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4888 E. Jensen Ave Fresno, CA 93725 KINGS RIVER FISHERIES MANAGEMENT PROGRAM ANNUAL TECHNICAL REPORT Water Year 2023-2024



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Issued: February 26, 2025

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# **EXECUTIVE SUMMARY**

The Kings River Water Association, Kings River Conservation District, and California Department of Fish and Wildlife 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 eighteen years in response to the Kings River Fisheries Management Program (KRFMP) Framework Agreement, which was approved on May 28, 1999, with the financial commitment extended for another ten-year period on June 26, 2009, and again on May 28, 2019. The Framework Agreement includes actions designed to protect and enhance fishery habitat within the lower Kings River and in Pine Flat Reservoir. The Technical Steering Committee is responsible for implementing the actions authorized under the agreement and approved by the Executive Policy Committee. The scope of activities undertaken as part of the KRFMP 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 KRFMP. Report timeline for activities includes Water Year 2024 (October 1, 2023- September 30, 2024) and CDFW stocking activity for Calendar Year 2024.

Key Elements of the program include:

- In-kind support from agencies and volunteers totaled 3,815 hours;
- Kings River runoff in Water Year 2024 was 95% of average, approximately 1.6 million-acre-feet;
- An Exhibit "D" enhanced minimum flow period was provided;
- All instream flow targets met as outlined in the Framework Agreement, except for five occurrences outlined in Section 2;
- Two sudden changes to Pine Flat release points were observed in June and July associated with lightning and wildfire activities, which impacted water quality;
- Submitted two habitat enhancement project grant applications;
- Continued implementation of a supplemental Rainbow Trout stocking plan in addition to CDFW annual stocking allotment, catchable or larger size class stocking from all sources in the Kings River below Pine Flat dam totaled 50,704 pounds (100,412 fish);
- Incubated 285,000 rainbow trout eggs in the incubator building;
- Annual fish population survey in the Kings River and Thorburn Channel survey completed;
- Seven field trips were hosted and twelve Clean-Up events were held;
- New water pumps were installed at the incubator building.

#### **1.0 INTRODUCTION**

The Kings River Water Association (KRWA), Kings River Conservation District (KRCD), and California Department of Fish and Wildlife (CDFW) 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 twenty years in response to the Kings River Fisheries Management Program (KRFMP) Framework Agreement, which was approved on May 28, 1999. The Framework Agreement includes 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. The scope of activities undertaken as part of the KRFMP between October 2023 and September 2024 and CDFW stocking in 2024 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;
- Fish stocking by the CDFW, KRFMP and KRCD supplemental stocking, and continued contributions of rainbow trout fry produced from the incubator building.

The annual report provides a project management structure for reviewing and prioritizing existing and proposed 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 improves 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 KRFMP.

# **1.1 Administrative Activities**

Along with the financial commitment, in-kind support from KRFMP agencies is estimated below. In-kind support may include staff time for data collection, weir management, analysis, reporting, water operations, meetings, and other administrative activities which vary by agency. The following tables show estimates of agency in-kind support for October 1, 2023 through September 30, 2024: KRWA (Table 1-1), KRCD (Table 1-2), CDFW (Table 1-3). Estimated in-kind support from agencies for the KRFMP was 3,247 hours or about 1.56 Full-Time Equivalent (FTE). Additionally,

volunteers involved with assisting the KRFMP are vital for the program success, providing approximately 568 hours of service (Table 1-4).

The in-kind support does not account for CDFW fish stocking or the loss of water supply and storage loss for temperature control pool management. Section 5 outlines stocking activities related to the KRFMP. In 2024, CDFW's catchable trout allotment for the Kings River, Avocado Lake and Pine Flat Reservoir was 25,099 pounds (\$111,942) of catchable size trout of which the Lower Kings River received 17,799 pounds, Avocado Lake received 5,600 pounds, and Pine Flat Reservoir received 11,700 pounds. In addition to the 25,099 pounds of catchable trout planted in the Kings River, Avocado Lake and Pine Flat Reservoir, the upper Kings River received 4,240 pounds (\$18,910) of sub-catchable trout and Pine Flat received an additional 760 pounds (\$3,390) of sub-catchable trout. Kings River below Pine Flat reservoir received an additional 4,334 pounds (\$19,330) of sub-catchable trout, 800 pounds (\$3,568) of super-catchable trout and 11,680 pounds (\$52,093) of trophy trout. Avocado Lake received an additional 400 pounds (\$1,784) of super catchable trout and 11,500 pounds (\$51,290) of trophy trout. Total pounds of all trout planted in the Upper Kings River, Pine Flat Reservoir, Lower Kings River and Avocado Lake was 68,813 pounds (\$306,906).

 Table 1-1: Estimate of KRWA In-Kind Support for the KRFMP, October 1, 2023 - September 30,

 2024

KRFMP Support Activity	Hours/Year	Days/Year	FTE
Weir Management (Dennis Cut)	115	14.4	0.06
Weir Management (Fresno Weir)	130	16.3	0.06
Fall Electrofishing Survey	160	20.0	0.08
Incubator Operation	17	2.1	0.01
Incubator Fry Release	18	2.3	0.01
River Clean-Up	15	1.9	0.01
River Operations	115	14.4	0.06
Internal Water Accounting	120	15.0	0.06
Administrative Activities	400	50.0	0.19
Total In-Kind Support	1090	136.3	0.52

Table 1-2: Estimate of KRCD In-Kind Support for the KRFMP, October 1, 2023 - September 30,2024

KRFMP Support Activity	Hours/Year	Days/Year	FTE
Administrative	955	119.3	0.46
Electro-fishing Survey	330	41.3	0.16
Fishing Access Maintenance	12	1.5	0.01
Incubator Fry Release	18	2.3	0.01
Incubator Maintenance	8	1.0	0.00
Incubator Operation	142	17.8	0.07
Outreach	31	3.9	0.01
River Clean-up	45	5.6	0.02
Pine Flat Reservoir Profile	93	11.6	0.04
Total In-Kind Support	1634	204.2	0.79

Table 1-3: Estimate of CDFW In-Kind Support for the KRFMP, October 1, 2023 - September 30,2024

KRFMP Support Activity	Hours/Year	Days/Year	FTE
Fall Electrofishing Survey	139	17.4	0.07
Administrative Activities	384	48	0.18
Total In-Kind Support	523	65.4	0.25

Table 1-4: Estimate of	Volunteer Hours	s for the KRFMP.	October 1, 2023 -	September 30, 2024
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KRFMP Support Activity	Hours/Year	Days/Year	FTE
Electro-fishing Survey	235	29.4	0.11
Incubator Fry Release	88	11.0	0.04
Incubator Operation	42	5.3	0.02
Public Advisory Group	53	6.6	0.03
River Clean-up	150	18.8	0.07
Total In-Kind Support	568	71.0	0.27

### **1.2 Annual Technical Report**

Interested parties and stakeholders, including the KRFMP Executive Policy Committee (ExCom), KRFMP Public Advisory Group (PAG), resource and water agencies, local angling groups, and others have expressed interest in the information being collected as part of the KRFMP'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.

# 2.0 HYDROLOGY AND OPERATIONS

Section 2 outlines hydrologic conditions for hydrologic or Water Year 2024, October 1, 2023 through September 30, 2024, including general hydrology and details regarding target flows as outlined in the KRFMP. The temperature control pool has been maintained above 100,000 acre-feet, a storage volume unavailable to water users.

