches each year for meeting the goals for the enhancement program, and for evaluating program performance.

1.1 ADMINISTRATIVE ACTIVITIES

The Kings River Fisheries Management Program's seventh 5-Year Implementation Plan (for program year 2007-2008) was presented and approved by the Executive Committee at their meeting in August of 2007. This 5-Year Plan provided the basic direction for the Technical Steering Committee and program activities through the year.

The ExCom met twice during the program year, on September 28, 2006 and April 26, 2007, to hear reports from the TSC and the public, and to provide direction to the TSC. The TSC met on an ongoing basis to continue their work on program development and administration. The PAG, with Hank Urbach as Chairmen, met on a monthly basis to discuss and develop issues important

to them. Members of the TSC and ExCom routinely attend the PAG meetings to report on their activities and to provide input as requested.

1.2 ANNUAL TECHNICAL REPORT

A number of interested parties and stakeholders, including the ExCom, PAG, resource and water agencies, local angling groups, and others have expressed interest in the information being collected as part of the FMP's monitoring program. Preparation and distribution of an annual technical report has been identified as a useful method of conveying information regarding the program status and monitoring results to interested parties.

Fishery enhancement work under the guidance of the Framework Agreement has occurred on the lower Kings River and Pine Flat Reservoir since the signing of the Framework Agreement on May 28, 1999. The first annual report for the FMP covered the period of May 2002 through May 2003 and was released in September 2004. The second annual technical report covered the period of May 2003 through May 2004 and was released in February 2005. The third annual technical report, which summarizes results of the habitat enhancement activities, trout management, and fishery and habitat monitoring between May 2004 and May 2005, was released in February 2006, and the fourth was released in August 2007. This report represents the fifth in the series, and covers the program year between May 2006 and May 2007.

The annual technical report summarizes key accomplishments and performance of the habitat enhancement actions and findings of the monitoring program. Compilation and analyses of available information used to assess performance of the FMP and habitat enhancement program is based upon results of both baseline monitoring within the Kings River and results of project-specific monitoring and performance evaluations. Information from a variety of program elements has been compiled each year representing results of each element of the Kings River monitoring program, as outlined in the 5-Year Plan. The annual technical report includes an executive summary followed by brief descriptions of individual monitoring program elements and results of key findings. The annual technical report summarizes information regarding the status and trends of the physical conditions affecting habitat quality and availability for rainbow trout within the river, and provides guidance and recommendations for future actions and modifications to the program. Documentation of data and other relevant information are included as appendices.

2.0 HYDROLOGY AND OPERATIONS

2.1 RESERVOIR INFLOW

Daily runoff into Pine Flat Reservoir from June 1, 2006 through May 31, 2007 is shown in Figure 2-1. Inflow into Pine Flat Reservoir is characterized by high seasonal and inter-annual variability reflecting variation in precipitation, snow pack, and runoff within the watershed. The total estimated annual inflow into Pine Flat Reservoir and the corresponding percent water year is summarized below (Table 2-1):

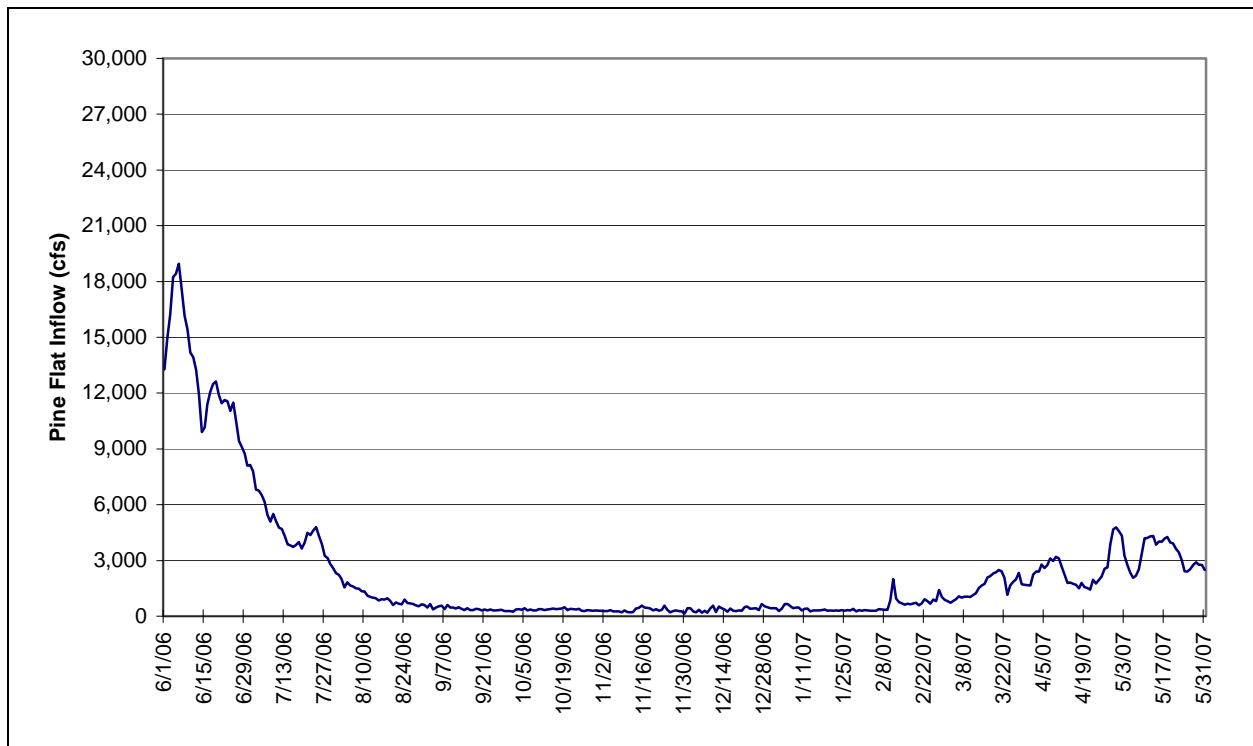


Figure 2-1. Daily inflow into Pine Flat Reservoir between June 1, 2006 and May 31, 2007.

2.2 RESERVOIR STORAGE

Daily reservoir water storage volume and water surface elevation in Pine Flat Reservoir from June 2006 through May 2007 is shown in Figure 2-2. Reservoir storage reflects the combined effects of reservoir inflow, releases from Pine Flat Reservoir to the lower Kings River, and evaporation. As part of the Framework Agreement, a voluntary 100,000 acre-feet temperature control pool was established. Reservoir operations since implementation of the Framework Agreement have retained the temperature control pool at or above the 100,000 acre-foot pool.

Table 2-1. Annual runoff in thousands of acre-feet (TAF) and Percent Water Year from October 1999 through September 2006.

<u>Period</u>	<u>Annual Runoff (TAF)</u>	<u>Percent Water Year</u>
October 1999 -- September 2000	1,534	90%
October 2000 -- September 2001	1,010	59%
October 2001 -- September 2002	1,141	67%
October 2002 -- September 2003	1,426	84%
October 2003 -- September 2004	1,050	62%
October 2004 -- September 2005	2,531	149%
October 2005 -- September 2006	2,952	173%
October 2006 -- September 2007	679	39%

2.3 RESERVOIR RELEASES

Water releases from Pine Flat Reservoir to the lower Kings River show high variability within the year as shown in Figure 2-3. Releases from Pine Flat Reservoir during the late fall, winter, and spring months have been in accordance with the Exhibit C flow schedule established by the Framework Agreement. In addition to the Exhibit C releases, the 2006-2007 program year represented the second year of enhanced Exhibit D releases in a row. As per the Framework Agreement, the KRWA member units voluntarily increased the flow schedule in accordance with the levels representing a wet hydrologic year of the Exhibit D flow schedule (250 cfs at Fresno Weir, for water year exceeding 2,100,000 acre feet). Beginning in the early spring, releases from Pine Flat Reservoir increase in response to downstream water demand and irrigation delivery schedules for water from storage. Average daily flow in the lower Kings River from June 2006 through May 2007 ranged from 156 to 11,414 cubic feet per second (cfs) (Figure 2-3).

The Framework Agreement established minimum instream Exhibit C flow releases from Pine Flat Reservoir, flow at Piedra, in Dennis Cut, at Fresno Weir and below Fresno Weir to support resident fish populations in the lower river. Results of daily flow measurements below Fresno Weir from June 2006 through May 2007 have demonstrated 100% compliance with the instream flow requirements as outlined in the Framework Agreement, and these results are shown in Figure 2-4. Flows measured at Fresno Weir were subject to the levels representing a wet hydrologic year of the Exhibit D flow schedule (250 cfs at Fresno Weir, for water year exceeding 2,100,000 acre feet), and the corresponding results are shown in Figure 2-5.

There were six days in the 2006-2007 program year in which instream flow requirements at Fresno Weir were not met. On November 7th and 8th, flows at Fresno Weir were 140 and 154 cfs respectively, which was well below the compliance level. However, these dates were part of a flow variance that was approved by the Executive Policy Committee for necessary work to be performed in the river, and for safety purposes of those performing the work (Appendix H).

From December 24-26, flows at Fresno Weir were 248 cfs, 247 cfs, and 247 cfs respectively. On January 13th, flows at Fresno Weir were 248 cfs. The first set of three days (December 24-26) of non-compliance was due to operational errors while the uncontrolled flows of Mill Creek dropped off from an earlier rain event. The January incident occurred during an unseasonably cold period (recorded high temperature for January 13, 2007 at Pine Flat was 44 degrees F), resulting in additional water being pumped from the river by farmers along the riparian corridor for protection of their crops. Additional water was released to counteract the effect of the pumping, thereby increasing the flow to 251 cfs and up from that point on.

While the 2006-2007 program year did have 6 days of flows that were below the instream flow requirement at Fresno Weir, there were only 8 days in which the target of 250 cfs at Fresno Weir was reached exactly. In every single instance other than these 14 days, the flow requirement at Fresno Weir was exceeded, meaning that the flow was at 251 cfs or more for every other day during the low flow period. In total, the KRWA member units contributed an additional 24,800 acre-feet of water to ensure that Exhibit D flow schedules were met. Information on daily water releases from Pine Flat Reservoir and daily flows at Fresno Weir is summarized in Appendix A.

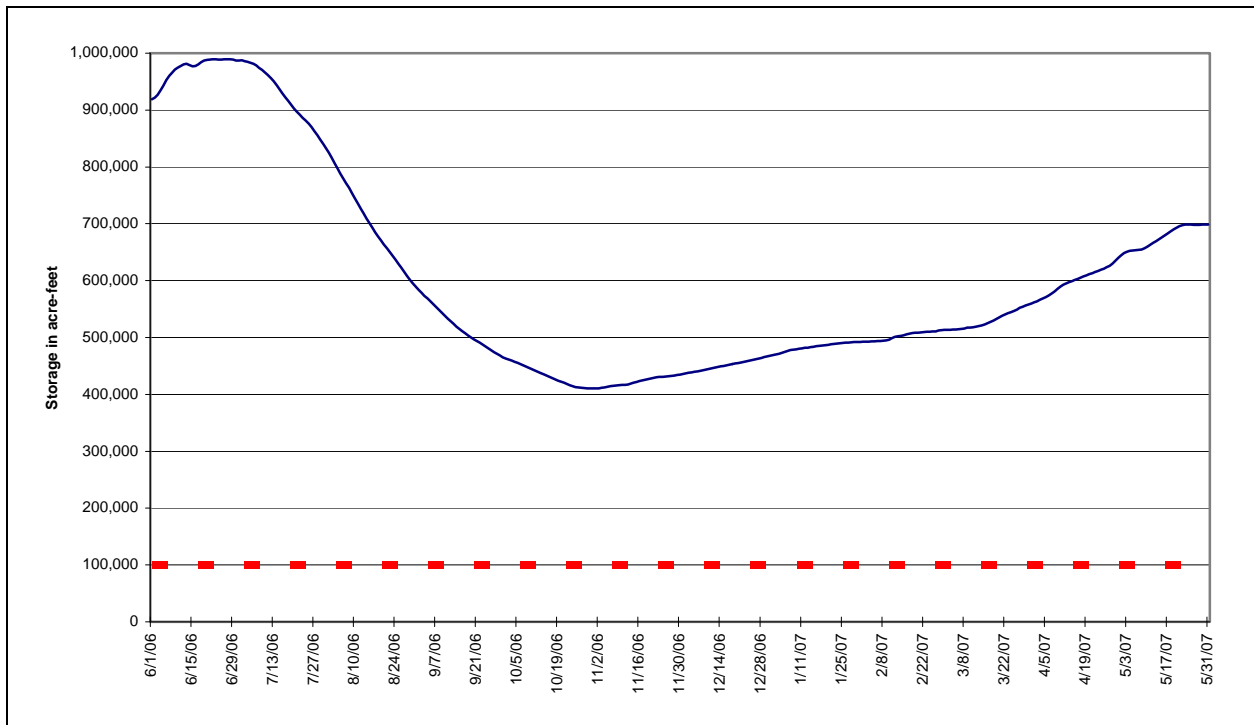


Figure 2-2. Daily storage volume in Pine Flat Reservoir from June 2006 to May 2007.

Note: ----- Dashed Line indicates Temperature Control Pool of 100,000 acre-feet.

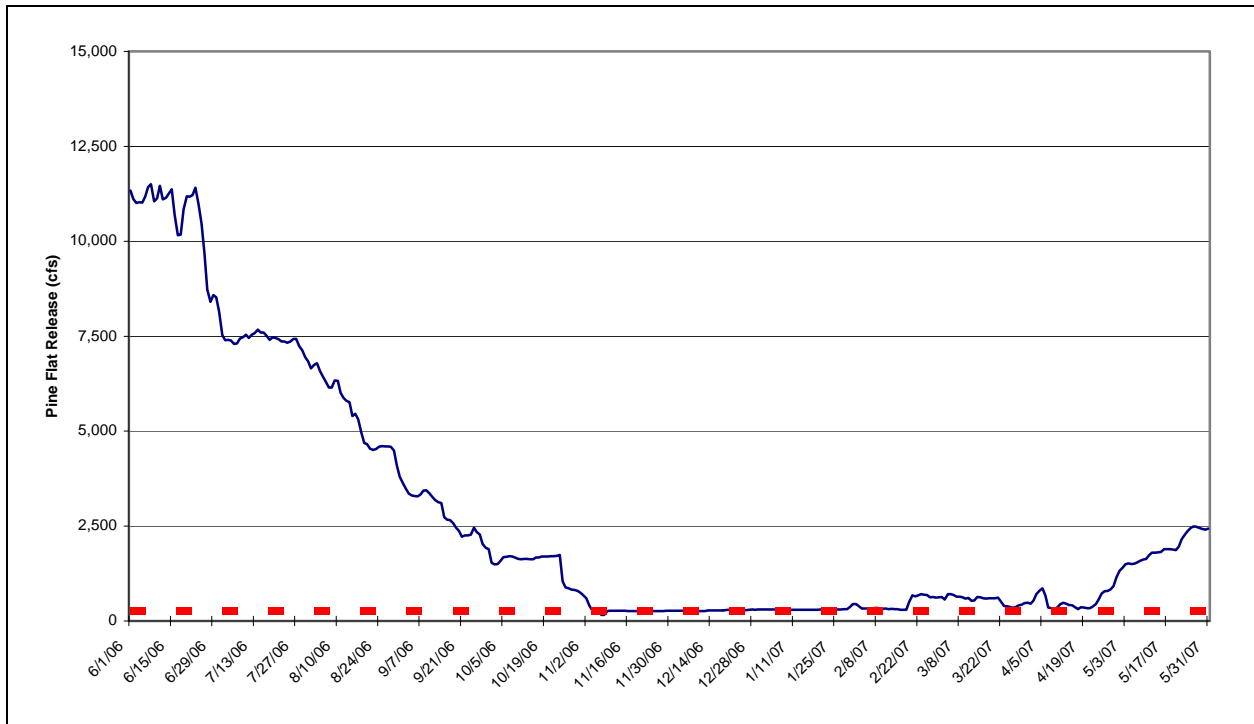


Figure 2-3. Average daily water releases from Pine Flat Reservoir to the lower Kings River between June 2006 and May 2007. Note: -----Dashed Line represents minimum flow rate as established by Exhibit D criteria (cfs).