#### 2.1 Reservoir Inflow

Daily average inflow into Pine Flat Reservoir from October 1, 2023 through September 30, 2024, are shown in Figure 2-1. Inflow into Pine Flat Reservoir is characterized by high seasonal and interannual variability reflecting variation in precipitation, snowpack, and runoff within the watershed. Kings River inflow into Pine Flat averaged 2,275 cfs, ranging from 381 to 10,241 cfs. Table 2-1 shows the Kings River calculated annual runoff and the corresponding percent of average water year for the past 25 years; This year included in this report is bold text. Water Year 2024 had nearly average runoff, at 95% of average. Roughly 1.6-million-acre-feet of water was yielded from the Kings basin, which on average yields about 1.7-million-acre-feet.

Water Year (Oct-Sept)	Annual Runoff (TAF)	Percent Water Year
2000	1,534	90%
2001	1,010	59%
2002	1,141	67%
2003	1,426	84%
2004	1,050	62%
2005	2,531	149%
2006	2,952	174%
2007	679	40%
2008	1,216	72%
2009	1,348	79%
2010	2,062	121%
2011	3,318	195%
2012	826	49%
2013	691	41%
2014	537	32%
2015	361	21%
2016	1,253	74%
2017	4,096	241%
2018	1,275	75%
2019	2,177	128%
2020	913	54%
2021	396	23%
2022	786	46%
2023	4,509	265%
2024	1,615	95%

 Table 2-1: Kings River Basin Calculated Annual Runoff by Water Year, October-September.



Figure 2-1: The annual inflow into Pine Flat Reservoir from October 1, 2023 through September 30, 2024

#### 2.2 Reservoir Storage

Daily reservoir water storage volume in Pine Flat Reservoir from October 1, 2023 through September 30, 2024 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. Pine Flat reservoir storage was maintained above the temperature control pool during this report period. Having caried over storage from the record runoff year of 2023, the minimum storage in Pine Flat, 394,697 acre-feet, did not occur until the second-to-last day of the water year September 29, 2024. Impacting reservoir storage and releases, the Army Corps of Engineers started a flood release on May 4, 2024 at 00:01 hours, which continued for 12-days until May 15, 2024 at midnight and then reinitiated a flood release on May 29, 2024 at 00:01 hours, which continued for 8-days until June 6, 2024. A total of 20 days of Army Corps of Engineers was required. Maximum storage in Pine Flat, 992,144 acre-feet, occurred on June 10, 2024, five days after the Army Corps of Engineers ended the flood release criteria. This was the seventh flood release since the signing of the KRFMP Framework Agreement. Prior flood releases occurred in water years 2005, 2006, 2011, 2017, 2019, and 2023.



Figure 2-2: Average daily storage in Pine Flat from October 1, 2023 through September 30, 2024

# 2.3 Reservoir Releases

The Framework Agreement established minimum instream Exhibit "C" and Exhibit "D" flow releases from Pine Flat Reservoir (Figure 2-3), flow at Piedra (Figure 2-4), in Dennis Cut (Figure 2-5), to Fresno Weir (Figure 2-6) and below Fresno Weir (Figure 2-7) to support resident fish populations in the lower river (Table 2-2).

Water discharge from Pine Flat Reservoir to the lower Kings River shows high variability within the year as shown in Figure 2-3, including two flood release periods determined by the Army Corps of Engineers. Average daily discharge from Pine Flat in the lower Kings River from October 1, 2023 through September 30, 2024 ranged from 137 to 8,201 cfs, all above target flows. The average discharge from Pine Flat was 2,275 cfs during the report period.

Daily average Kings River flow at Piedra from October 1, 2023 through September 30, 2024 ranged from 206 to 8,209 cfs, all above target flows. Flow at Piedra averaged 2,644 cfs during the report period.

Daily average flow at Dennis Cut from October 1, 2023 through September 30, 2024 ranged from 4 to 305 cfs. Flow at Dennis Cut averaged 106 cfs during the report period. (Figure 2-5). Two departures from target flows occurred during the report period; November 8 and 9, 2023, flow at Dennis Cut was 4 cfs. This occurred immediately following a reduction in Dennis Cut irrigation flow when the bifurcation structure at Dennis Cut was being adjusted for the low-flow period. Average flow at Dennis Cut during November was 8 cfs, ranging from 4 to 34

cfs. Several inspections and measurements were made at the end of October through November as flows were adjusted from over 100 cfs in October to the 5 cfs target.

Target flow to Fresno Weir followed Exhibit "D" from October 1, 2023 till March 31, 2024 and Exhibit "C" flow schedule thereafter (Table 2-2), due to preceding year wet conditions in Water Year 2023. Daily average Kings River flow to Fresno Weir from October 1, 2023 through September 30, 2024 was 2,289 cfs, ranging from 180 to 6,941 cfs (Figure 2-6). Several departures from target flows occurred: three days in December 2023 under the direction of the ExCom to conduct fish population surveys, and three days in January 2024. December 5, 6 and 7, 2023, flow to Fresno Weir was 180, 186, and 247 cfs, respectively. This occurred under flow variance approved by the KRFMP ExCom during the annual fish population survey, where flow was ramped down to safer levels for wading. The average flow for the month of December was 252 cfs. On January 23, 24, and 25, 2004, flow to Fresno Weir was 249, 249, and 247 cfs, respectively. Real-time observations of flow indicated that targets were met. However, final data of all discharge ratings and diversions shifted the values below target number. This was compounded by Mill Creek flow variability and adjusting for changing conditions, Hughes creek reported flows likely being too high, and diversion changes in the reach above Fresno Weir. The average flow for the month of January was 262 cfs.

Daily average flow below Fresno Weir from October 1, 2023 through September 30, 2024 ranged from 46 to 4,241 cfs (Figure 2-7). Flow below Fresno Weir averaged 1,169 cfs during the report period, all above target flows.



Figure 2-3: Average daily discharge from Pine Flat into the Kings River from October 1, 2023 through September 30, 2024



Figure 2-4: Average daily flow of Kings River at Piedra from October 1, 2023 through September 30, 2024



Figure 2-5: Average daily flow in Dennis Cut from October 1, 2023 through September 30, 2024



Figure 2-6: Average daily flow of Kings River at Fresno Weir from October 1, 2022=3 through September 30, 2024



Figure 2-7: Average daily flow of Kings River below Fresno Weir from October 1, 2023 through September 30, 2024

#### 2.4 Telemetry System

Use of real-time flow monitoring stations below Fresno Weir and at Dennis Cut continued. These systems provide data that supports informed decisions on water temperature and flow management after completing the irrigation and delivery season when elevated water temperatures may impact habitat quality within the lower river.

#### 2.5 Exhibit "C" and "D" Flows

Minimum flow targets are dependent on prior water year runoff volumes. Exhibit "D" flows were triggered by the wetter than normal Water Year in October 2022 – September 2023, with approximately 4.5-million-acre-feet of runoff, 265% of normal. Exhibit "D" flow requirements are observed when the preceding water year exceeds 1,555,000 acre-feet. The minimum flow targets also increase when the preceding water year runoff exceeds 2,100,000 acre-feet. The "enhanced minimum flow period" at Fresno Weir (250 cfs to Fresno Weir) for Water Year 2024, October 1, 2023 through September 30, 2024, began when the minimum flow to Fresno Weir would otherwise have fallen below 250 cfs through March 31, 2024. Irrigation flows were reduced to these levels to Fresno Weir starting in December 2023. On April 1, 2024 target flows reverted to Exhibit "C" flows for the remainder of the Water Year (Table 2-2). However, irrigation demand had already started to exceed the minimum target in February and March of 2024 (Figure 2-6).

Exhibit "C" flows	Oct 1 - Nov 15	Nov 16 - Mar 31	Apr 1 - Sept 30
Required from Pine Flat	50	50	50
Total flow at Piedra 100		100	100
Minimum in Dennis Cut	5	5	5
Minimum to Fresno Weir	95	95	95
Water divertible to China Slough	10	5	15
Required over Fresno Weir	40	45	35

 Table 2-2. Exhibit "C" Target Flows (cfs) from the Framework Agreement.

### 2.6 Summary

Hydrologic conditions, Pine Flat Reservoir operations and flows within the lower river during Water Year 2024 are characterized by high seasonal variability characteristic of the Kings River watershed and water supply operations following the wettest, most runoff, Water Year on record and near average runoff within the season. Carryover storage from the preceding year continued irrigation demand above Exhibit "D" levels until December 2023, and early starts to irrigation occurred in March, which kept the river above target minimums during much of the enhanced minimum flow period. Average runoff conditions during the season, coupled with carryover storage, allowed for some late season irrigation and higher flows in the fall than would have not otherwise occurred. The Army Corps of Engineers flood release requirements bolstered river flow in May above what typical irrigation demand would have been, for two periods totaling 20-days. Findings and recommendations regarding hydrology and operations for this reporting period 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;
- Daily average discharge from Pine Flat, Kings River flow at Piedra, and flow over Fresno Weir demonstrated 100% compliance with the instream flow targets as outlined in the Framework Agreement, with most days greatly exceeding these targets;
- Daily average flow in Dennis Cut and flow to Fresno Weir showed slight departures from target instream flow as outlined in the Framework Agreement, with most days greatly exceeding these flow targets;
- A real-time telemetry system provided information on flow at Fresno Weir and Dennis Cut that is available for monitoring and managing conditions within the lower river as part of the fishery program;
- Flows levels representing Exhibit "D" and Exhibit "C" flow schedules were observed during WY 2024;
- Kings River Flow regime was influenced by flood control criteria determined by the Army Corps of Engineers for 20-days, from May 4-15, and May 29-June 5, 2024;
- Kings River runoff in Water Year 2024 was 1,614,557 acre-feet, which will require a Paragraph 2 Exhibit "D" enhanced minimum flow period in Water Year 2025.

### **3.0 WATER QUALITY**

Water quality monitoring as part of the KRFMP has focused 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.

#### 3.1 Reservoir Water Quality

Reservoir temperature and dissolved oxygen measurements are monitored monthly throughout the year. Reservoir profile data are used in temperature control pool management during the fall months after completion of the irrigation season to provide suitable temperature conditions for trout and other fish species within Pine Flat Reservoir and the lower river. Water temperature at each outlet (dam and power plant) are used on a real-time basis for use in evaluating water temperature released from the reservoir into the lower Kings River. By taking advantage of blending colder water from the lower levels of the reservoir with well oxygenated water from the turbine bypass, conditions within the tailrace could be maintained better for the fishery than would have occurred otherwise. Blending to maintain habitat conditions did not occur during this reporting period.

Vertical profiles in Pine Flat Reservoir of temperature and dissolved oxygen are collected on a regular basis. An example reservoir profile is presented in Figure 3-1. Appendix A includes monthly vertical reservoir temperature and dissolved oxygen profile measurements during the reporting period. A characteristic seasonal pattern of thermal stratification beginning in the spring includes formation of a reservoir hypolimnion (cold water layer near the bottom) and epilimnion (warmer water layer near the surface), which increases through the summer months. In late fall and winter, the water temperature in the reservoir becomes almost uniform. Reservoir profiles indicate thermal stratification occurred throughout eight months of the year, and most pronounced June through September, with isothermal temperatures December through March (Appendix A, A3-A6). In many water bodies, turnover occurs during late fall and winter when cold air temperatures cool the upper layer of water so that the epilimnion is colder than the hypolimnion. Pine Flat Reservoir did not experience turnover in this reporting period. Reservoir profiles indicated dissolved oxygen levels greater than 7.0 mg/L occurred throughout the reservoir in January and February, were generally above 6.0 mg/L March through August, and stayed mostly above 4.0 mg/L in October through December and September, in all but the bottommost levels of the reservoir through the water year.



#### PINE FLAT RESERVOIR 10/3/2023 (Time: 1029-1152) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 885.46

Figure 3-1: Pine Flat Reservoir profile taken 10/3/2023

#### **3.2 River Water Quality**

Water temperature and dissolved oxygen concentrations within the lower Kings River are continuously monitored at the Army Corps of Engineers (ACOE) Bridge, which is located 0.6 miles downstream of Pine Flat Dam using a Eureka Manta water quality sonde. Water temperature is also measured at Fresno Weir at the stilling well in the weir pool. Although not ideal for measurement of main current temperature, these locations allow for real-time data collections throughout the season.

Average daily water temperature in the lower Kings River is shown for ACOE Bridge (Figure 3-2) and Fresno Weir (Figure 3-3). The daily minimum, maximum, and average water temperatures recorded at the ACOE Bridge were 9.6°C, 21.6°C, and 12.8°C, respectively. The daily minimum, maximum, and average temperatures recorded at Fresno Weir were 11.1°C, 21.8°C, and 14.5°C, respectively. Throughout the season, daily average water temperature at Fresno Weir was approximately 1.7°C higher than at ACOE Bridge. However, daily average water temperature at Fresno Weir were recorded as much as 4.2°C higher and 0.4°C lower than at ACOE Bridge.



Figure 3-2: Daily average water temperature at the ACOE Bridge October 1, 2023 through September 30, 2024.



Figure 3-3: Daily average water temperature at Fresno Weir October 1, 2023 through September 30, 2024

Temperatures within the river have a seasonal pattern, with lowest temperatures occurring during the winter and early spring and 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. For much of the year, the diel temperature variation (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. However, as atmospheric conditions cool in the fall and early winter, a reverse temperature gradient is observed, and cooler temperatures are recorded at Fresno Weir than at the ACOE Bridge.

Notable this report period, two unusual events occurred that increased water temperatures below Pine Flat; lightning strikes throughout Fresno County and subsequent wildfires that required Pine Flat releases to be suddenly transferred between the powerhouse to the dam. On June 24, 2024, a lightning strike and powerhouse trip required Pine Flat releases from the powerhouse to the dam tainter gates (the highest release point). Resultant river temperatures went from approximately 12°C to 20°C. Several hours later the powerhouse was restored, the water releases were moved back to generators, and water temperatures dropped from 20°C to 12°C. Several fires started in the area associated with the lightning strikes. The Basin Fire started just upriver from Pine Flat, between the Bailey bridge and Garnet Dike. On June 27, 2024, the transmission line servicing the area was deenergized as fire crews are working in the area to

protect those facilities. The same transmission lines are used by the Pine Flat Powerhouse, so the powerhouse was required to be shut off and all Pine Flat releases were being made through the tainter gates. The outflow temperature increased from approximately 12°C to 20°C and remained elevated until the transmission lines and the powerhouse were restored on July 3, 2024.

During this reporting period, dissolved oxygen concentrations within the lower Kings River remained within the range considered suitable for various fish and macroinvertebrate species that occur in this section of the river. The daily average dissolved oxygen concentration at the ACOE Bridge from October 2023 through September 2024 is presented in Figure 3-4. The Manta dissolved oxygen meter used for monitoring has an accuracy of  $\pm$  0.1 mg/L. Minimum and maximum dissolved oxygen content recorded during this reporting period was 6.0 mg/L and 12.9 mg/L respectively. The daily average dissolved oxygen content exceeded 7.0 mg/L throughout this reporting period, with an annual average of 8.8 mg/L.