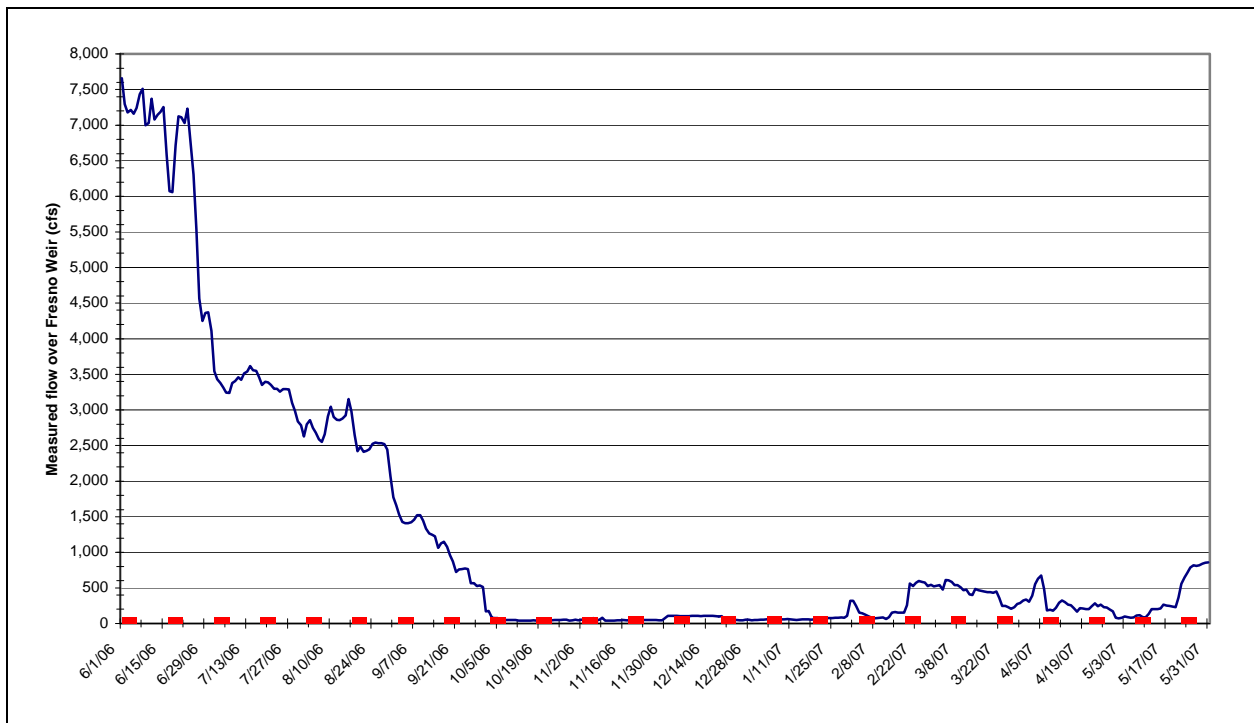


Figure 2-4. Average daily flows in the Kings River below Fresno Weir from June 2006 through May 2007. Note: -----Dashed Line represents minimum flow rate as established by Exhibit C criteria (cfs).

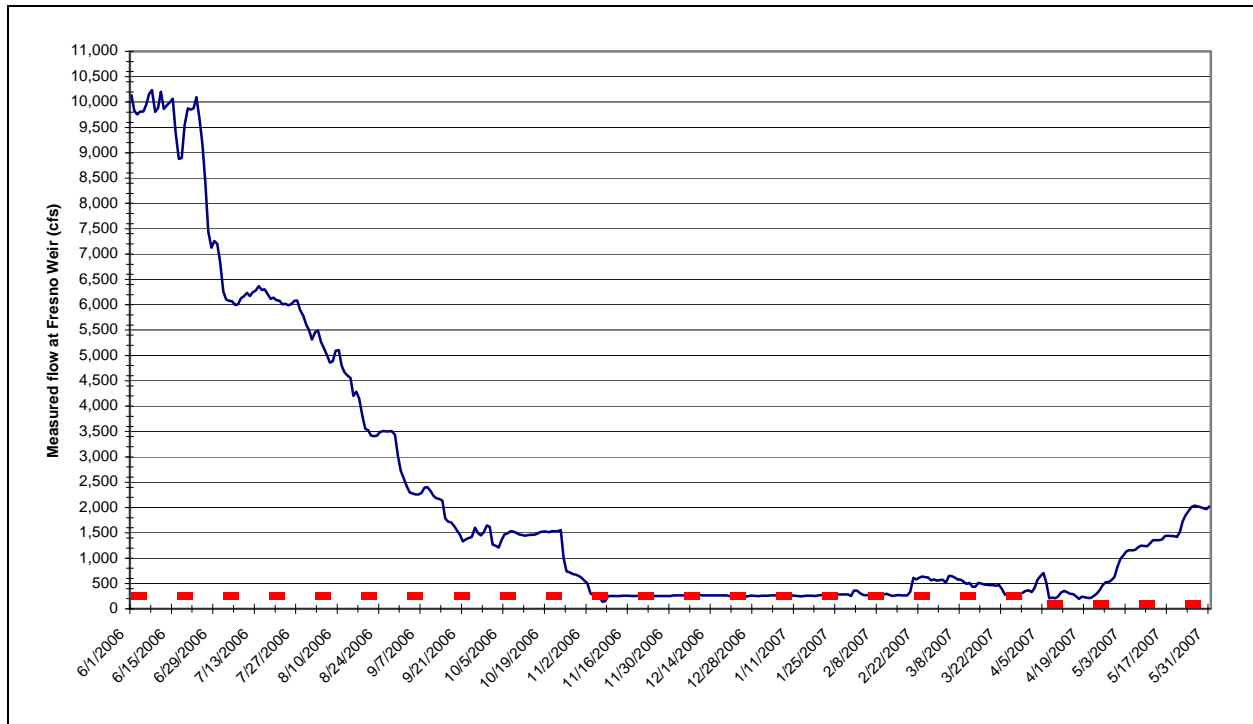


Figure 2-5. Average daily flows in the Kings River at Fresno Weir from June 2006 through May 2007.
 Note: ----Dashed Line represents minimum flow rate as established by the enhanced Exhibit D criteria (cfs).

2.4 TELEMETRY SYSTEM

During 2006-2007, KRWA continued the use of a real-time (telemetry) flow monitoring station at Fresno Weir. This system provides data that supports informed decisions on water temperature and flow management after completing the irrigation and delivery season when elevated water temperatures may affect habitat quality for trout within the lower river. The real-time telemetry water temperature monitoring system complements the ongoing temperature monitoring at fixed locations within the river (Section 3.1.2) for use in evaluating factors affecting habitat conditions and the potential health and condition of trout within the river.

2.5 TURBINE BYPASS PROJECT

The turbine bypass project was completed in March 2003. The project was developed through the U. S. Army Corps of Engineers (ACOE) Pine Flat Dam Fish and Wildlife Habitat Restoration Investigation that began in 1993. KRCD served as the local sponsor with contributions from the CDFG, KRWA, and California Department of Water Resources (DWR). The turbine bypass provides increased flexibility in operating and managing flows and water temperatures released from Pine Flat Dam. The turbine bypass is operated by KRCD.

The approximately 6-million dollar project involved constructing a conduit system to the existing penstocks to allow for low flows to bypass the power plant turbines. This allows greater flexibility in making releases at various water elevations in Pine Flat Reservoir by allowing releases through the penstocks when flows are less than the 500 to 600 cfs necessary to run the power plant. In this way, there is more flexibility given to the limited releases of colder water

made into the river from the reservoir to benefit the coldwater fishery during low-flow periods of the year. The turbine bypass is also used to increase the dissolved oxygen level in waters released from the power plant.

During the 2006-2007 program year, temperature management was not an issue, with plenty of cold water available throughout the time period. The Turbine Bypass was utilized for the purposes of dissolved oxygen management, by blending releases between the turbine bypass and the mid level gates from the Pine Flat Dam.

2.6 EXHIBIT C AND D FLOWS

Section 1(e) of the Framework Agreement calls for the KRWA to diligently endeavor to increase the minimum water flows in the Kings River downstream of Pine Flat Dam as set forth in Exhibit C to those levels shown in Exhibit D by October 1, 2005. The Exhibit C flow schedule presented in the Framework Agreement is summarized in Table 2-2. Exhibit C flows have been implemented and monitored since 1999.

A KRWA Exhibit D committee was formed and has met regularly to develop programs that will enable the KRWA to reach the Exhibit D flow goals while avoiding or minimizing unacceptable water supply or operational impacts to its member units. Some ideas under discussion in the KRWA Exhibit D committee include rescheduling of irrigation demands and/or the temperature control pool, groundwater recharge and water banking projects, exchange arrangements with the State Water Project (SWP), downstream surface storage projects, and member contribution of entitlement/storage.

Exhibit D flows at a rate of 250 cfs (level representing a wet hydrologic year) at Fresno Weir were released for the second year in a row in the fall and winter 2006. These flows were triggered by the larger than normal water-year in 2005-2006 (173% WY), and the KRWA Member Units voluntarily provided the Exhibit D flows in the following water-year (2006-2007).

Table 2-2. Exhibit C flows (cfs) from the Framework Agreement.

Season	Total Flow at Piedra	Minimum Flow in Dennis Cut	Minimum Flow to Fresno Weir	Water Divertable in China Slough	Required Flow Over Fresno Weir
Oct. 1 – Nov. 15	100	5	95	10	40
Nov. 16 – March 31	100	5	95	5	45
April 1 – Sept. 30	100	5	95	15	35

In December of 2006, the KRWA member units signed internal agreements that will govern Exhibit D contributions in the future. Prior to signing these agreements, the KRWA member units have provided Exhibit D flows under draft agreements during the 2005-2006 and 2006-2007 water years. The TSC supports and applauds the activities of the KRWA in completing these essential agreements.

2.7 DISSEMINATION OF TEMPERATURE DATA

Experience has taught the TSC that sharing water temperature information with our stakeholders during critical or near critical periods that are stressful to trout is important. To this end, KRWA began providing weekly hydrologic and climate reports (Appendix B) to the PAG members and other interested parties several years ago. These one-page reports provide information on flows in the lower river and tributary streams as well as a summary of flow and temperature trends. This has been beneficial to everyone who has an interest in the well being of the trout population in the lower river and has resulted in much improved communications regarding these possible temperature events.

2.8 SUMMARY AND DISCUSSION

Hydrologic conditions and Pine Flat Reservoir operations and flows within the lower river during 2006-2007 are characterized by high seasonal variability characteristic of the Kings River watershed and water supply operations. Findings and recommendations regarding hydrology and operations include:

- Pine Flat Reservoir operations were successful in maintaining the temperature control pool in the reservoir above the minimum level specified in the Framework Agreement;
- The reservoir releases were characterized by relatively high stream flows during the irrigation season, which were substantially reduced during the non-irrigation season. Average daily stream flows, measured passing over Fresno Weir, were in compliance with the minimum stream flow requirements contained in the Framework Agreement for all 365 days comprising the 2006-2007 program year.
- A real-time telemetry system provided information on flow at Fresno Weir that is available for monitoring and managing conditions within the lower river as part of the fishery program;
- Enhanced Exhibit D flows were provided by KRWA Member Units voluntarily at a rate of 250 cfs (level representing a wet hydrologic year) at Fresno Weir for the second year in a row in the fall and winter of 2006-2007.
- Average daily stream flows, measured at Fresno Weir, were in compliance with the minimum stream flow requirements contained in the Framework Agreement for 359 days comprising the 2006-2007 program year. Of the six days on non-compliance, three were due to operational errors while the uncontrolled flows of Mill Creek dropped off from an earlier rain event. One day was due to unseasonably cold weather (recorded high temperature for January 13, 2007 at Pine Flat was 44 degrees F), resulting in additional water being pumped from the river by farmers along the riparian corridor for protection of their crops. Two days were due to a flow variance that was approved by the Executive Policy Committee for necessary work to be performed in the river, and for safety purposes of those performing the work. There were only 8 days in which the target of 250 cfs at Fresno Weir was reached exactly. In every single instance other than these 14 days, the flow requirement at Fresno Weir was exceeded, meaning that the flow was at 251 cfs or more for every other day during the low flow period. In total, the KRWA member units contributed an additional 24,800 acre-feet of water to ensure that Exhibit D

flow schedules were met;

- The turbine bypass was utilized during the season for dissolved oxygen management. The turbine bypass provides additional flexibility in managing the cold water pool within Pine Flat Reservoir and the temperature of water released into the lower river to support suitable habitat conditions for trout as part of the FMP; and
- In December of 2006, the KRWA member units signed internal agreements that will govern Exhibit D contributions in the future. Prior to signing these agreements, the KRWA member units have provided Exhibit D flows under draft agreements during the 2005-2006 and 2006-2007 water years. The TSC supports and applauds the activities of the KRWA in completing these essential agreements.

3.0 WATER QUALITY

Water quality monitoring as part of the FMP has focused principally on measurements of water temperature and dissolved oxygen concentrations that directly affect habitat quality for fish and macroinvertebrates within Pine Flat Reservoir and the lower Kings River. The TSC developed a water quality monitoring program to characterize the chemical and physical parameters at Mill Creek near the confluence with the lower Kings River, and at Fresno Weir. Results of water temperature and dissolved oxygen monitoring within the reservoir and lower river are presented below.

3.1 WATER TEMPERATURE MONITORING

Habitat quality and availability to support resident trout within the lower Kings River is dependent, to a large extent, on the suitability of seasonal water temperatures. Water temperatures within the lower Kings River are affected by a variety of environmental factors including, but not limited to, the temperature of water released from Pine Flat Reservoir, air temperature, stream flow, and the distance downstream from Pine Flat Reservoir. Given the importance of water temperature as a factor affecting habitat conditions for trout within the lower river, the FMP includes an extensive water temperature monitoring component designed to provide information on water temperature within Pine Flat Reservoir and at various locations along the lower river.

3.1.1 Reservoir

Water temperature and dissolved oxygen profile measurements for Pine Flat Reservoir have been collected by KRCD biologists on approximately a monthly basis since 1986. Measurements are taken at a monitoring location approximately 0.5 mile upstream of the dam using a Hydrolab portable water quality meter. Vertical profile measurements of both water temperature and dissolved oxygen concentrations are recorded at approximately 3-foot intervals from the surface to the bottom of the water column to characterize the limnological profile within Pine Flat Reservoir in the vicinity of the dam outlet structures.

Results of water quality monitoring have shown a characteristic seasonal pattern of thermal stratification beginning in the spring forming a reservoir hypolimnion (cold water layer near the bottom) and epilimnion (warmer water layer near the surface) increasing through the summer months. Reservoir thermal stratification continues into the fall, at which time atmospheric cooling results in fairly uniform water temperatures throughout the reservoir (reservoir destratification). Later in the fall, cold air temperatures cool the upper layer of water so that the epilimnion is colder than the hypolimnion (reservoir turnover). Results of the May 2007 reservoir profile are presented in Figure 3-1 as an example of monitoring. Results of monthly vertical reservoir temperature and dissolved oxygen profile measurements during the period May 2006 through May 2007 are summarized in Appendix C. Additional vertical profile temperature measurements, collected during previous years, are on file at KRCD.