Figure 3-4: Daily average dissolved oxygen content at the ACOE Bridge October 1, 2023 through September 30, 2024

As a condition of the Federal Energy Regulatory Commission (FERC) Project License P-2741 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 organisms inhabiting the lower Kings River when the power plant is in operation. KRCD met its license operating and monitoring requirements for the duration of this reporting period, except for four days when the dissolved oxygen concentration immediately

below Pine Flat Power Plant dropped below 7.0 mg/L (Table 3-1). During each of these events, plant operations took actions to improve dissolved oxygen levels by either ramping down generation and increasing spill through the turbine bypass and/or mid-level sluice gates. On September 13, the power plant was taken out of service for the year to overcome persistent dissolved oxygen levels below the 7.0 mg/L required minimum.

Date	Reporting Periods D.O. < 7.0 mg/L	Duration of Event <sup>1</sup>	Minimum D.O.	Average D.O. Over Duration
		(minutes)	(IIIg/L)	(IIIg/L)
10/31/2023	1	30	6.7	7.0
8/15/2024	1	30	6.9	7.0
8/30/2024	3	50	6.8	6.9
9/13/2024	5	70	6.3	6.8
9/13/2024	7	90	6.0	6.5

Table 3-1. Dissolved oxygen (D.O.) events < 7.0 mg/L for Pine Flat Power Plant (Project No. 2741) in WY</th>2024.

<sup>1</sup> Duration includes the ten-minute interval just prior to the low value, through interval it remains greater than or equal to 7.0 mg/L.

### 3.3 Summary

Water quality monitoring within Pine Flat Reservoir and the lower Kings River during Water Year 2024 have shown:

- Pine Flat Reservoir can become 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). Reservoir profile water temperature becomes almost uniform in late fall and winter. During the 2023-2024 water year reservoir profiles indicate thermal stratification occurred throughout most of the year but was most pronounced June through September, with isothermal temperatures December through March. Pine Flat Reservoir did not experience turnover in this reporting period. Reservoir profiles also indicated dissolved oxygen levels greater than 7.0 mg/L occurred throughout the reservoir in January and February, and was generally above 6.0 mg/L March through August, and stayed mostly above 4.0 mg/L in October through December and September, in all but the bottommost levels of the reservoir through the water year.
- Water temperatures are variable along a longitudinal gradient downstream of Pine Flat Dam. During much of the year the coldest temperatures are immediately downstream of the dam and temperatures typically increase with distance downstream. During the fall and winter, as atmospheric temperatures cool, a reverse temperature gradient may be observed with temperatures decreasing as a function of distance downstream.
- Aeration and mixing of water released from the reservoir are effective in maintaining suitable temperature and dissolved oxygen concentrations within the lower river. The daily average

dissolved oxygen level exceeded 7.0 mg/L throughout the year.

• Two sudden changes to Pine Flat release points were observed in June and July associated with lightning and wildfire activities.

# 4.0 HABITAT ENHANCEMENT

One goal of the KRFMP 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. A brief description of the habitat enhancement projects planned and/or implemented as part of the KRFMP during the year is summarized below.

### 4.1 River

Cramer Fish Sciences was contracted in 2018 to create a 2D hydrologic model, quantify the seasonal availability of spawning and rearing habitat by flow rate, locate and identify locations for future habitat enhancement projects and create weighted habitat suitability models. The final report was submitted to the KRFMP in September 2019. The document is intended to serve as a tool to direct future habitat enhancement projects within the tailwater fishery for rainbow trout. Findings indicated a substantial lack of spawning sized gravel in areas of seasonal inundation, channelization, fewer than optimal pool to riffle habitat transitions and a deficit in available habitat for young of the year. In 2021 Cramer Fish Sciences was contracted to create a technical memorandum and to bring the following habitat enhancement projects to a 30% design level:

- Site ID 1 Gravel augmentation or injection below the Pine Flat Bridge
  - This project entails the injection/placement of gravel for rainbow trout below the Pine Flat Bridge and will help replenish the coarse sediment supply immediately below Pine Flat Dam. Dependent on concept development gravel may be injected into high flow releases or augmented through riffle and bar construction. Key components to be identified include identifying available gravel sources, sediment augmentation volume, potential constraints, and feasibility of construction methods.
- Site ID 6 Thorburn Channel enhancements
  - This project would enhance juvenile rearing habitat for rainbow trout in the Thorburn Channel considering alterations to the intake structure and grading of the channel. This project will examine if structure removal benefits habitat performance and/or if modifications to the side channel's topography could improve physical habitat and water temperature.

These documents were completed and accepted into the program at the end of the 2022 reporting period. These projects remain on hold pending available grant funding. On September 11, 2024, applications were submitted to the California Department of Fish and Wildlife's Office of Spill Prevention Environmental Enhancement Fund for each of these projects to complete project design and construction. It was anticipated that funding award announcements would be made before the end of the 2024 calendar year. However, neither project was selected for funding in this grant cycle.

#### 4.2 Pine Flat Reservoir

The KRFMP budgets for projects to enhance and/or benefit the fishery created within Pine Flat Reservoir.

The Pine Flat Army Corps of Engineers staff have been instrumental in helping the program discern the size, type, and locations of such projects. In addition, the Army Corps of Engineers has provided the necessary personnel and logistic resources needed to ensure project completion. Due to high reservoir levels no habitat projects were undertaken to benefit the fishery in the program year. KRFMP plans to continue working with CDFW and the Army Corps of Engineers throughout the foreseeable future.

### 5.0 FISH STOCKING

Rainbow trout stocking in the Kings River includes KRFMP and KRCD supplemental stocking, incubator releases, and CDFW stocking allotments. The supplemental rainbow trout stocking program initiated by the KRFMP in the fall of 2018 was continued during this reporting period and is further supplemented by KRCD. Rainbow trout eggs were incubated by the KRFMP and released in the lower river. CDFW allotment for the Kings River for 2024 included: sub-catchable, catchable, super-catchable and trophy rainbow trout were planted in the Lower Kings River, below Pine Flat Dam. The upper Kings River, above Pine Flat Reservoir, received a sub-catchable brown trout and sub-catchable rainbow trout allotment. Pine Flat Reservoir received a catchable rainbow trout and sub-catchable brown trout allotment. No fingerling Chinook salmon were planted in Pine Flat Reservoir in 2024. Avocado Lake received a sub-catchable, super-catchable and trophy trout allotments of rainbow trout.

### 5.1 Supplemental Stocking

In 2017 the KRFMP developed a supplemental rainbow trout stocking plan for the tailwater fishery below Pine Flat Dam. The plan focuses on stocking diploid trout, when available, with increased stocking in the fall and winter months when river flows and temperature are best for angler success. The intent is to provide a population of hatchery-produced catchable sized trout capable of sustaining the current level of angler pressure in both the put-and-take and catch-and-release zones. The plan was fully approved in May 2018 and Calaveras Trout Farm (CTF), a private aquaculture facility in Snelling, CA was awarded a 3-year renewable contract to provide the KRFMP 30,000 (10,000 lb.) to 50,000 (16,600 lb.) catchable diploid rainbow trout between October and March each year. Catchable sized trout are typically between 9- and 10-inches fork length and weigh 3 fish per pound.

In 2023-2024 the KRFMP contracted with Desert Springs Trout Farm (DSTF) to provide triploid catchable sized trout which averaged 2.8 fish/pound. To enhance the efforts of CDFW and the KRFMP supplemental stocking plan, KRCD contracted with Calaveras Trout Farm to provide diploid catchable sized trout which averaged 3.0 fish/pound. The KRFMP and KRCD supplemental stocking are both included in this report. The supplemental stocking occurred from October 2023 through May 2024.

The goals of the KFRMP are to stock supplemental trout at a ratio of 75% into the Put & Take Zone (Reach 1) and 25% into the Catch & Release Zone (Reach 2), while those stocked for the KRCD are stocked at a ratio of 60%. Reach 1 and 40% Reach 2. Total pounds and number of fish delivered are reported in Table 5-1.

	Reach 1				Rea	ch 2		KR	FMP + KI	RCD	
	KR	FMP	KR	CD	KR	FMP	KF	RCD	То	tal	Average
Month	# Ib	# fish	# Ib	# fish	# Ib	# fish	# Ib	# fish	# Ib	# fish	fish/lb
October	0	0	250	750	0	0	250	750	500	1500	3.00
November	375	975	966	2,898	1,125	2,925	534	1,602	3,000	8,400	2.80
December	1,125	3,442	996	2,988	375	1,148	554	1,662	3,050	9,240	3.03
January	1,125	3,172	1,200	3,600	375	1,058	800	2,400	3,500	10,230	2.92
February	1,125	3,049	1,200	3,600	375	1,016	800	2,400	3,500	10,065	2.88
March	1,105	3,045	800	2,400	370	1,020	700	2,100	2,975	8,565	2.88
April	1,050	3,024	800	2,400	350	1,008	700	2,100	2,900	8,532	2.94
May	0	0	400	1,200	0	0	600	1,800	1,000	3,000	3.00
Total	5,905	16,707	6,612	19,836	2,970	8,175	4,938	14,814	20,425	59,532	2.91

Table 5-1: Summary of 2023-2024 KRFMP and KRCD supplemental stocking by Desert Springs Trout Farm and Calaveras Trout Farm.

#### 5.2 Incubator Building

The incubator building has run seasonally since November 2012. Maintenance has been facilitated by KRCD staff as well as volunteers interested in the fishery and the Kings River. During the 2023 – 2024 program year diploid rainbow trout eggs were purchased from Cold Springs Trout Farm, with two incubation periods completed. Table 5-2 summarizes the incubation periods, number of eggs incubated, estimated hatch rate, estimated number of fry released, and the percentage of fry released into both the Put & Take and Catch & Release Zones. When trout fry reached the button up stage (about 1" long) they were released at multiple locations within the fishery management area.

Table 5-2: Incubator building activity FY23-24. Number of eggs incubated per rearing period, estimated hatch rate, estimated number of fry released, and percentage released in both the Put & Take and Catch & Release Zones.

	Number of Eggs	Estimated	Estimated Fry	Put & Take	Catch & Release
Incubation Period	Incubated	Hatch Rate	Released	Zone	Zone
1/3/2024-2/22/2024	150,000	97%	90,000	62%	38%
2/28/2024-4/18/2024	135,000	92%	79,000	54%	46%

During the January through February rearing period limited temperature monitoring in the incubator raceways was available due to a software issue with HOBOware. Hourly temperature data was unavailable for the egg incubation/sac-fry period, so it was unknown if average water temperature in the incubator was within the range Woynarovich et al. (2011) consider optimal (7°C-12.5°C) for the incubation of rainbow trout eggs and sac-fry. Based on historical trends, and available data from the ACOE Bridge, hourly raceway temperatures during this period likely ranged between 9°C and 14°C, with average temperatures around 11°C during the egg incubation/sac-fry period. Prior to reaching the swim-up stage a high portion of fry with severely deformed spinal columns were observed and removed. It is unknown what caused the spinal deformities, which primarily consisted of fish with a strong "C" shape which when extreme causes the fish to spin when swimming, rather than travel in a straight line or proper orientation. These deformities are commonly observed in the hatch and typically comprise ~10-20% of the hatched population. It is unknown what triggers these deformities to occur, but some theories are genetics (DFG 1976), vitamin & mineral deficiencies (Woynarovich et al 2011), or inappropriate pH values of the water (McGlynn).

On January 24, twenty-one days after the initiation of this rearing period, the sac-fry were observed transitioning to the swim-up stage. Average water temperature in the incubator was within the range Woynarovich et al. (2011) consider optimal for swim-up fry (7°C-20°C) throughout the remainder of the period. Reported mortalities from swim-up to fry release were approximately 9,400 confirmed losses and ranged from 140 to 764 fish per day. These losses may have been due to any number of unconfirmed factors. It may be that fish which perished did so due to lack of food, a poor transition to exogenous feeding, crowded raceways, or some other condition not identified here. One factor that does not appear to have been an issue is water temperature, although other water quality parameters trout are sensitive to, such as dissolved oxygen, pH, nitrates, and heavy metal levels were not monitored.

It is known that an untold number of fry escaped the incubator prior to release as they were observed either passing through the drains, or residing within the high-water channel which the incubator drains into. The screens which separate the drain area from the rearing area of the raceways have perforations which are large enough that swim-up fry are able to squeeze through. Fry were routinely found in the drain areas during daily staff visits. When fry are present in the drain area, staff and volunteers are instructed to net them back into the rearing portion of the raceway in order to minimize losses to the high-water channel the incubator drains into. The high-water channel that where incubator drains are disconnected from the river except when instream flows exceed about 3,000 cfs. Under the current configuration, this channel completely dries out when outflows from the incubator stop. During dry water years the incubator pumps remain in operation beyond the final fry release of the season, and with sufficient flows from the incubator, to maintain escaped trout fry in this channel until the 3,000 cfs threshold in the river is met, reconnecting the high-water channel to the river. In the past, attempts have been made to net trout from this channel and relocate them into the main river during low flows. This was found to be labor intensive, and few trout were successfully relocated. When flow in the high-water channel is sufficient, trout can continue rearing within, with the expectation they will move into the main river prior to the dewatering of the channel at the end of the irrigation season in the late summer or early fall.

During the February through April rearing period average water temperatures within the incubator remained within the range Woynarovich et al. (2011) consider optimal (7°C-12.5°C) for the incubation of rainbow trout eggs and sac-fry as well as for swim-up fry (7°C-20°C). Prior to reaching the swim-up stage, as observed in the prior run, the portion of fry with severely deformed spinal columns were observed and removed. On March 20, twenty-one days after the initiation of this rearing period, the sac-fry were observed transitioning to the swim-up stage. Reported mortalities from swim-up to fry release were approximately 3,300 confirmed losses and ranged from 20 to 248 fish per day. It is unknown what factors contributed to these losses. Additionally, as in the prior run, an untold number of fry were known to have escaped the incubator raceways prior to release, and were observed rearing within the high-water channel.

# 5.3 CDFW Stocking

The CDFW annual stocking between January 1 – December 31, 2024 are summarized here. CDFW provided hatchery grown salmonids in several different size categories to the Kings River below Pine Flat Reservoir (34,613 pounds, 93,614 trout), the upper Kings River, above Pine Flat Reservoir (4,240 pounds, 35,757 trout), Pine Flat Reservoir (12,460 pounds, 35,073 trout), and Avocado Lake (17,500 pounds, 15,474 trout). These numbers do not include the supplemental fish provided for the KRFMP. Details for each size class are summarized below.