Results of the reservoir temperature and dissolved oxygen measurements are used as part of the FMP to determine both the dissolved oxygen concentration and temperature of water released from the reservoir into the lower river. The data are also used in temperature control pool

management during the fall months after completion of the irrigation season to provide suitable habitat conditions to support trout and other fish species within Pine Flat Reservoir and the lower river. In addition to the vertical temperature profile measurements, water temperature is measured by KRCD at each of the individual outlet ports on Pine Flat Dam. Water temperature at each outlet is available on a real-time basis for use in evaluating water temperature released from the reservoir into the lower Kings River.

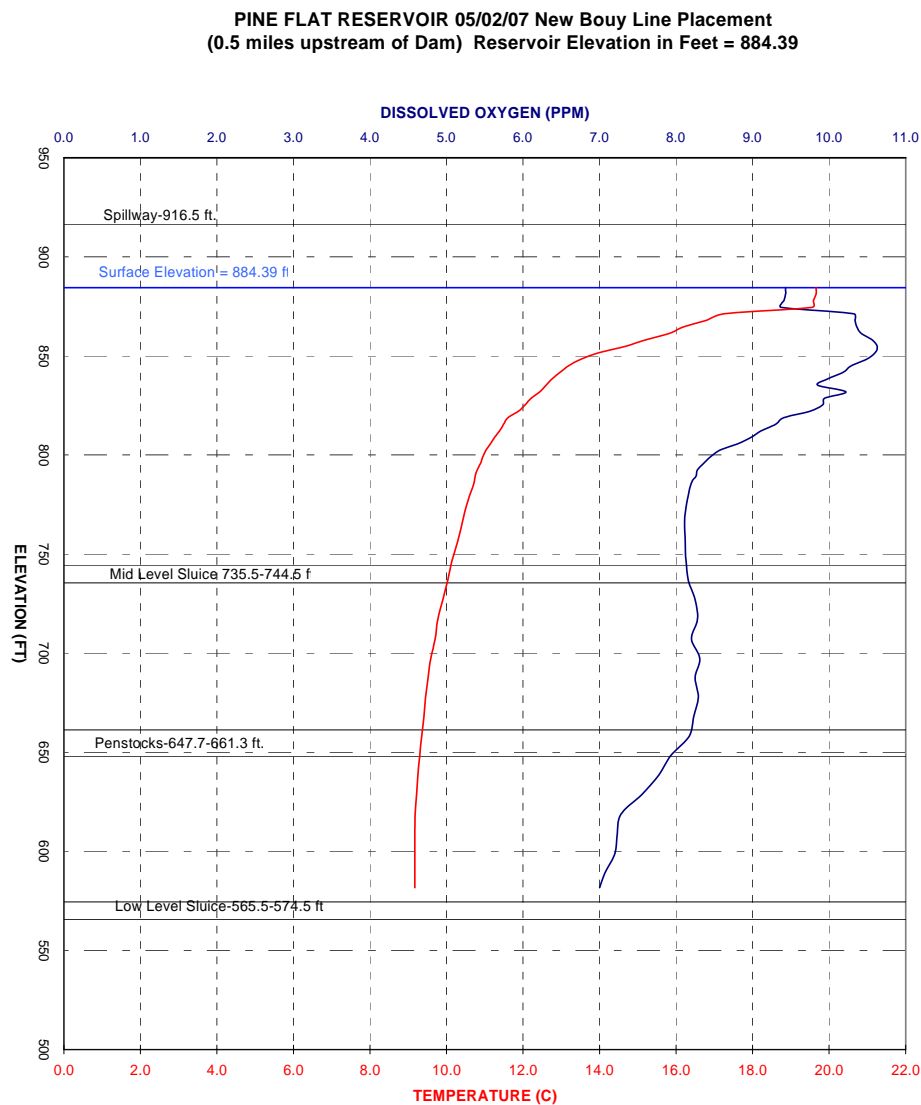


Figure 3-1. May 2007 vertical reservoir temperature and dissolved oxygen profile measurements at Pine Flat Reservoir.

3.1.2 River

Water temperature within the lower Kings River is routinely monitored at a variety of locations from Pine Flat Dam downstream to Highway 180. Permanent monitoring locations within the lower river are shown in Figure 3-2. Water temperature is recorded throughout the year at each location using a computerized temperature sensor and data recording system (Onset temperature recorders), which is routinely calibrated to laboratory standards and is accurate within $\pm 0.5^{\circ}\text{C}$.

Results of water temperature monitoring within the lower Kings River are shown, for example, at the Army Corp of Engineers Bridge (ACOE Bridge) (Figure 3-3) and Fresno Weir (Figure 3-4) for May 2006-May 2007. Results of water temperature monitoring at other locations (Avocado Side and Gould Weir Channel) within the river are included in Appendix D

Results of temperature monitoring within the river have shown a general seasonal pattern with lowest temperatures occurring during the winter and early spring, increasing during the spring and summer months, with the greatest increase in seasonal temperatures occurring during the late summer and early fall after completion of the irrigation season. Results of temperature monitoring have also shown a general gradient of temperatures with the coldest temperatures occurring typically near Pine Flat Dam and increasing as a function of distance downstream within the lower river during summer months. In addition, results of temperature monitoring have shown that the diel temperature variation (e.g., difference between the maximum and minimum daily temperature) is typically lowest immediately downstream of Pine Flat Dam with diel temperature variation increasing as a function of distance downstream within the lower river.

A substantial body of information exists on the habitat suitability and response of trout to water temperatures. A variety of factors influence habitat suitability including, but not limited to, the average and daily maximum temperature, the duration of exposure to elevated temperature, diel temperature variation, prey availability, fish condition and stress, availability of microhabitat temperature refugia, and other factors. As a result of these interacting factors specific water temperature criteria have not been identified for use in evaluating habitat conditions but rather, general guidelines have been established to assess habitat conditions within the lower river. Information from the scientific literature was used by the TSC to assess conditions within the river during the 2006-2007 study period. As a general guideline, water temperatures within the range from approximately $15\text{-}18^{\circ}\text{C}$ have been identified as providing optimal habitat conditions for trout (Moyle 2002). Habitat conditions for trout were identified as stressful as average daily temperatures approach or exceed approximately 21°C or maximum daily temperatures approach or exceed 25°C . As water temperature becomes elevated above the optimal range, quality and availability of habitat within the river to support coldwater species such as rainbow trout may decrease. As part of the FMP, water temperature data collected through the ongoing monitoring program are continuing to be analyzed and evaluated, in addition to the evaluation of alternative management strategies, after completion of the irrigation season, and prior to seasonal declining

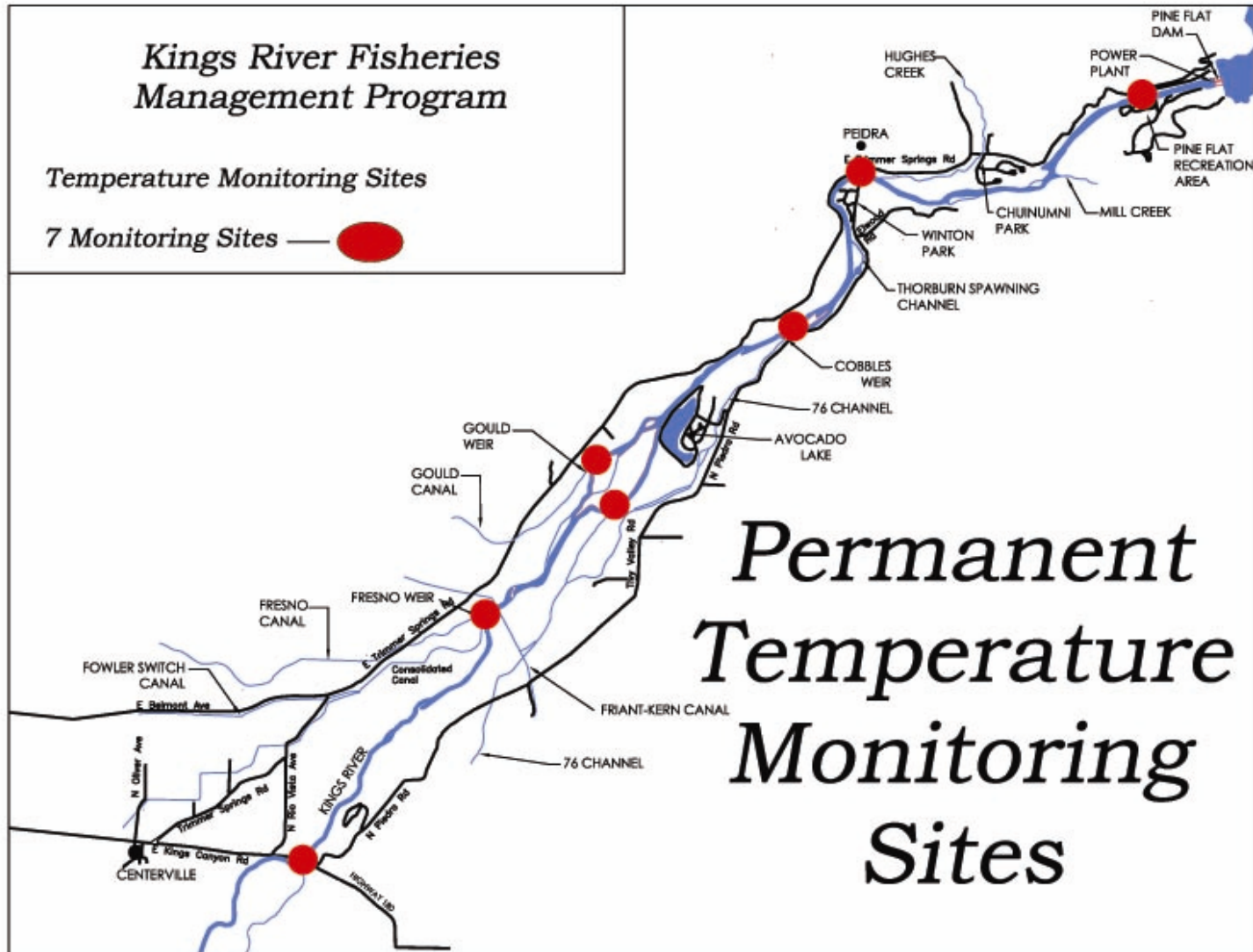


Figure 3-2. Permanent water temperature monitoring locations on the lower Kings River.

**KINGS RIVER WATER TEMPERATURE
ACOE Bridge
May 2006 to May 2007**

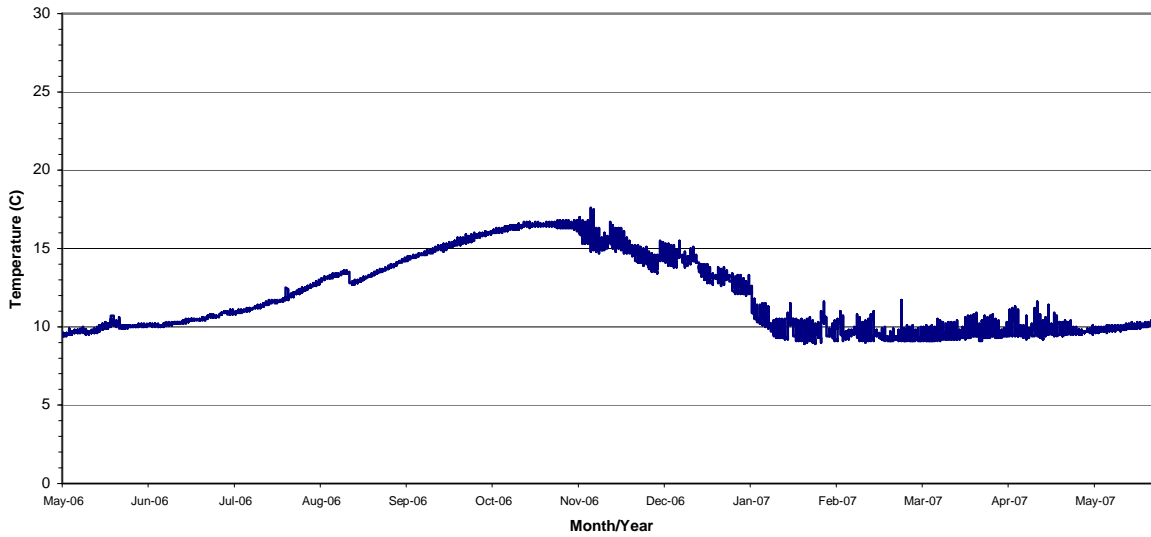


Figure 3-3. Hourly water temperature monitoring results, Army Corps of Engineers Bridge.

**KINGS RIVER WATER TEMPERATURE
ACOE Bridge
May 2006 to May 2007**

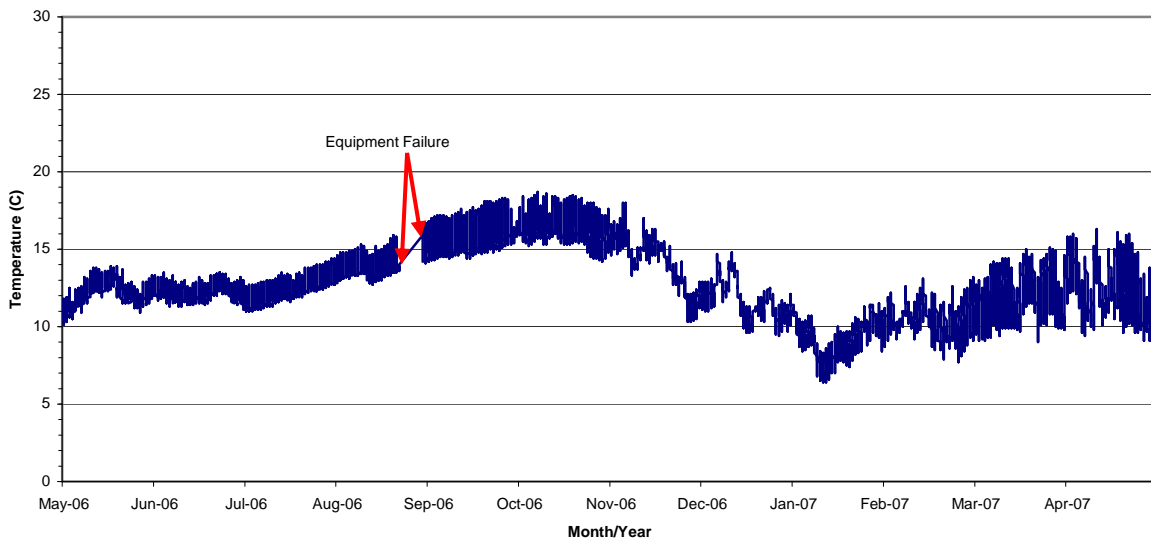


Figure 3-4. Hourly water temperature monitoring results at Fresno Weir.

atmospheric temperatures during the fall months (Section 3.4) to help maintain suitable conditions for trout.

Results of water temperature monitoring at the Army Corps of Engineers Bridge (Figure 3-3) showed that seasonal temperatures were generally lower than temperatures observed downstream at Fresno Weir (Figure 3-4). Water temperature throughout the reach was within the range considered to provide suitable habitat conditions for resident trout during the entire year. Water temperatures at other locations within the lower river, were also monitored (Appendix D) as part of the evaluation of habitat conditions. The TSC is continuing to investigate and evaluate water temperature conditions affecting the quality and availability of habitat within the lower river for trout during the late-summer and early-fall and the effectiveness of various management actions, including operation of the turbine bypass (Section 3.4), to provide suitable habitat conditions downstream to Fresno Weir for resident trout throughout the year.