#### 5.3.1 Fingerlings

Fingerling trout are defined as trout that are 16.1 or more fish/pound and are generally less than 4 inches in length. Table 5-3 details stocking of sub-catchable trout. No fingerling rainbow trout or brown trout were stocked in the Kings River, below Pine Flat Reservoir, Pine Flat Reservoir nor the upper Kings River in 2024

		Fingerlings	
Motor	Enocios	Year	
water	Species	2024	
		# Trout	Pounds
Kings River below Pine Flat Reservoir	Rainbow/Brown Trout	0	0.0
Pine Flat Reservoir	Rainbow/Brown Trout	0	0.0
Upper Kings River, above Pine Flat Reservoir	Rainbow/Brown Trout	0	0.0
To	tal	0	0.0

Table 5-3: CDFW fingerling trout stocked in 2024.

### 5.3.2 Sub-Catchable Trout

Sub-catchable rainbow trout stocked by CDFW are generally 4-6 inches long. Table 5-4 details stocking of sub-catchable trout. The Kings River, below Pine flat Reservoir received 4,334 pounds (52,734 trout) of sub-catchable size rainbow trout, Pine Flat Reservoir received 760 pounds (10,108 trout) of sub-catchable rainbow trout. The Upper Kings River received 900 pounds (10,080 trout) of sub-catchable brown trout and 3,340 pounds (25.667 trout) of sub-catchable rainbow trout in 2024.

 Table 5-4: CDFW sub-catchable trout stocked 2024.

Water	Species	Sub-Cat Ye 20	tchables ear 124
		# Trout	Pounds
Kings River below Pine Flat Reservoir	Rainbow Trout	52,734	4,334
Pine Flat Reservoir	Brown Trout	10,108	760
Linner Kinge Diver	Brown Trout	10,080	900
Opper Kings River	Rainbow Trout	25,677	3,340
Total		98,599	9,334

# 5.3.3 Catchables

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. Table 5-5 details stocking of catchable size trout. A total of 17,799 pounds (37,073 rainbow trout)

of catchable size rainbow trout were stocked in the lower Kings River during 2024. Pine Flat received a total of 11,700 pounds (24,965 rainbow trout) and Avocado Lake received a total of 5,600 pounds (11,920 rainbow trout) of catchable size trout. The Upper Kings River did not receive an allotment of catchable trout in 2024.

		Catch	ables
Mator	Species	Year	
vvalei	species	2024 # Trout Pounds	
Kings River below Pine Flat Reservoir	Rainbow Trout	37,073	17,799
Pine Flat Reservoir	Rainbow Trout	24,965	11,700
Upper Kings River	Rainbow Trout	0	0
Avocado Lake	Rainbow Trout	11,920	5,600
Total		73,958	35,099

Table 5-5: CDFW catchable sized trout stocked 2024.

# 5.3.4 Super-Catchables

Super-catchable size trout are defined as trout greater than one pound and less than 3.00 pounds. Table 5-6 details stocking of super-catchable size trout. Kings River below Pine Flat Reservoir received a total of 800 pounds (660 rainbow trout) and Avocado Lake received 400 pounds (396 rainbow trout) of super-catchable trout in 2024. Pine Flat Reservoir and Upper Kings River did not receive an allotment of super catchable trout.

 Table 5-6: CDFW super-catchable sized trout stocked 2024.

Water	Species	Super-Ca Ye	atchables ear
Water	opecies	2024	
		# Trout	Pounds
Kings River below Pine Flat Reservoir	Rainbow Trout	660	800.0
Pine Flat Reservoir	Rainbow Trout	0	0.0
Avocado Lake	Rainbow Trout	396	400.0
Total		1,056	1,200.0

# **5.3.5 Trophy Trout**

Trophy size trout are defined as trout greater than 2.99 pounds each. Table 5-7 details stocking of trophy size trout. Kings River below Pine Flat Reservoir received a total of 11,680 pounds (3,147 rainbow trout) and Avocado Lake received 11,500 pounds (3,158 rainbow trout) of trophy rainbow trout in 2024.

		Trophy		
	Creation	Year		
water	Species	2024		
		# Trout	Pounds	
Kings River below Pine Flat Reservoir	Rainbow Trout	3,147	11,680	
Avocado Lake	Rainbow Trout	3,158	11,500	
Total		6,305	23,180	

#### Table 5-7: CDFW trophy sized trout stocked 2023.

#### **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 KRFMP and the overall status of the fishery. Water temperature and dissolved oxygen monitoring remain a priority. The KRFMP is also dedicated to continuing its annual fish population surveys in the fall.

### 6.1 Annual Fish Population Surveys in the Lower Kings River

Long-term annual baseline fisheries monitoring within the lower Kings River is conducted as part of the KRFMP to determine (1) the assemblage, abundance, and condition of the fish community inhabiting the lower Kings River; (2) overall biomass; (3) hatchery and "wild" rainbow trout abundance and distribution; (4) overwintering survival, size, and age structure of rainbow trout populations. Surveys are completed with KRFMP agency staff and the assistance of local volunteers.

Electro-fishing surveys methods have been used since 1983 by KRCD and CDFW biologists to monitor the fish population in the Kings River. Methods have varied over time, but since 2007, a multi-pass depletion method, utilizing backpack electro-fishers and block nets on the upstream and downstream ends of each 300-foot-long survey site has been used. This method allows for more rigorous sampling and provides a more complete assessment of the species composition and abundance found in the sample site. Sampling the same sites can show trends in the fish populations. Sampling is conducted at six sites within the three uppermost management reaches of the lower Kings River (Figure 6-1). Reach One which consists of the section of river between Pine Flat Dam and Cobbles (Alta) Weir is managed as a put-andtake trout fishery, permitting take of up to five trout daily, between the ACOE Bridge and Cobbles (Alta) Weir. The area above the ACOE Bridge has been closed to fishing by order of Homeland Security since September 2001. Additionally, within Reach One, the Thorburn Channel and a 200' radius from the channel exit is closed to fishing by CDFW regulations. Both Reach Two and the portion of Reach Three above Highway 180 are managed as a catch-and-release trout fishery, with special regulations permitting zero take of trout and prohibitions on the use of bait and barbed hooks between Cobbles (Alta) Weir and the Highway 180 crossing. Reach Two is located between Cobbles (Alta) Weir and Fresno Weir while Reach Three consists of the portion of river from Fresno Weir to the Reedley Narrows gauging station. This reach is an opportunistic trout fishery as water temperatures downstream of Fresno Weir may not remain suitable for trout in some years.

Each fish collected was identified to the lowest practical taxon, weighed, and total length measured, except for trout which are measured to fork length. Further, rainbow trout are classified as either hatchery trout or "wild" trout based on characteristics observed while in hand. CDFW (2010) defines a wild trout as "A trout that was born in the wild and lives its life cycle in the wild, regardless of the origin of its

parents." Since 1983 KRCD has used visual inspection of fin condition as the primary means to distinguish between "wild" and hatchery origin rainbow trout. Rainbow trout with fins in excellent condition were classified as "wild" rainbow trout while rainbow trout exhibiting missing or abraded fins were categorized as hatchery rainbow trout. Because of morphological similarity trout may be misclassified. There may be little morphological difference in rainbow trout assumed to have originated via natural in-river reproduction, the KRFMP incubator facility, or hatchery trout who have carried over from a past season. Reports of past Fisheries Population Surveys can be found on the KRFMP website: http://krfmp.org/resources/reports-documents/.