3.2 DISSOLVED OXYGEN MONITORING

Dissolved oxygen concentrations are measured both within Pine Flat Reservoir and within the lower Kings River at the Army Corp of Engineers Bridge. Results of dissolved oxygen monitoring, conducted by KRCD, are briefly summarized below.

3.2.1 Reservoir

As briefly described above, KRCD conducts monthly monitoring within Pine Flat Reservoir to evaluate vertical profiles in both water temperature and dissolved oxygen concentrations. Results of dissolved oxygen measurements have shown a seasonal pattern, which is strongly associated with reservoir stratification; in which dissolved oxygen concentrations throughout the water column within the reservoir are typically within a suitable range for fish (7 mg/L and above) during the winter and early spring months. As the reservoir becomes thermally stratified during late spring and early summer months, a vertical distribution of dissolved oxygen concentrations becomes apparent with greater dissolved oxygen levels in the upper part of the water column (warmer epilimnion waters) and decreased dissolved oxygen concentrations in the colder waters near the bottom (hypolimnion). The hypolimnion contains very low levels of oxygen. These seasonal patterns in the vertical distribution of dissolved oxygen concentrations within Pine Flat Reservoir are typical of other reservoirs located within the Central Valley, though the actual values may differ significantly. Results of dissolved oxygen monitoring within Pine Flat Reservoir during the period May 2006 through May 2007 are shown monthly in Appendix C in combination with results of vertical water temperature profile measurements. Additional information on results of dissolved oxygen monitoring conducted within Pine Flat Reservoir is on file at KRCD.

In addition to monitoring dissolved oxygen concentrations within the reservoir, KRCD also monitors dissolved oxygen concentrations in the water released from Pine Flat Reservoir into the lower Kings River. Monitoring is conducted at the reservoir outlet elevations to determine both the minimum dissolved oxygen concentrations and potential gas supersaturation resulting from releases through the hydroelectric generator outlet works.

3.2.2 River

KRCD routinely monitors dissolved oxygen concentrations within the lower Kings River at the Army Corp of Engineers Bridge, which is located 0.6 miles downstream of Pine Flat Dam. Dissolved oxygen concentrations are measured on a continuous basis using a Hydrolab dissolved oxygen meter routinely (approximately monthly) calibrated to laboratory standards with an accuracy of ± 0.5 mg/L (Figure 3-5). As a condition of the Federal Energy Regulatory Commission (FERC) license, KRCD is required to maintain a minimum dissolved oxygen concentration at the ACOE Bridge of 7.0 mg/L for the protection of fish and other aquatic

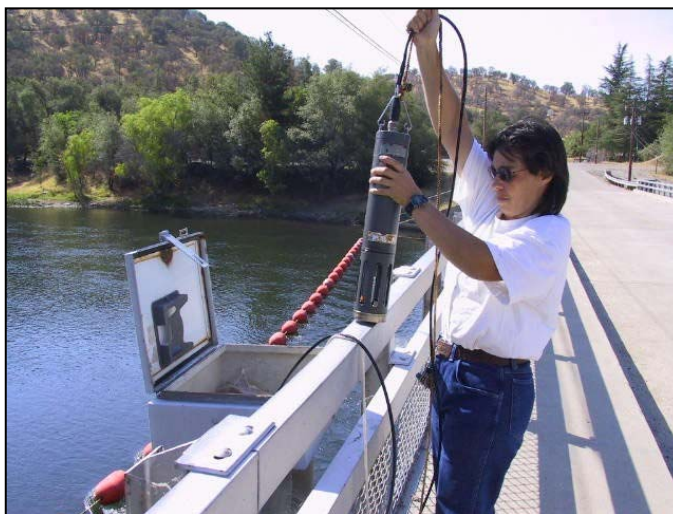


Figure 3-5. Dissolved oxygen monitoring station on the ACOE Bridge.

organisms inhabiting the lower Kings River when the power plant is operating. Results of dissolved oxygen measurements at the ACOE Bridge during the period from May 2006 through May 2007 are presented in Figure 3-6. Information on dissolved oxygen measurements within the lower Kings River is on file at KRCD. Results of these measurements have shown that dissolved oxygen concentrations within the lower Kings River are within the range considered to be suitable for various fish and macroinvertebrate species that occur in this section of the river.

3.3 COMPLIANCE WITH DISSOLVED OXYGEN REQUIREMENTS

Minimum dissolved oxygen concentrations specified by the FERC license are 7.0 mg/L when the power plant is operating. During 2006-2007, KRCD met its operating and monitoring requirements, and conditions were suitable for fish throughout the period when the power plant was in operation. Results of the monitoring are presented in KRCD's report "Dissolved Oxygen Monitoring, Final Report for Calendar Year 2006" (KRCD 2007) which is on file at KRCD.

3.4 PLANNING FOR WARM WATER TEMPERATURE EVENT

One of the fundamental goals and objectives, as outlined in the Framework Agreement, is the maintenance of suitable instream habitat conditions for trout throughout the year downstream to Fresno Weir. Water temperature in the lower Kings River during the early fall, after completion of irrigation demand releases, may become elevated to a level where habitat conditions are stressful and/or unsuitable for trout. Having real-time temperature data available allows for informed decisions by managers to perform operations, as needed, for temperature maintenance of water downstream of Pine Flat Dam in an effort to maintain suitable water temperatures for coldwater species such as rainbow and brown trout. Several management strategies have been identified for addressing temperature maintenance issues including: 1) operation of the turbine bypass to maintain downstream temperatures within an acceptable range; 2) selective releases from the dam's three levels of gates, 3) short-term (pulsed) water releases from Pine Flat Reservoir, and 4) rescheduling of water deliveries to KRWA member units. These alternative operational strategies will continue to be developed by the TSC to maintain suitable water temperature conditions during the late-summer and fall months.

Temperatures at the ACOE Bridge and Fresno Weir were consistently within the range considered to provide suitable habitat for trout (average daily temperatures less than 21°C). Water temperatures within the lower river were maintained within the range considered to be suitable for trout throughout the late-summer and fall of 2006. Temperature management during this period was achieved, in part, by modifying operations of Pine Flat Dam and the turbine bypass to allow release of cold water to the lower river through the low-level sluice gates when needed. Reservoir releases for the FMP during this period were coordinated between KRCD, KRWA and ACOE using results of real-time water temperature monitoring at Fresno Weir and other locations to manage reservoir releases to maintain suitable habitat conditions for trout. Operation of the turbine bypass, which became available for water temperature management in 2003, provided greater flexibility in managing water temperature releases from the dam to maintain suitable fish habitat in the lower river.

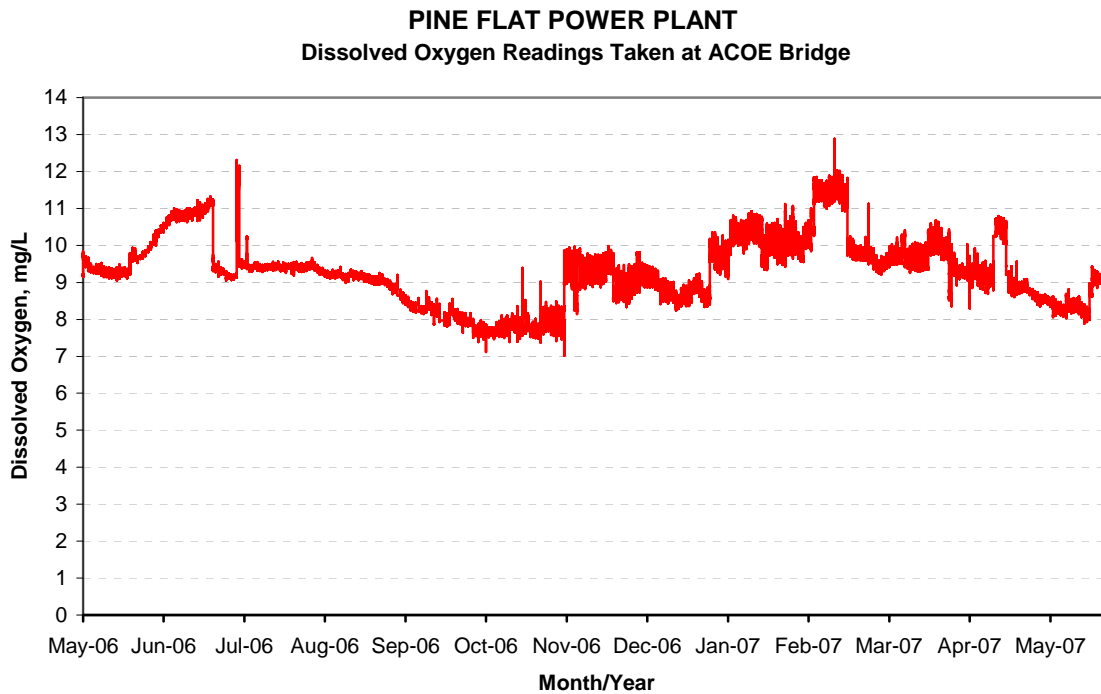


Figure 3-6. Results of dissolved oxygen measurements at the Army Corps Bridge from May 2006 through May 2007

3.5 SUMMARY AND DISCUSSION

A great deal of progress has been made with real-time temperature monitoring and the ability to regulate and manage water temperature in the lower river during critical periods. Valuable tools for managing water temperature in the lower river to protect fish habitat include cooperation from the ACOE in allowing the use of the lower sluice gates to release cold water during critical periods, and improved flexibility in managing water temperatures by using the turbine bypass.

Results of water quality monitoring within Pine Flat Reservoir and the lower Kings River during 2006-2007 have shown:

- Pine Flat Reservoir becomes stratified during late spring, summer, and fall showing a characteristic pattern of warmer water near the surface (epilimnion) and colder water with reduced dissolved oxygen concentrations near the bottom of the reservoir (hypolimnion). The reservoir destratifies in the late-fall and winter due to water temperature becoming uniform throughout the water column;
- The temperature of water released from the reservoir into the lower river can be regulated and managed, to some extent, through selective operation of different outlet works, including the turbine bypass, which initiated operations during 2003. However, the ability to manage water temperatures is limited and constrained by the availability of cold water and release points during various seasonal periods within the reservoir, hydroelectric generation, requirements for irrigation releases, and other factors;
- Aeration and mixing of water released from the reservoir have proven to be effective in maintaining suitable dissolved oxygen concentrations within the lower river during periods when the power plant was in operation. Mean monthly dissolved oxygen concentrations, as measured at the ACOE Bridge, during 2006-2007 exceeded 7.0 mg/L.
- Water temperatures within the lower river showed a seasonal pattern with the coldest temperatures occurring during the late winter and temperatures generally increasing during the summer and early fall;
- Water temperature showed a characteristic longitudinal gradient downstream of Pine Flat Dam. During summer months the coldest temperatures were located immediately downstream of the dam and temperatures generally increased with distance downstream from the dam. During the fall and winter, when atmospheric temperatures are cool, a reverse temperature gradient was observed with temperatures decreasing as a function of distance downstream from Pine Flat Dam;
- Results of temperature monitoring, and results from the fishery monitoring program, provided no evidence that either dissolved oxygen concentrations or water temperature conditions within the lower river resulted in mortality to trout or other fish species during 2006-2007;

- Results of the 2006-2007 water temperature and dissolved oxygen monitoring are being used by the TSC to refine water quality monitoring as part of the FMP and as a basis for evaluating alternative operational strategies, including operations of the turbine bypass, to address water quality issues affecting habitat conditions for trout in the future;

4.0 HABITAT ENHANCEMENT

A fundamental goal and objective of the FMP is to enhance the quality and availability of habitat for a variety of fish and macroinvertebrates within Pine Flat Reservoir and the lower Kings River. As part of the 2006-2007 FMP a variety of habitat enhancement projects were planned and/or implemented to benefit various life stages of trout, other fish species, and macroinvertebrates in the lower Kings River. A brief description of the habitat enhancement projects planned and/or implemented as part of the FMP during 2006-2007 is summarized below.

4.1 RIVER

Section 1(f) of the Framework Agreement – Funding / Projects discusses fish habitat improvements to enhance fish and wildlife resources in the lower Kings River. Habitat enhancement projects included the purchase and stockpiling of spawning gravel, the purchase and stockpiling of boulders, and the approval and implementation of a Fishery Habitat Master Plan (June 2004).

4.1.1 Project Permitting

Permits from various state and federal agencies are required to perform work in a stream or river channel. These permits are meant to fully disclose the details of the work, identify any negative environmental impacts that might occur, and identify how these impacts will be avoided or mitigated. The FMP obtained riverwide and multi-year permits for future fish habitat enhancement projects as part of the Fishery Habitat Master Plan. Permits were obtained from the U. S. Army Corps of Engineers, Regional Water Quality Control Board, California Department of Fish and Game, and State Reclamation Board. The activities were conducted under Element C-2004-10: Riverwide Permit for Fish Habitat Projects of the 5-Year Implementation Plan.

4.1.2 Gravel Placement

No gravel was placed in the river during the program year.

4.1.3 Boulder Acquisition and Stockpiling

Approximately 2800 boulders were placed in the Kings River for habitat enhancement as approved in the Fishery Habitat Master Plan. An additional 2900 boulders were stockpiled for placement later. The activities were conducted under Element C-2007-1: Fishery Habitat Master Plan of the 5-Year Implementation Plan.

4.1.4 Placement of Half Logs in the Thorburn Channel

As logs were placed during the last program year, no additional habitat work was completed on the Thorburn Channel during the 2006-2007 program year.

4.1.5 Lower Kings River Habitat Conservation Framework

During the program year, little activity occurred on this element. Other groups such as the Kings River Conservancy, Sierra Foothill Conservancy, and Trust for Public Lands are planning conservation projects on the Kings River. The FMP and participating agencies are engaged and cooperating with those efforts.

The activities were conducted under Element N-2007-5: Lower Kings River Habitat Conservation Framework of the 5-Year Implementation Plan.



Figure 4-1. Placing boulders near Avocado Lake County Park



Figure 4-2. Logs providing cover in Thorburn Spawning Channel

4.1.6 Development of a Fisheries and Habitat Improvement Plan

The TSC has developed a Habitat Enhancement Master Plan as part of the FMP. The Master Plan provides guidance and direction for future habitat enhancement efforts (e.g., gravel and boulder projects) and serves as the basis for purchasing and stockpiling gravel and boulders to be placed in the river at strategic locations throughout the coming years.

The activities were conducted

under Element N-2007-6: Development of a Fisheries and Habitat Improvement Plan of the 5-Year Implementation Plan.

4.1.8 Development of Exhibit D Flows

During the 2006-2007 program year, the second enhanced Exhibit D releases in the history of the program were provided for by KRWA member units. These enhanced flows were triggered by a 173% Water Year (approximately 2,952,000 acre feet) in 2005-2006, and were voluntarily

provided by the KRWA member units in accordance with the levels representing a wet hydrologic year of the Exhibit D flow schedule (250 cfs at Fresno Weir, for water year exceeding 2,100,000 acre feet) in 2006-2007.

Additionally, KRWA's Exhibit D subcommittee continued to meet throughout the year and worked to develop the internal mechanisms to achieve higher fall and winter flows in the lower Kings River for future triggering years. In December of 2006, the KRWA member units signed internal agreements that will govern Exhibit D contributions in the future. Prior to signing these agreements, the KRWA member units provided Exhibit D flows voluntarily under draft agreements during the 2005-2006 and 2006-2007 water years. The TSC supports and applauds the activities of the KRWA in completing these essential agreements.