Figure 6-1: Annual Fish Population Survey sites in the Kings River and their respective KRFMP management zones

During this reporting period fish population surveys were conducted at three sample sites between November 30 and December 6 (Figure 6-1). Due to unsafe conditions, sites Winton, Alta, and Avo Boulder were not sampled, despite efforts to reduce flows to safe levels. A total of 2,192 fish were collected, with complete data collected for 2,143 fish and entered into MicroFish 3.0 for further analysis. The species composition reported here is reflective of the entire capture, while all other results are based only on the fish entered in MicroFish 3.0.

Native fishes dominated the survey in abundance (97%) and biomass (78%), with introduced fish accounting for the remainder. While catch results show populations of different species fluctuate by site, the assemblage continues to be dominated by native Sacramento suckers, cyprinid species, lamprey, and sculpin. These fish most accurately meet the criteria for a low-elevation valley floor assemblage characterized by the pikeminnow-hardhead-sucker assemblage as described by Moyle (2002). While deep-bodied fishes were present, they made up less than two percent of the species assemblage. "Wild" trout were present, but were less than one percent of the species assemblage, as expected for a low elevation, low gradient, fish assemblage.

Catch results provided evidence of successful reproduction for native species as juvenile life stages were collected for all taxa, except three-spine stickleback. Three-spine stickleback typically live no more than one year, and all members of the annual cohort would have reached adulthood by the time of the survey. Catch results also provided evidence that introduced non-native bass and possibly bluegill have successfully reproduced in the Kings River.

For each of the species captured in the Kings River several different variables were calculated for each 300-foot sample site. Collected data was entered into MicroFish 3.0 which then generated the total catch, population estimates, and biomass for each species collected for each site. Population estimates were used to calculate the estimated fish per mile for each species per site. For species collected during the 2023 survey, species composition, lengths of captured fish, and the ranges across sites for population estimates, fish per mile, and biomass are summarized below in Table 6-1.

The condition factor of collected trout was also examined. While Fulton's condition factor suggested that on average, rainbow trout of both "wild" and hatchery origins were in good condition, length-weight regression analysis indicated "wild" rainbow trout were in slightly better condition than their hatchery counterparts, a reflection of excellent instream conditions for trout in in prior water year 2023. The single brown trout collected, was also found to be in excellent condition.

Fluctuations in fish populations are normal. While native fish currently dominate the species assemblage throughout the Kings River below Pine Flat Dam, there may be years when release temperatures are warmer, and instream flows lesser and of longer duration which may provide better conditions for introduced non-native fish. Variations in species composition cannot be attributed to any single cause and most likely a combination of environmental and anthropogenic factors influences the fishery population.

		Range across Survey Sites!			
	Species	Population	Fish per Mile	Biomass	Length
Species Collected	Composition (%)	Estimates*	(estimated)	(lb)	(in)
Sacramento Sucker	47.58	309-810	5,438-14,256	3.3-17.3	1-21
California Roach	17.24	17-270	299-4,752	0.2-2.9	1-5
Lamprey	10.54	14-452	246-7,955	0.1-1.9	3-8
Sculpin	8.53	24-139	422-2,446	0.3-2.5	2-6
Three-spine Stickleback	6.66	30-183	528-3,221	0.05-0.1	1-3
Sacramento Pikeminnow	6.07	20-63	352-1,109	0.1-0.2	1-4
Rainbow Trout - Hatchery <sup>a</sup>	1.14	0-22	0-387	0-10.6	8-16
Green Sunfish <sup>a</sup>	0.82	0-15	0-264	0-0.4	3-5
Rainbow Trout - "Wild"	0.73	4-6	70-106	1.5-2.8	7-14
Bluegill <sup>a</sup>	0.32	0-9	0-158	0-0.1	2-4
Bass <sup>a</sup>	0.18	0-4	0-70	0-0.2	4-6
Hardhead	0.09	0-2	0-35	No Data	~ 4
Brown Trout <sup>a</sup>	0.05	0-1	0-18	0-0.4	9.4
Catfishª	0.05	0-1	0-18	0-0.01	3.3

 Table 6-1: Summary results, Annual Fish Population Survey, 2023.

<sup>1</sup>Range of values across sampled reaches between Pine Flat Dam & Highway 180, this should not be interpreted as all of the fish between Pine Flat Dam and Highway 180

\*Confidence intervals for each site are provided in the Results and Discussion section of this report

<sup>a</sup> Introduced (non-native to the watershed or hatchery reared trout)

# 6.2 Thorburn Channel

The Thorburn Channel is an anthropogenic, 2,200-foot-long channel located on private property, of which KRCD has been granted a 50-year easement too. Fishing within the channel is closed year-round, as well as the 200' radius of the confluence with the Kings River. Construction was completed in program year 2000 to provide spawning and rearing habitat for fish in the Kings River. A headgate structure was installed to control instream flows entering from the Kings River, spawning gravel and large woody debris features were placed, and a k-rail was installed to facilitate a rearing pool before the channel empties back into the Kings River. Since, there have been several large flood releases, which have resulted in heavy sediment deposition within the channel.

The survey occurred in a portion of the Thorburn Channel which has been proposed for habitat enhancement. Data provided will serve as part of pre-activity monitoring for the proposed project, which seeks to improve stream flow through improved functionality by removal of the current headgate structure and k-rail, and potential modifications to the grading and contours of the channel, with the goal of maintaining flow and reducing sediment accumulation within the channel. The survey reach was 300 feet long, and instream flows, as measured immediately upstream of the surveyed reach were 0.04 cfs as measured by KRWA at the time of the survey on November 28, 2023. The reach was characterized by shallow water, ranging from 1 to 8 inches deep and channel width ranging from approximately 1 to

6 feet, emergent vegetation and large woody debris and some boulders were present throughout the reach. Soft, and occasionally deep fine sediment was the most dominant substrate, although some small gravel was observed in a few locations in the thalweg, and some large cobble was present.

A total of 112 fish, representing four species, were collected during the survey with data entered into MicroFish 3.0 for further analysis. Native fish dominated the survey in both abundance (99.1%) and biomass (99.6%). Species composition, population estimates, estimated fish per mile, biomass, and captured lengths are summarized in Table 6-2.

Thorburn Channel: November 28, 2023					
Species Collected	Species Composition (%)	Population Estimate	Fish per Mile (estimated)	Biomass (lb)	Length (in)
Three-spine Stickleback	58.0	98	1,725	0.078	1-3
Sacramento Sucker	37.5	44	774	0.076	1-2
Sacramento Pikeminnow	3.6	4	70	0.008	1-2
Western Mosquitofish <sup>a</sup>	0.9	1	18	0.001	1.2

<sup>a</sup> Introduced (non-native to the watershed)

The presence and quantity of these fish suggest, at the time of the survey, the Thorburn Channel provided adequate habitat for juvenile Sacramento suckers and Sacramento pikeminnow, as well as mature threespine stickleback and western mosquitofish. The extent of shallow and slow-moving water which was present within the channel during the survey would have effectively prevented large piscivorous fish from being present, and emergent vegetation helped provide cover from predators. It is unknown if there is a self-sustaining resident population of western mosquitofish within the Thorburn Channel, or if they were introduced in 2023 by the Consolidated Mosquito Abatement District whose service area includes the Kings River downstream of Pine Flat Dam. Under their program, at the request of the landowner, areas of standing water are stocked with mosquitofish as a means of vector control.

Continued annual monitoring of this site is foreseen to document instream changes in the fish assemblage over time. This monitoring will provide both pre-activity and post-project changes in the assemblage observed as conditions within the channel are anthropogenically altered to improve streamflow, and through the resulting channel function in subsequent years.