The activities were conducted under Element N-2007-1: Development of Exhibit D Flows of the 5-Year Implementation Plan.

4.2 PINE FLAT RESERVOIR

The major fish habitat improvement work completed during this report period occurred between Deer Creek and Island Park. The improvements consisted of a series of concrete anchors measuring about 2 ft x 6 ft by 2 ft high being placed at strategic locations in the area of the lake bottom. Aviation cable of 3/16-inch stainless steel was strung between the concrete anchors to form a grid for attaching tree and bush cover. The entire area affected by the project was approximately 100 by 400 feet.

Wire gabions filled with Manzanita brush that were prepared last year were moved to a site in Sycamore Cove where they joined approximately 90 other gabions already installed as fish habitat structures.

Planting seed of both winter wheat and barley were conducted at three locations including Deer Creek and Island Park and also Edison Point near Windy gap. The growth of the grasses was very good and much enhanced by the late rains. This should be excellent habitat for warm water species of fishes.

The CDFG biologist previously assigned to this project was redirected to other projects. Personnel from the ACOE took the lead in overseeing that these projects were completed. We support and applaud the efforts of the ACOE. Supplies were purchases using FMP funds.

4.3 SUMMARY AND DISCUSSION

The FMP continued habitat enhancement efforts on the lower Kings River by the following actions:

- Placed approximately 2800 large (3 to 6 feet in diameter) boulders in the Kings River for habitat improvement and stockpiled an additional 2900 boulders;
- The second enhanced Exhibit D releases in the history of the program were provided for by KRWA member units in accordance with the levels representing a wet hydrologic year of the Exhibit D flow schedule (250 cfs at Fresno Weir, for water year exceeding 2,100,000 acre feet);
- In December of 2006, the KRWA member units signed internal agreements that will govern Exhibit D contributions in the future. Prior to signing these agreements, the KRWA member units provided Exhibit D flows voluntarily under draft agreements during the 2005-2006 and 2006-2007 water years; and
- Fish habitat improvement work in Pine Flat Reservoir completed during this report period occurred between Deer Creek, Island Park and Sycamore Cove. Personnel from the ACOE took the lead in overseeing that these projects were completed. We support and applaud the efforts of the ACOE.

5.0 FISH STOCKING

The stocking of fish in State waters is the responsibility of the California Department of Fish and Game. During the 2006-2007 reporting period, the allotted numbers of catchable and sub-catchable size rainbow trout were stocked in the Kings River between Pine Flat Dam and Fresno Weir. In addition, trout eggs were supplied to the program by the CDFG for incubation and hatching in the lower river. Catchable size rainbow trout were also planted in Pine Flat Reservoir and Avocado Lake. A brief description of the fish stocking activities is presented below.

5.1 RIVER

5.1.1 Whitlock-Vibert Boxes

Section G(1)(j) of the Framework Agreement “Stocking Program” discusses trout stocking in the lower Kings River. Trout egg planting is conducted to increase trout numbers by augmenting the naturally spawned population of rainbow trout. Planting of trout eggs is a fast, efficient, and inexpensive way to increase recruitment of juvenile fish in the river.

Whitlock Vibert Boxes (WVB) were used during this reporting period to hatch eyed rainbow trout eggs, inside the streamside incubators.

5.1.2 Streamside Incubators

The streamside incubators consisted initially of refrigerators that had been modified to hatch trout eggs. Beginning in 2003, permanent streamside incubators were constructed to replace the refrigerators. The incubators consist of a concrete vault that contains a tank constructed of plywood and fiberglass. A 0.75 horse power pump supplies water from the river that flows through the tank, over the charged WVBs, and back into the river (Figure 5-1).

The upper streamside incubator is located downstream of Pine Flat Recreation Area. The lower incubator is located at the lower end of the Thorburn Spawning and Rearing Channel adjacent to the river. These incubators were used three times during the 2006-2007 program year. In December 2006, approximately 200,000 eyed Highway (hatchery strain) rainbow trout eggs were loaded into the tanks. Once hatched, the fry were distributed to the adjacent sections of the river. An additional 100,000 eyed Hot Creek (hatchery strain) rainbow trout eggs were loaded into the tanks in March of 2007. Finally, in May of 2007, approximately 66,000 triploid trout eggs were loaded into the tanks as part of the Incubator Effectiveness Study proposed in the 2007-2008 5-Year Implementation Plan. Overall, the 2006-2007 program year was one of the most busy on record for incubator activities.



Figure 5-1. Streamside incubator with thousands of rainbow trout fry

5.1.3 Rainbow Trout Stocking

Trout stocking is the responsibility of the CDFG and occurs at no cost to the FMP.

5.1.3.1 Sub-Catchable Size Rainbow Trout

On October 16th, 2006, 2,100 pounds (25,830 trout) of sub-catchable rainbow trout (4-6 inches in length) were stocked in the lower Kings River as part of the put-and-grow program. The strain of trout utilized were the offspring of Eagle Lake rainbow trout from Eagle Lake in northern California.

Eggs are taken from female Eagle Lake trout as they ascend a tributary creek to spawn. They were fertilized by males also collected during the spawning run, and the eggs held in the hatchery for later distribution. San Joaquin Hatchery personnel stocked the small trout at Winton and Choinumni Parks. These fish were provided by the CDFG at no cost to the FMP.

5.1.3.2 Fingerling Rainbow Trout

On 12/12/2006 the San Joaquin Hatchery planted 138,244 Rainbow trout fingerlings (323 pounds) in the lower river. There currently is no annual allotment for RT fingerlings on the Kings River. These fish were in excess of the production needs of the hatchery and the Kings was selected as a suitable destination.

5.1.3.3 Catchable-Sized Rainbow Trout

The current annual allotment for the Kings River below Pine Flat is 18,000 pounds of catchable trout. However, a total of 29,037 pounds of catchable sized trout (35,827 fish) were stocked in the lower Kings River during this reporting period. This increase (61%) over the proposed allotment was due to the “Trophy Trout” program implemented on the Kings River. Normally, catchable trout (2 fish per pound) are stocked either once or twice per week during the non-irrigation period (roughly October through March) and once each week during the irrigation season when flows are high. Beginning December 2005, large trout were planted in the put-and-take section as well as the catch-and-release section. This program continued into the 2006-2007 program year. The trout in the program averaged over 7 pounds each overall, with the larger fish weighing in over 10 pounds during the December through March (Figure 5-2). During this period, 800 trout (5,590 pounds) were planted as part of the program to increase licenses sales and get anglers to return to the Kings River. This created a huge response from anglers, throughout the Valley and State. The program also generated positive press releases and

magazine articles as a result. The program will continue a minimum of one more year for evaluation. The full Kings River Planting Records from the San Joaquin Hatchery are available in Appendix E.



Figure 5-2. Trout averaging 4.1 pounds each were stocked by CDFG from December through March. The program will continue a minimum of two more years for evaluation.

5.1.4 Trout Relocation to the Lower Kings River

In 2004-2005, an element to relocate wild rainbow trout from the upper Kings River watershed to the lower Kings River was developed. Some preliminary planning and discussions were conducted for this element. This element may be implemented in the future. The activities were conducted under Element N-2004-8: Trout Relocation to the Lower Kings River of the 5-Year Implementation Plan. However, no work occurred during 2006-2007 reporting period.

5.2 RESERVOIR

5.2.1 Kokanee Salmon

No Kokanee salmon were planted in Pine Flat Reservoir during this reporting period.

5.2.2 Fingerling Rainbow Trout

The CDFG San Joaquin hatchery personnel stocked fingerling rainbow trout twice during the reporting period in Pine Flat Reservoir. The first plant was 46,872 trout weighing a total of 216 pounds and occurred on 1/24/2007. The second fingerling plant was two days later on 1/26/2007, and consisted of 54,058 trout weighing a total of 302 pounds.

5.2.3 Sub-Catchable Sized Rainbow Trout

No sub-catchable trout were planted in Pine Flat Reservoir during the reporting period.

5.2.4 Catchable-Sized Rainbow Trout

The current annual allotment for Pine Flat Reservoir is 22,000 pounds for the calendar year. Between 11/1/2006 and 3/5/2007, 25,000 pounds (42,500 trout) were planted in Pine Flat Reservoir. The catchable trout averaged around ½ pound each (2 fish/pound) at the time they were stocked in the reservoir (load averages ranged 1.4 to 2.4 fish/pound).

5.2.5 Chinook Salmon

The most recent planting of Chinook salmon fingerling was 4/30/2007, which was 59,940 fingerlings weighing 780 pounds.

5.2.6. Avocado Lake

Avocado Lake is a Fresno County Park located adjacent to the lower Kings River. The lake site served as a source of rock and gravel for the construction of Pine Flat Dam. The lake is a popular recreational site and supports thousands of angler hours each year. The annual allotment delivered during the winter months is 6,000 pounds. In 2006-2007 reporting period, the San Joaquin Hatchery planted 7,200 pounds (12,270 trout) of catchable size rainbow trout in Avocado Lake.

5.3 SUMMARY AND DISCUSSION

- Whitlock Vibert Boxes (WVB) were used during this reporting period to hatch eyed rainbow trout eggs, inside the streamside incubators;
- The streamside incubators located downstream of Pine Flat Recreation Area and adjacent to the lower end of the Thorburn Spawning and Rearing Channel, were used extensively during the 2006-2007 program year. 200,000 eggs were planted in December of 2006, 100,000 eggs in March of 2007, and 66,000 triploid eggs in May of 2007. The fry were distributed to the adjacent section of river;
- On October 16th, 2006, 2,100 pounds (25,830 trout) of sub-catchable rainbow trout (4-6 inches in length) were stocked in the lower Kings River as part of the put-and-grow program. These fish were provided by the CDFG at no cost to the FMP;
- On December 12th, 2006, the San Joaquin Hatchery planted 138,244 Rainbow trout fingerlings (323 pounds) in the lower river. There currently is no annual allotment for RT fingerlings on the Kings River. These fish were in excess of the production needs of the hatchery and the Kings was selected as a suitable destination;
- A total of 29,037 pounds of catchable sized trout (35,827 fish) were stocked in the lower Kings River during this reporting period. This increase (61%) over the proposed allotment was due to the "Trophy Trout" program implemented on the Kings River. Beginning December 2005, large trout were planted in the put-and-take section as well as the catch-and-release section. This program continued into the 2006-2007 program year. The trout in the program averaged over 7 pounds each overall, with the larger fish weighing in over 10 pounds during the December through March. The program will continue a minimum of one more year for evaluation;
- No sub-catchable trout were planted in Pine Flat Reservoir during the reporting period;
- Between November 1st, 2006 and March 5th, 2007, 25,000 pounds (42,500 trout) were planted in Pine Flat Reservoir. The catchable trout averaged around ½ pound each at the time they were stocked in the reservoir;

- The most recent planting of Chinook salmon fingerling was April 30th, 2007, which was 59,940 fingerlings weighing 780 pounds; and
- In 2006-2007 reporting period, the San Joaquin Hatchery planted 7,200 hundred pounds (12,270 trout) of catchable size rainbow trout in Avocado Lake.

6.0 MONITORING

Section G (1)(k) of the Framework Agreement “Development of Criteria/Monitoring” calls for the agencies to carry out a monitoring program to determine the effects of various elements of the FMP and the overall status of the fishery. One objective of the FMP is to establish a comprehensive monitoring program that is to provide the agencies and the public with a gauge with which to evaluate the status of the fishery and the relative merits of any particular project.

6.1 RIVER

6.1.1 Annual Fish Population Surveys

Long-term annual baseline trout fisheries monitoring within the lower Kings River is being conducted as part of the FMP to determine (1) juvenile trout abundance and distribution; (2) adult trout abundance and distribution; (3) reproductive success, growth, and survival; (4) over-wintering survival, size and age structure of the population; and (5) assess the abundance and condition of the fish community inhabiting the lower Kings River.

The 5-Year Plan proposed that electrofishing surveys would be conducted two times per year during (1) spring (prior to initiation of the major irrigation releases) and (2) fall (at the completion of the irrigation season). During the 2006-2007 study period, electrofishing surveys were conducted one time, in November, 2006. Electrofishing is performed at sampling sites within each of the three management reaches of the lower Kings River (Figure 6-1). Surveys are conducted at the same sampling sites each year for use in establishing an abundance index, and for determining trends in abundance of trout and other fish species. Sampling is conducted using a block net on the upper end of the sample reach and backpack electrofishers. Electrofishing surveys have been conducted over a period of 23 years (since 1983) in the Kings River by KRCD and CDFG biologists. The number of sites sampled has been expanded over the years. To the extent possible, sampling methods and the sampling locations utilized in previous surveys by KRCD have been incorporated as part of the electrofishing monitoring program to allow comparison of current results with previous monitoring. Data collected during the survey include species and number of fish, length and weights of trout and any marked trout are noted. This data can then be compared to previous surveys to determine trends in the populations and condition of the trout.

Six of the seven permanent sampling sites, ranging from 200 to 500 yards in length, were sampled using backpack electrofishers in November 2006. Crews consisting of 15 to 24 people and five to seven electrofishers were used to conduct the sampling. Low numbers of rainbow trout were caught at three of the four sites upstream of Fresno Weir and no trout were caught at one of the two sites sampled downstream of the Fresno Weir. The Alta site produced a high number of trout captured (47) but do to possible misidentification by assistants, the actual number of trout may have been lower. Historically, however, the Alta site has produced lots of trout. The numbers of wild trout captured in 2006 were slightly higher than the numbers captured in 2004 and 2005. No large 1+ year old trout were captured at any of the sampling sites. As in past years, the most abundant fish were the Sacramento sucker (*Catostomus occidentalis*) and riffle sculpin (*Cottus gulosus*).

6.1.2 Macroinvertebrates Study

In November 2006 and February 2007, KRCD staff collected insect samples from six sites on the lower Kings River. Samples were collected according to CDFG's California Stream Bioassessment Procedure modified for low gradient channels. Additional instructions for bifurcated channels and channels immediately below impoundments were followed. The results of the laboratory analysis were not available for publication in the 2006-2007 Annual Technical Report.

6.1.3 Fish Tracking Study

182 radio transmitters were implanted into study fish which were subsequently released into the lower Kings River for study. To date, more than 5 million data points have been collected.

Experimentation with other tracking methods such as aerial tracking and float tracking continued during the program year. The California Department of Fish & Game (CDFG) provided a fixed wing aircraft for monitoring a large section of the watershed in a relatively short period of time. CDFG also supplied 2 inflatable pontoon boats in an effort to cover the entire study area in one day. Float tracking proved to be a highly efficient method of tracking study fish. The FMP purchased 2 inflatable pontoon boats and float tracking trips are now conducted on a weekly basis. The activities were conducted under Element C-2007-5: Monitoring of the 5-Year Implementation Plan.

6.1.6 Electroshocking Survey (Raft)

While funds were budgeted for this element, no activity occurred and funds will be carried over to the next program year. Raft testing and repairs are planned in the future. Funds were budgeted under Element C-2007-5: Monitoring of the 5-Year Implementation Plan.

6.1.7 Water Quality Sampling (River)

As per the Fisheries Management Program's 2004 Water Quality Monitoring Report, sampling occurred during the 2006-2007 program year at Fresno Weir. The sampling included monthly measurements for general parameters such as temperature, pH, turbidity, alkalinity, and hardness, as well as for basic metals and organophosphates. Results will be analyzed once all samples are collected. Water quality monitoring will continue into the 2007-2008 program year according to the Water Quality Monitoring Report. This report is available at the KRCD offices, or on the Fisheries Management Program's website, currently hosted by KRCD at <http://www.krcd.org>. The activities were conducted under Element C-2007-5: Monitoring of the 5-Year Implementation Plan.

6.1.8 Real-Time Monitoring

While funds were budgeted for this element, no activity occurred and funds will be carried over to the next program year. No special monitoring events occurred that required the use of the funds. The funds were budgeted under Element C-2007-5: Monitoring of the 5-Year Implementation Plan.

6.1.9 Algal Monitoring

While funds were budgeted for this element, no activity occurred and funds will be carried over to the next program year. No observations of dead or dying algae were reported. The funds were budgeted under Element C-2007-5: Monitoring of the 5-Year Implementation Plan.

6.1.10 Fish Tag Purchase

An additional 80 transmitters (40 large, 40 small) were purchased during the program year for a total cost of \$15,710.00. In addition, one mobile receiver required repairs for water damage. A similar receiver was rented while waiting for completion of repairs, with the cost of repairs and rental totaling \$4,001.00. The stationary units were upgraded from the SRX-400 models to the SRX-600 models due to quicker data transfer rates and higher memory capacity. The cost of the upgrades totaled \$6,928.00. The total expenditure for telemetry tracking materials was \$26,639.00. The funds were budgeted under Element C-2007-5: Monitoring of the 5-Year Implementation Plan.

6.1.11 Annual Technical Report

The fourth Annual Technical Report was published and distributed by the FMP in February 2007. The report covered activities for program year 2005-2006 and its 5-Year Implementation Plan. The report was reviewed and approved by the PAG and ExCom. The activities were conducted under Element C-2007-5: Monitoring of the 5-Year Implementation Plan.

6.2 RESERVOIR

6.2.1 Bass Tournament Results

The results of organized angling events are a cost effective means of monitoring the overall condition of the warmwater fishery (see 2002-2003 Annual Technical Report for details and references). The CDFG summarizes results of tournament records on an annual basis. The available information is summarized in Table 6-3.

For the 2006-2007 program year, a complete data set is available for 30 permitted bass tournaments held at Pine Flat Reservoir. The number of participants was 1,000 and the average size of bass returned for Weigh-In was 1.38 pounds.

Table 6-1. Summary of results of organized bass angling tournaments held at Pine Flat Reservoir.

Year	2000	2001	2002	2003	2004	2005	2006	2007
No. Tournaments	31	16	25	29	33	32	23	32
No. Anglers	862	367	702	820	890	841	658	1,000
Total Hrs. Fished	7,012	3,454	6,428	7,067	7,807	7,304	5,279	7,940
Total No. Bass	1,495	811	1,680	2096	2136	1,634	1,505	2,315
Total Weight (lbs.)	1,750	1,245	3,108	3,593.5	3,289.1	2,385	2,570	3,199
Hrs fished/angler	8.13	9.41	9.16	8.62	8.77	8.68	8.02	7.93
Avg. per bass (lbs)	1.17	1.54	1.85	1.71	1.54	1.46	1.71	1.38
Catch/Hr.	0.213	0.235	0.261	0.297	0.274	0.224	0.285	0.292

6.2.2 Pine Flat Reservoir Fish Population

No electrofishing, gill netting, or sub-sampling of bass tournaments occurred during this reporting period.

6.3 SUMMARY AND DISCUSSION

As part of the FMP habitat and fishery monitoring has been conducted within the lower river and Pine Flat Reservoir. Results of the 2006-2007 monitoring program have shown:

- During the 2006-2007 study period, electrofishing surveys were conducted one time, in November, 2006. Six of the seven permanent sampling sites, ranging from 200 to 500 yards in length, were sampled using backpack electrofisher. The numbers of wild trout captured in 2006 were slightly higher than the numbers captured in 2004 and 2005. As in past years, the most abundant fish were the Sacramento sucker (*Catostomus occidentalis*) and riffle sculpin (*Cottus gulosus*);
- In November 2006 and February 2007, KRCD staff collected insect samples from six sites on the lower Kings River. The results of the laboratory analysis were not available for publication in the 2006-2007 Annual Technical Report;
- Transmitters were implanted and 3 groups of tagged fish were released in the Kings River for study;
- As per the Fisheries Management Program’s 2004 Water Quality Monitoring Report, sampling occurred during the 2006-2007 program year at Fresno Weir. The sampling included monthly measurements for general parameters such as temperature, pH, turbidity, alkalinity, and hardness, as well as for basic metals and organophosphates.

Results will be analyzed once all samples are collected. Water quality monitoring will continue into the 2007-2008 program year according to the Water Quality Monitoring Report; and

- The Fourth annual Technical Report was completed in February 2007;
- There were 30 permitted bass tournaments with complete data sets at Pine Flat Reservoir during the 2006-2007 program year. The number of participants was 1,000 and the average size of bass returned for Weigh-In was 1.38 pounds.

7.0 PUBLIC EDUCATION AND OUTREACH

7.1 News Releases and Newsletters

An issue of Kings River Fisheries News newsletter was published and distributed in the early summer of 2006 with the assistance of the Public Advisory Group. The activities were conducted under Element C-2007-4: Public Education of the 5-Year Implementation Plan.

7.2 Summer Hydrology and Temperature Report

KRWA has developed a real-time telemetry system for monitoring water temperature and streamflow at Fresno Weir. During the summer and fall of 2004 information developed from monitoring being conducted on the lower Kings River was compiled in weekly reports and distributed by KRWA to members of the PAG and other interested parties to provide current information on environmental conditions occurring within the lower river that would affect habitat quality for trout. Weekly reports were distributed electronically to inform managers and other interested parties regarding conditions currently occurring within the lower river. The water temperature and flow monitoring and reporting provided a valuable tool for disseminating real-time information. The TSC has recommended that the real-time monitoring and dissemination of weekly reports, when appropriate, be continued as part of the FMP. In addition, the TSC recommends that information on current conditions occurring within the lower Kings River be developed in a format compatible with posting on an Internet based web page that would be accessible to the public. The activities were conducted under Element C-2007-5: Monitoring of the 5-Year Implementation Plan.

7.3 Web Page Development

The PAG has developed and is operation a web page to inform the public, fishing groups, and government agencies about the FMP. The web page also presents angling opportunities and information related to the Kings River. This website is viewable at <http://www.kingsriverfisheries.org>. The activities were conducted under Element C-2007-4: Public Education of the 5-Year Implementation Plan.

7.3.5 Ad-Hoc Group on Public Outreach

An Ad-Hoc committee as approved by the Ex-Com began meeting in April of 2007 on development of public outreach materials for the Fisheries Management Program. The activities were conducted under Element C-2007-4: Public Education of the 5-Year Implementation Plan.

7.4 Educational Tours & Clean-up: Thorburn Spawning and Rearing Channel

During the program year, several educational tours were conducted at the Thorburn Spawning and Rearing Channel.

7.5 Kings River Day 2007

The PAG worked extensively with the 2007 Kings River Day event, to provide valuable historical, operational, scientific and recreational opportunities to hundreds of 6th graders. The event was successfully held on May 18, 2007. This annual event has become an important part of the outreach function of the PAG, and comments from students, teachers, and administrators have been very positive.

8.0 OUTSTANDING ELEMENTS

With limited exception, efforts on elements from previous years and the 2006-2007 5-Year Implementation Plan were not conducted during the program year or are ongoing. Some elements may be carried over to the next program year. Below is a brief summary of those elements.

Study of Pool Habitat and Constructed Deep Water Habitat Pilot Project (C-2007-15). - Implementation of this element did not occur during the program year. Funds will be carried over to the next program year.

Phytoplankton and Nutrient Resource Study (N-2007-9). -Little activity occurred for this element during the program year. This is an important element that the TSC plans to research and address in the future.

9.0 MAINTENANCE ACTIVITIES

9.1 Thorburn Channel Maintenance

Spraying of weeds, brushing, and tree trimming took place along the roadway and nature trail. The headgate was checked every one to two weeks and accumulated debris was removed. The k-rail was checked for beaver dam-building activities and dams were removed. Two areas damaged by the flood releases were repaired. The activities were conducted under Element M-2007-1: Thorburn Channel Maintenance of the 5-Year Implementation Plan.

9.2 Streamside Incubator Operation and Maintenance

The two streamside incubators located near the Thorburn Channel and the Pine Flat Recreation Area were maintained during the year. Plumbing repairs and a new intake screens were installed to improve operation of the water pump. The activities were conducted under Element M-2007-2: Streamside Incubator Operation and Maintenance of the 5-Year Implementation Plan.

10.0 DEVELOPMENT OF 5-YEAR PLAN

Section G(1) of the Framework Agreement includes elements addressing adaptive management (Section 1b); stream temperature monitoring (Section 1d); funding for habitat enhancement projects (Section 1f); enforcement, education, and awareness program (Section 1i); stocking program (Section 1j); development of criteria/monitoring (Section 1k); and access (Section 1p). The 5-Year Plan helps to provide guidance, prioritize activities and the allocation of expenditures, and coordinate among the parties to facilitate efficient implementation of these elements of the Framework Agreement.

A 5-Year Plan was developed during this reporting period (May 2006 to May 2007). This was the sixth annual modification to the 5-Year Plan since the signing of the Framework Agreement on May 28, 1999. Development of the 5-year work plan is based on a consideration of (1) specific requirements identified within the Framework Agreement; (2) results of previous fisheries and water quality monitoring; and (3) prioritization of habitat restoration activities based upon limiting factors analyses. The 5-Year Plans: (1) provide a project management structure for reviewing and prioritizing proposed habitat enhancement activities, fish stocking, and other elements of the Framework Agreement; (2) identify the objectives and methods to be used to assess the overall response of trout and other species for use in evaluating achievement of the Kings River aquatic resource goals as identified in Section 1a of the Framework Agreement; and (3) provide a framework for the experimental design and evaluation of specific enhancement activities (e.g., enhancement projects funded under the Framework Agreement, fish stocking and supplementation, pulse flows for temperature management, etc.) within the context of the overall goals and activities being implemented through the Framework Agreement. Results of monitoring and evaluation activities serve, in part, as the basis for the adaptive management element of the Framework Agreement (Section 1b) and for identifying changes in program priorities, or the allocation of resources from one program element to another. The 5-Year Plan is a “living plan” that is reviewed by the TSC, PAG and ExCom on an annual basis throughout the 10-year period of the agreement and revised as projects and elements of the program are implemented and as new scientific information becomes available.

11.0 REFERENCES

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APPENDIX A

Summary of Daily Hydrologic Data for Pine Flat and the Kings River
(on following pages)

Provisional data, storage in acre-feet, other data in cubic feet per second.

Date	Pine Flat Storage Acre-feet	Flow at Piedra cfs	Pre Project Piedra cfs	Measured Flows Below Fresno Weir cfs
6/1/2006	918891	11335	13287	7,660
6/2/2006	921780	11106	14949	7,293
6/3/2006	926777	11012	16214	7,180
6/4/2006	934817	11024	18233	7,215
6/5/2006	943473	11015	18421	7,162
6/6/2006	952870	11180	18957	7,243
6/7/2006	960289	11426	17559	7,434
6/8/2006	965527	11502	16153	7,512
6/9/2006	971131	11053	15429	6,999
6/10/2006	974761	11126	14182	7,028
6/11/2006	977484	11459	13929	7,373
6/12/2006	980045	11097	13241	7,080
6/13/2006	981398	11145	11905	7,145
6/14/2006	979339	11257	9912	7,189
6/15/2006	976931	11372	10166	7,253
6/16/2006	977694	10700	11389	6,586
6/17/2006	980515	10158	12061	6,075
6/18/2006	984166	10175	12490	6,061
6/19/2006	987058	10837	12629	6,714
6/20/2006	988357	11183	11912	7,122
6/21/2006	988831	11175	11459	7,112
6/22/2006	989421	11221	11621	7,029
6/23/2006	989186	11414	11559	7,232
6/24/2006	988890	10960	11048	6,791
6/25/2006	988771	10466	11489	6,305
6/26/2006	989421	9704	10495	5,534
6/27/2006	989480	8723	9430	4,565
6/28/2006	989362	8406	9095	4,250
6/29/2006	988712	8585	8730	4,360
6/30/2006	987117	8524	8098	4,369
7/1/2006	986939	8143	8143	4,110
7/2/2006	987353	7530	7801	3,546
7/3/2006	986114	7397	6820	3,433
7/4/2006	984873	7399	6762	3,377
7/5/2006	983341	7388	6518	3,316
7/6/2006	981398	7297	6165	3,241
7/7/2006	978517	7307	5454	3,237
7/8/2006	974351	7440	5085	3,380
7/9/2006	970663	7467	5505	3,407
7/10/2006	966284	7535	5101	3,459
7/11/2006	961509	7453	4771	3,425
7/12/2006	956286	7537	4699	3,512

Provisional data, storage in acre-feet, other data in cubic feet per second.

Date	Pine Flat Storage Acre-feet	Flow at Piedra cfs	Pre Project Piedra cfs	Measured Flows Below Fresno Weir cfs
7/13/2006	950386	7578	4325	3,539
7/14/2006	943646	7670	3872	3,616
7/15/2006	936648	7594	3823	3,557
7/16/2006	929339	7601	3731	3,550
7/17/2006	922630	7513	3843	3,459
7/18/2006	916347	7407	3990	3,353
7/19/2006	909414	7470	3654	3,396
7/20/2006	902680	7450	3963	3,388
7/21/2006	897203	7424	4491	3,351
7/22/2006	891910	7360	4362	3,296
7/23/2006	886527	7364	4606	3,298
7/24/2006	881716	7327	4804	3,257
7/25/2006	876313	7358	4322	3,294
7/26/2006	870163	7428	3884	3,293
7/27/2006	862892	7432	3258	3,290
7/28/2006	855766	7241	3125	3,099
7/29/2006	848403	7128	2828	2,986
7/30/2006	840918	6947	2594	2,838
7/31/2006	833148	6842	2326	2,786
8/1/2006	824997	6650	2241	2,627
8/2/2006	816256	6747	1987	2,799
8/3/2006	806729	6789	1551	2,859
8/4/2006	797683	6590	1816	2,748
8/5/2006	788746	6447	1649	2,682
8/6/2006	780124	6294	1605	2,589
8/7/2006	771607	6151	1489	2,550
8/8/2006	763039	6150	1483	2,658
8/9/2006	753918	6332	1347	2,912
8/10/2006	744709	6323	1329	3,045
8/11/2006	735711	6015	1093	2,902
8/12/2006	726922	5875	1030	2,862
8/13/2006	718043	5805	996	2,856
8/14/2006	709371	5759	966	2,880
8/15/2006	701387	5397	844	2,924
8/16/2006	693258	5454	918	3,153
8/17/2006	685276	5312	890	2,978
8/18/2006	677916	4963	965	2,651
8/19/2006	670883	4688	818	2,419
8/20/2006	663607	4656	594	2,482
8/21/2006	656887	4543	741	2,412
8/22/2006	650298	4505	677	2,426
8/23/2006	643420	4531	635	2,450

Provisional data, storage in acre-feet, other data in cubic feet per second.

Date	Pine Flat Storage Acre-feet	Flow at Piedra cfs	Pre Project Piedra cfs	Measured Flows Below Fresno Weir cfs
8/24/2006	636672	4592	886	2,524
8/25/2006	629504	4603	698	2,543
8/26/2006	622469	4599	690	2,533
8/27/2006	615294	4601	646	2,533
8/28/2006	608074	4594	590	2,521
8/29/2006	600988	4486	526	2,442
8/30/2006	594790	4097	632	2,065
8/31/2006	589200	3795	601	1,775
9/1/2006	583901	3643	462	1,663
9/2/2006	578716	3487	653	1,530
9/3/2006	573380	3359	366	1,428
9/4/2006	568548	3314	461	1,412
9/5/2006	563693	3290	533	1,412
9/6/2006	558429	3283	566	1,425
9/7/2006	553191	3333	378	1,461
9/8/2006	548234	3438	596	1,521
9/9/2006	543130	3443	465	1,521
9/10/2006	538221	3362	467	1,447
9/11/2006	533459	3267	418	1,333
9/12/2006	528930	3187	482	1,266
9/13/2006	524253	3132	401	1,249
9/14/2006	519184	3109	323	1,226
9/15/2006	515378	2734	422	1,065
9/16/2006	511257	2672	332	1,128
9/17/2006	507398	2660	334	1,152
9/18/2006	503579	2573	390	1,080
9/19/2006	500134	2458	386	962
9/20/2006	496683	2374	309	873
9/21/2006	493811	2223	361	723
9/22/2006	490786	2256	316	759
9/23/2006	487811	2257	362	765
9/24/2006	484364	2276	315	772
9/25/2006	480692	2459	308	764
9/26/2006	477274	2345	334	567
9/27/2006	473983	2282	336	565
9/28/2006	471140	2026	279	524
9/29/2006	468304	1925	279	536
9/30/2006	465361	1896	279	514
10/1/2006	462896	1532	233	170
10/2/2006	461140	1494	361	176
10/3/2006	459541	1497	378	80
10/4/2006	457519	1583	342	78

Provisional data, storage in acre-feet, other data in cubic feet per second.

Date	Pine Flat Storage Acre-feet	Flow at Piedra cfs	Pre Project Piedra cfs	Measured Flows Below Fresno Weir cfs
10/5/2006	455618	1683	425	78
10/6/2006	453412	1694	310	43
10/7/2006	451095	1713	362	46
10/8/2006	448593	1705	311	49
10/9/2006	446327	1669	316	50
10/10/2006	444067	1632	375	51
10/11/2006	442005	1623	372	51
10/12/2006	439908	1630	327	40
10/13/2006	437627	1630	357	40
10/14/2006	435353	1625	370	40
10/15/2006	433122	1624	418	40
10/16/2006	430784	1673	385	40
10/17/2006	428565	1674	396	47
10/18/2006	426502	1701	420	42
10/19/2006	424220	1700	481	41
10/20/2006	422541	1704	328	40
10/21/2006	420641	1712	402	40
10/22/2006	418413	1713	383	40
10/23/2006	416338	1714	364	43
10/24/2006	414306	1743	396	49
10/25/2006	413089	1047	300	49
10/26/2006	412315	887	274	49
10/27/2006	411727	857	321	54
10/28/2006	411211	827	302	55
10/29/2006	410477	815	290	40
10/30/2006	410330	790	307	43
10/31/2006	410330	737	284	55
11/1/2006	410587	674	300	46
11/2/2006	410844	596	283	53
11/3/2006	411543	398	277	48
11/4/2006	412536	277	335	48
11/5/2006	413273	277	262	52
11/6/2006	414269	264	261	77
11/7/2006	415007	156	261	42
11/8/2006	415673	164	208	56
11/9/2006	416190	260	308	81
11/10/2006	416782	266	229	40
11/11/2006	416930	266	203	40
11/12/2006	417598	266	218	40
11/13/2006	418821	267	405	40
11/14/2006	420492	267	449	47
11/15/2006	422056	266	571	45

Provisional data, storage in acre-feet, other data in cubic feet per second.

Date	Pine Flat Storage Acre-feet	Flow at Piedra cfs	Pre Project Piedra cfs	Measured Flows Below Fresno Weir cfs
11/16/2006	423436	264	458	50
11/17/2006	424818	260	445	46
11/18/2006	425978	260	409	47
11/19/2006	426765	258	304	49
11/20/2006	428002	257	379	46
11/21/2006	429091	260	294	48
11/22/2006	430257	260	350	49
11/23/2006	430671	260	561	49
11/24/2006	431085	260	344	49
11/25/2006	431575	260	205	49
11/26/2006	431952	260	283	50
11/27/2006	432782	261	308	49
11/28/2006	433046	265	282	47
11/29/2006	433915	266	251	47
11/30/2006	434861	267	137	77
12/1/2006	435807	269	432	107
12/2/2006	437096	267	435	107
12/3/2006	438007	268	261	107
12/4/2006	438802	266	202	107
12/5/2006	439870	268	346	105
12/6/2006	440632	259	189	103
12/7/2006	441623	259	293	103
12/8/2006	442424	259	196	103
12/9/2006	443570	261	405	107
12/10/2006	444910	263	566	110
12/11/2006	445782	260	226	106
12/12/2006	447132	259	521	105
12/13/2006	448247	282	423	106
12/14/2006	449362	282	358	107
12/15/2006	450209	281	249	106
12/16/2006	451327	281	413	107
12/17/2006	452330	282	293	105
12/18/2006	453258	282	279	101
12/19/2006	454186	289	310	105
12/20/2006	455115	292	296	64
12/21/2006	456278	291	491	51
12/22/2006	457519	293	510	55
12/23/2006	458414	288	388	50
12/24/2006	459580	288	408	48
12/25/2006	460710	287	427	47
12/26/2006	461607	286	331	47
12/27/2006	463053	295	661	53

Provisional data, storage in acre-feet, other data in cubic feet per second.

Date	Pine Flat Storage Acre-feet	Flow at Piedra cfs	Pre Project Piedra cfs	Measured Flows Below Fresno Weir cfs
12/28/2006	464265	307	525	54
12/29/2006	465635	298	476	46
12/30/2006	466694	300	427	50
12/31/2006	467912	301	422	51
1/1/2007	469131	302	435	55
1/2/2007	470076	303	278	55
1/3/2007	471376	303	421	60
1/4/2007	472876	301	649	63
1/5/2007	474695	302	653	61
1/6/2007	476319	300	552	57
1/7/2007	477788	297	434	56
1/8/2007	478742	295	460	58
1/9/2007	479418	297	464	60
1/10/2007	480055	298	311	61
1/11/2007	480971	298	394	58
1/12/2007	481968	297	416	53
1/13/2007	482167	297	253	51
1/14/2007	482846	297	304	52
1/15/2007	483765	298	313	58
1/16/2007	484605	296	303	58
1/17/2007	485204	297	330	57
1/18/2007	486126	296	362	55
1/19/2007	486687	298	287	60
1/20/2007	487329	299	317	66
1/21/2007	488092	299	289	68
1/22/2007	488855	299	314	71
1/23/2007	489458	300	297	76
1/24/2007	490102	297	331	77
1/25/2007	490504	300	300	76
1/26/2007	490907	302	326	82
1/27/2007	491148	306	303	82
1/28/2007	491632	312	396	85
1/29/2007	491874	311	255	83
1/30/2007	492116	370	323	110
1/31/2007	492277	445	290	320
2/1/2007	492519	445	334	320
2/2/2007	492721	391	309	245
2/3/2007	492923	332	294	151
2/4/2007	493084	330	298	145
2/5/2007	493285	329	284	128
2/6/2007	493649	327	382	104
2/7/2007	493973	337	362	86

Provisional data, storage in acre-feet, other data in cubic feet per second.

Date	Pine Flat Storage Acre-feet	Flow at Piedra cfs	Pre Project Piedra cfs	Measured Flows Below Fresno Weir cfs
2/8/2007	494336	343	346	74
2/9/2007	494781	331	350	75
2/10/2007	495833	318	858	79
2/11/2007	498833	329	1988	87
2/12/2007	500906	312	950	65
2/13/2007	502047	317	763	91
2/14/2007	503066	313	688	152
2/15/2007	504168	309	619	161
2/16/2007	505515	292	671	151
2/17/2007	506620	294	644	151
2/18/2007	507726	295	680	151
2/19/2007	508422	503	718	255
2/20/2007	508710	673	585	562
2/21/2007	508874	645	682	525
2/22/2007	509612	677	908	571
2/23/2007	510023	704	816	597
2/24/2007	510106	689	668	584
2/25/2007	510557	680	896	575
2/26/2007	510722	623	808	524
2/27/2007	512285	634	1414	543
2/28/2007	513109	612	1034	520
3/1/2007	513480	623	884	530
3/2/2007	513603	629	800	537
3/3/2007	513768	568	715	476
3/4/2007	513974	705	819	613
3/5/2007	514139	704	919	605
3/6/2007	514634	685	1075	583
3/7/2007	515171	642	993	541
3/8/2007	515831	640	1054	540
3/9/2007	517493	623	1056	509
3/10/2007	517193	586	1040	467
3/11/2007	518024	609	1127	478
3/12/2007	518893	532	1245	407
3/13/2007	520262	542	1510	402
3/14/2007	521591	632	1644	483
3/15/2007	523129	621	1739	469
3/16/2007	525295	601	2088	456
3/17/2007	527466	592	2161	447
3/18/2007	529893	595	2311	442
3/19/2007	532409	598	2370	438
3/20/2007	535227	594	2492	430
3/21/2007	537967	611	2431	449

Provisional data, storage in acre-feet, other data in cubic feet per second.

Date	Pine Flat Storage Acre-feet	Flow at Piedra cfs	Pre Project Piedra cfs	Measured Flows Below Fresno Weir cfs
3/22/2007	540250	512	2058	361
3/23/2007	542580	394	1157	248
3/24/2007	544532	390	1650	249
3/25/2007	546615	368	1837	228
3/26/2007	549130	348	1982	217
3/27/2007	552292	367	2342	228
3/28/2007	554262	415	1720	273
3/29/2007	556236	430	1691	287
3/30/2007	557955	468	1669	325
3/31/2007	559592	484	1649	338
4/1/2007	561662	454	2255	305
4/2/2007	563736	538	2411	389
4/3/2007	566204	705	2406	551
4/4/2007	568851	798	2793	631
4/5/2007	570982	860	2596	676
4/6/2007	573423	674	2746	485
4/7/2007	577313	354	3113	183
4/8/2007	580998	338	2972	195
4/9/2007	585223	316	3194	180
4/10/2007	589200	356	3114	219
4/11/2007	592524	439	2672	292
4/12/2007	595323	478	2236	325
4/13/2007	597282	458	1782	301
4/14/2007	599156	422	1811	264
4/15/2007	601211	414	1739	258
4/16/2007	603091	365	1689	214
4/17/2007	605378	313	1498	167
4/18/2007	607489	360	1794	215
4/19/2007	609335	351	1561	209
4/20/2007	611228	340	1512	202
4/21/2007	612897	341	1426	203
4/22/2007	615294	382	1962	241
4/23/2007	617198	446	1757	282
4/24/2007	619194	575	1942	242
4/25/2007	621194	725	2150	266
4/26/2007	623609	784	2568	228
4/27/2007	626210	789	2627	223
4/28/2007	629779	831	3886	199
4/29/2007	634968	920	4677	170
4/30/2007	640041	1144	4783	82
5/1/2007	644393	1324	4572	72
5/2/2007	648296	1399	4329	81

Provisional data, storage in acre-feet, other data in cubic feet per second.

Date	Pine Flat Storage Acre-feet	Flow at Piedra cfs	Pre Project Piedra cfs	Measured Flows Below Fresno Weir cfs
5/3/2007	650671	1492	3265	99
5/4/2007	652210	1515	2763	89
5/5/2007	653191	1500	2361	80
5/6/2007	653658	1504	2062	86
5/7/2007	653986	1545	2181	113
5/8/2007	654827	1581	2525	117
5/9/2007	656653	1617	3359	88
5/10/2007	659890	1637	4190	86
5/11/2007	663041	1738	4221	137
5/12/2007	666342	1806	4308	200
5/13/2007	669557	1806	4321	200
5/14/2007	672780	1807	3861	201
5/15/2007	676249	1819	4032	213
5/16/2007	679394	1891	4009	266
5/17/2007	682978	1897	4184	251
5/18/2007	686811	1891	4267	245
5/19/2007	689838	1888	3979	237
5/20/2007	692872	1869	3923	231
5/21/2007	695623	1962	3637	363
5/22/2007	697557	2160	3442	557
5/23/2007	698574	2268	3022	645
5/24/2007	698671	2373	2423	713
5/25/2007	698332	2452	2408	784
5/26/2007	697896	2492	2546	816
5/27/2007	697751	2484	2771	807
5/28/2007	698090	2454	2908	816
5/29/2007	698429	2428	2771	842
5/30/2007	698671	2409	2776	854
5/31/2007	698332	2434	2499	858

APPENDIX B

Example of Hydrologic and Climate Summary Report
(on following page)

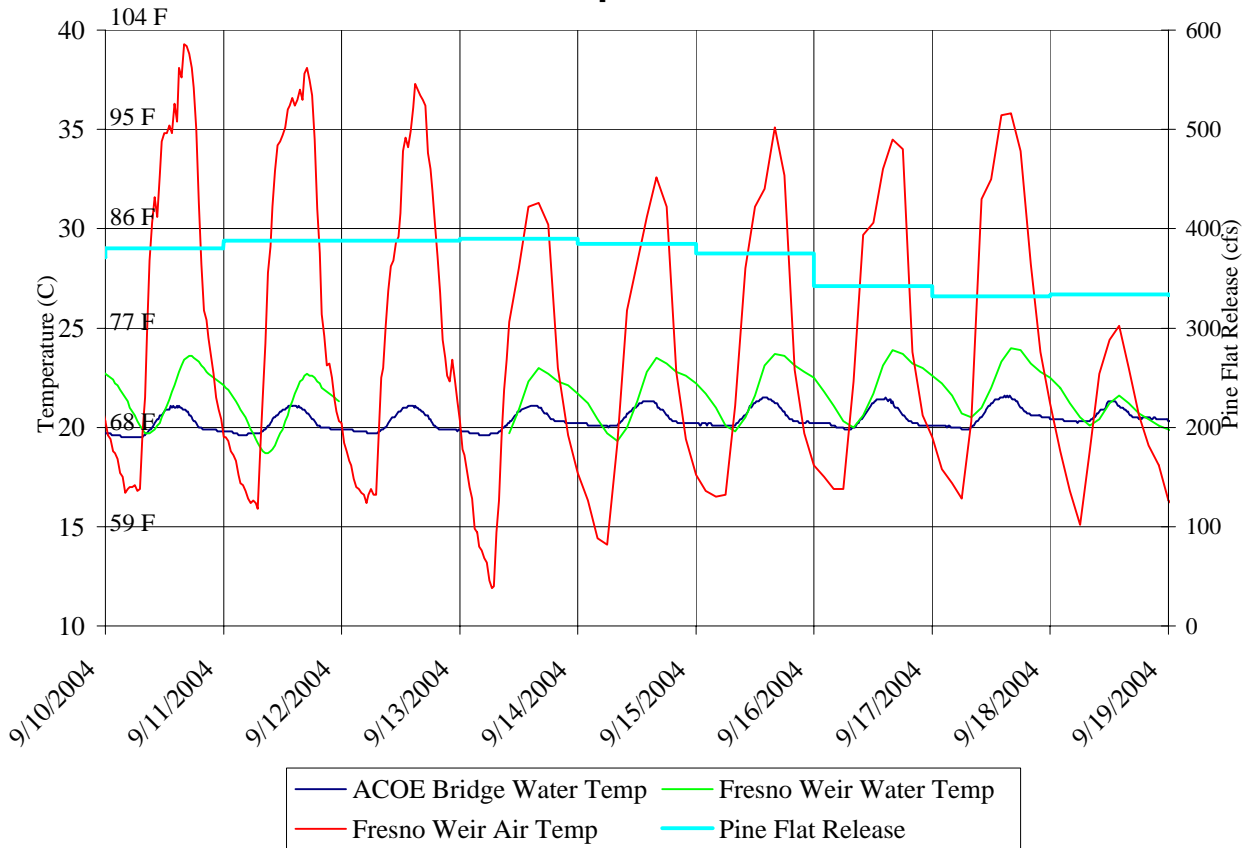
Kings River Fisheries Management Program Hydrologic and Climatic Summary Report

Provisional Data - Subject to Revision
9/21/2004

Flow Rates	Actual	Exhibit "C" Criteria	Date	
Mill & Hughes Creeks	0	NA	9/19/2004	KRWA
Piedra	333 cfs	100 cfs	9/19/2004	KRWA
Dennis Cut	55 cfs	5 cfs	9/19/2004	KRWA
At Fresno Weir	203 cfs	95 cfs	9/19/2004	KRWA
Over Fresno Weir	48 cfs	35 cfs	9/19/2004	KRWA

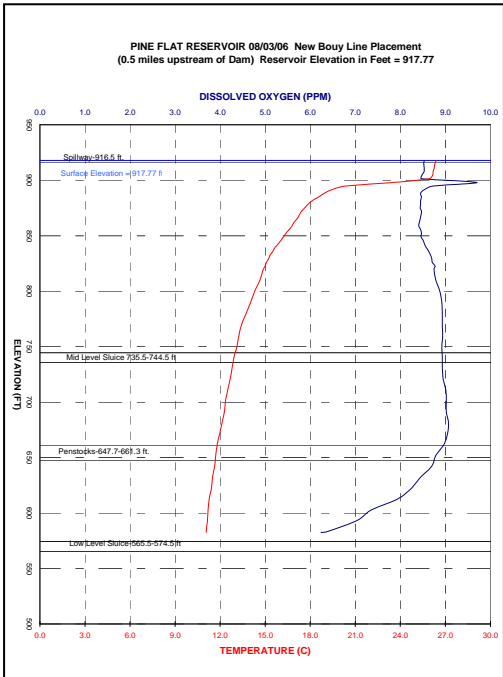
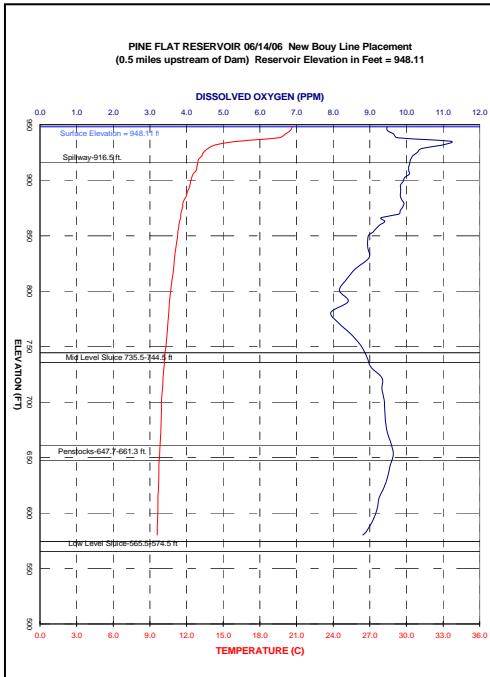
Pine Flat		Date			
Storage	115,300 af	9/19/2004	0700	ACOE	
Elevation	721 ft	9/19/2004	0700	ACOE	
Release	333 cfs	9/19/2004	0700	KRCD	
Release Temperature	69 F	20.3 C	9/19/2004	0700	KRCD
Avg. Fresno Weir Water Temp	67 F	19.6 C	9/19/2004		

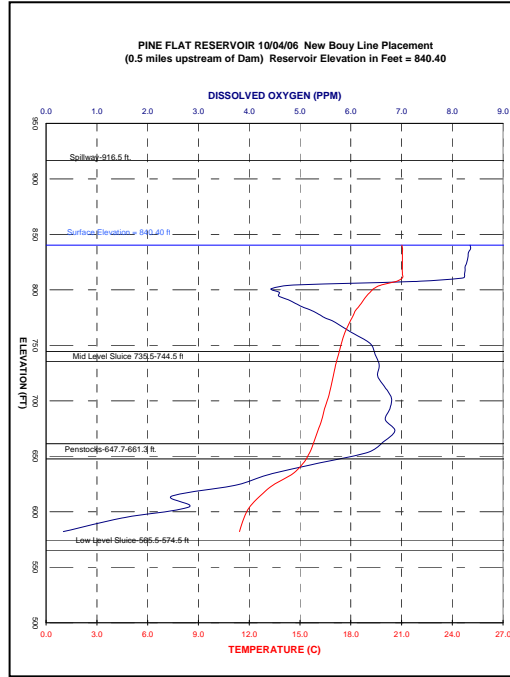
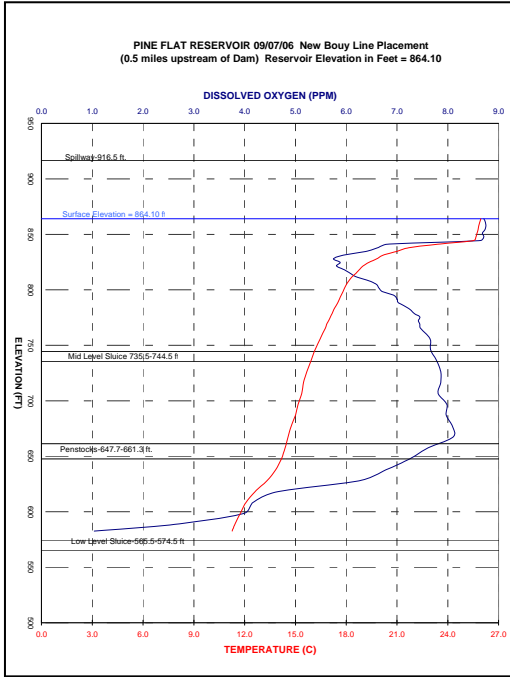
Flow and Temperature Trends

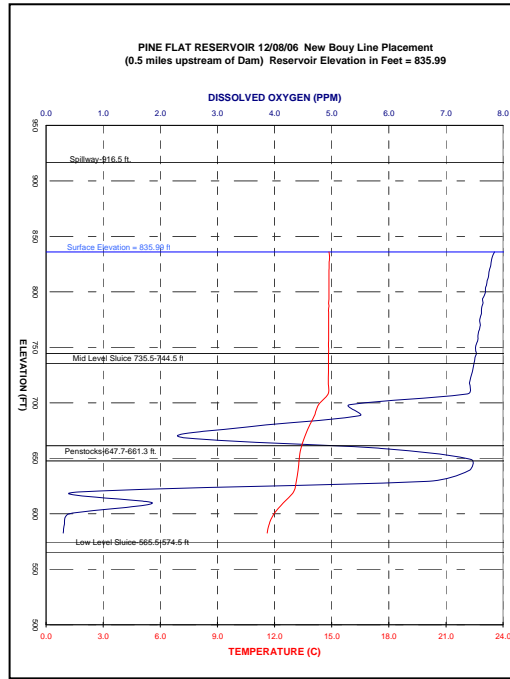
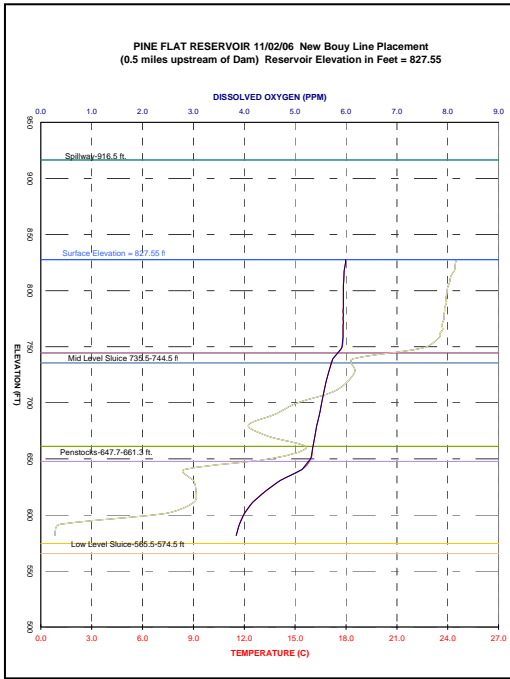


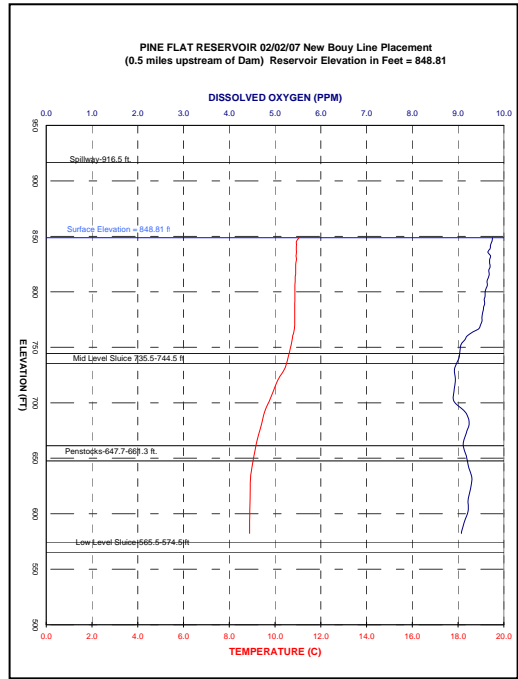
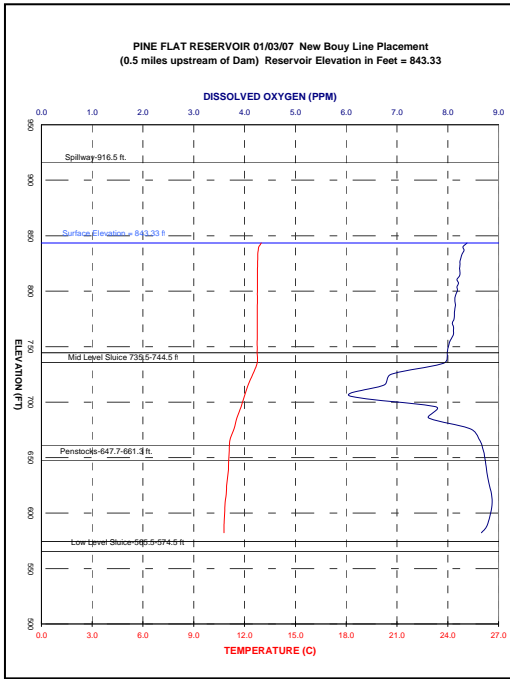
APPENDIX C

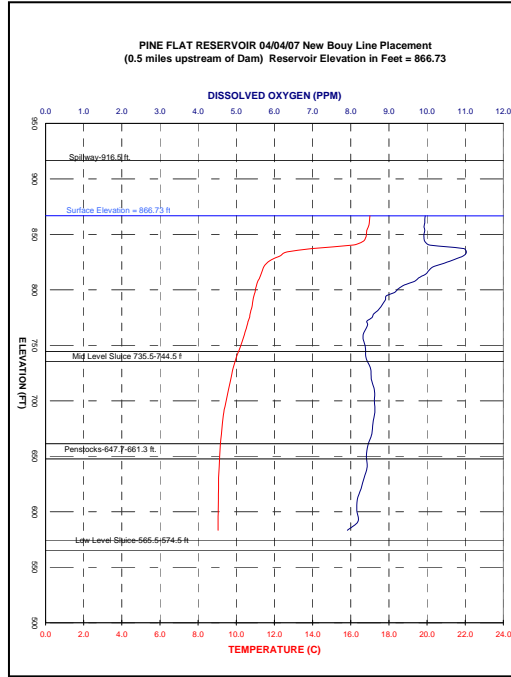
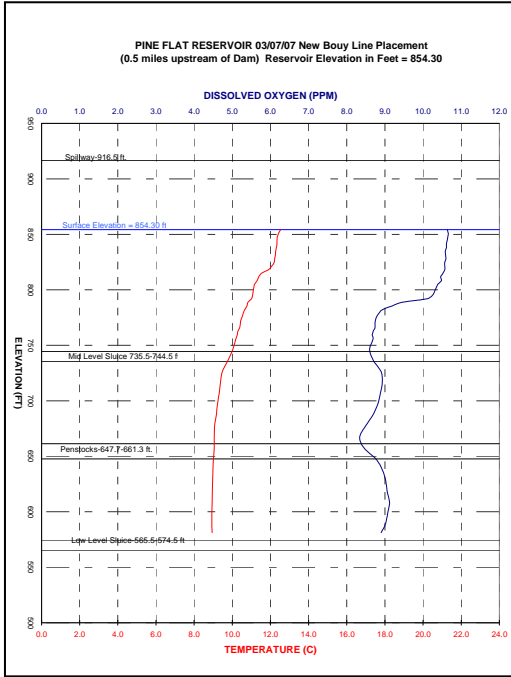
Pine Flat Reservoir Temperature and Dissolved Oxygen Profiles from May 2006 through
May 2007 (on following pages)

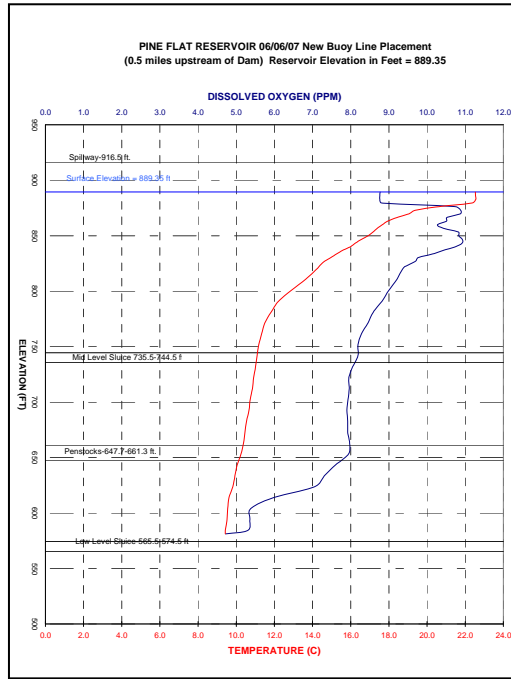
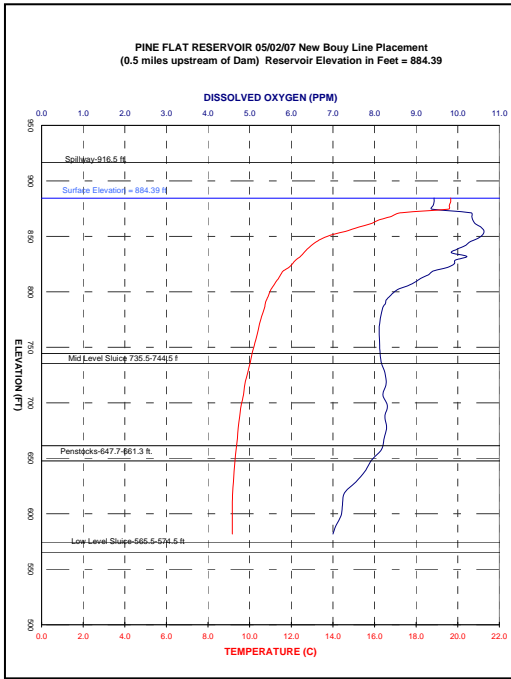












APPENDIX D

Results of Water Temperature Monitoring on the Lower Kings River
(on following page)

**Kings River Water Temperatures
Gould Weir
June 2006-May 2007**