#### 6.3 Lower Kings River Angler Creel Survey

CDFW implemented an angler creel survey in January through March 2020 to evaluate the effectiveness of the supplemental stocking program on the Kings River, below Pine Flat Reservoir. The surveyed reach started at the ACOE bridge and extended downstream to the Greenbelt parking lot. The reach was divided into 3 sections: Section 1 – ACOE bridge downstream to Piedra Bridge. Section 2 – Piedra Bridge downstream to Cobbles (Alta) Weir. Section 3 – Cobbles (Alta) Weir downstream to Greenbelt parking lot. Sections 1 and 2 are the traditional put-and-take reach and Section 3 is the catch-and-release reach. The three sections surveyed are historical sections used in past angler surveys. CDFW purchased Floy Tags in 2023 to run a tagging study, using supplemental stocked fish, concurrent with the Creel Survey. Floy Tags (5,500 Floy Tags) were purchased in eleven different colors (500 Floy Tags per color). The cost of Floy Tags was \$3,992.70. Creel surveys were not performed in 2023-2024 due to insufficient staffing needs.

# 7.0 PUBLIC EDUCATION AND OUTREACH

# 7.1 Website

KRCD staff has maintained and updated the website throughout the year. The site contains a photo album, contact page, volunteer site, access to program reports and documents, projects, and links to resources: <u>http://krfmp.org/</u>.

The TSC met with CDFW Nutria Eradication Program staff to learn about the program, efforts, and status. During this report period, no confirmed nutria were present in the Kings River area. However, nutria were present in the San Joaquin River at Mendota Pool and near Fresno Slough. Information was gathered and disseminated to Kings River agencies and the public at a broad range of meeting and by using KRCD flood resources website: <u>https://krcd.org/flood-resources/</u>.

Additional information on the Nutria Eradication Program can be found at CDFW program website: <u>https://wildlife.ca.gov/Conservation/Invasives/Species/Nutria/Infestation</u>

# 7.2 Hydrology and Temperature Report

For operations, KRWA uses a real-time telemetry system for monitoring water temperature and streamflow at Fresno Weir. Typically, during the summer and fall of dry hydrologic years, information collected on the lower Kings River is compiled in weekly reports and distributed by KRWA to members of the PAG and other interested parties to provide current information on environmental conditions that would affect habitat quality. These reports have provided information on flows in the lower river and tributary streams as well as a summary of flow and temperature trends. Copies of these reports remain on file at KRWA. Hydrologic and Climate Summary Reports were distributed June 28, July 1, and July 8, 2024, a timeframe when reservoir outflow was transferred between the powerhouse and the dam in response to lightning strikes and wildfire. No reports were circulated in the Fall of 2024.

# 7.3 Educational Tours

# 7.3.1 Incubator Building

Seven tours were hosted at the incubator during this reporting period (Table 7-1). Topics covered during tour events include a general overview of the purpose and history of the trout rearing program, the trout lifecycle, and the role of trout in the local ecosystem.

 Table 7 - 1: Organizations and classes provided with tours of the KRFMP Trout Incubator during the 2024 season.

Date	Organization
01/24/2024	Buchanan High School, (Agriculture), Clovis Unified School District
02/06/2024	Reedley College (Fisheries)
02/08/2024	Kings River High School (Photography), Sanger Unified School District
03/13/2024	Jorgensen Pump
03/26/2024	UC Davis, volunteer cleanup crew
04/08/2024	Fresno County Farm Bureau FAACT Class (Future Advocates for Agriculture Concerned
	About Tomorrow)
04/20/2024	KRCD District Staff

# 7.4 River Clean-Up

Beginning in July of 2021 the KRFMP member agencies partnered with the Kings River Conservancy,

United States Army Corps of Engineers (ACOE), County of Fresno, and the Public Advisory Group of the KRFMP to conduct monthly targeted clean-ups of the Kings River in different locations. Clean-up events typically occurred on the third Saturday of the month from 8:00AM – 9:30AM and public participation was encouraged. Participants removed trash and graffiti from along the riverbank, which restored the aesthetics of the waterway while removing potential hazards to the ecosystem, wildlife, and other users. The September 2024 cleanup was originally scheduled for September 21<sup>st</sup> but was moved to September 28th to support the ACOE's annual Public Lands Day event, which was held at Island Park Campground, one of campgrounds adjacent to Pine Flat Reservoir. The partner agencies provided staff to support this one-day event. A summary of clean-up events is provided in Table 7-2.

Date	Location	# Volunteers	Trash Bags
		(Agency Staff	Collected
		& Public)	
10/21/2023	Avocado Lake	11	12 bags
11/18/2023	Sycamore Point Public Access	14	9 bags
12/16/2023	Winton Park	9	7 bags
1/20/2024	North Riverside Access Park & southside	10	7 bags
2/17/2024	Cobbles Weir/ Alta E-fish site	30	Over 1,500 lbs (about 30 bags)
3/16/2024	Avocado Lake	11	7 bags
4/20/2024	"Piedra Road" Bridge	16	10 bags
5/18/2024	Sycamore Point Public Access	5	2
6/15/2024	North and South side below ACOE bridge	12	10
7/20/2024	Choinumni Park	9	7
8/17/2024	Cobbles Weir and Alta e-fish site	11	14
9/28/2024	National Public Lands Day - Island Campground	N/A	N/A

 Table 7 - 2: Location, number of volunteers, and quantity of trash removed during the 2023-2024 reporting period.

#### 7.5 Fishing Regulation Signs

Signs for the general regulations are posted throughout Reach 1 between the Army Corps of Engineer Bridge and Cobbles (Alta) Weir, while special regulation signs posted in Reach 2, and fishing closure signs posted for the area above the Army Corps of Engineer Bridge and the Thorburn Channel. These signs are posted in locations where they are readily visible to any person using or entering the area and close to those areas where stocking trucks plant fish. In this reporting period, to best assist law enforcement with enforcement of the regulations the KRFMP provided graffiti wipes to individuals whose responsibility area includes the Kings River and replaced signs which became damaged, unreadable, or were missing.

# **8.0 MAINTENANCE ACTIVITIES**

#### 8.1 Thorburn Channel

The headgate was opened in April 2023 to accommodate flood flows and flush accumulated sediment

from the Thorburn Channel and remained fully open throughout this reporting. As part of the easement agreement between Kings River Conservation District and the Kings River Conservancy, KRCD flood maintenance workers re-graded both the access and levee road. Maintenance activities to provide continuous connection with the main channel over the next reporting period includes removal of the beaver dam situated near the mouth of the Thorburn Channel, monthly clearing of vegetation from the headgate, and removing sediment by hand, as necessary to maintain connection with the main channel.

#### 8.2 Incubator Building

While in service, daily operation and maintenance of the incubator facility is the responsibility of KRCD staff Monday through Friday. Weekends, weekdays as needed, and holidays are covered by KRWA staff or public volunteers. Staff and public volunteers assist with planting trout fry into the river. The total number of individuals who volunteered time to assist with either daily operation of the incubator building or with fry release are summarized in Table 8-1. During this reporting period Jorgensen Pump was contracted to replace the pair of one-horsepower 35-GPM incubator pumps, motors, and the Yaskawa variable frequency drives (VFD) initially installed in 2012. Brush removal and tree limbing was completed by KRCD Pine Flat Power Plant staff to provide access to the pumps. All equipment was replaced with the same specifications as originally installed using the same models or upgraded versions of what was replaced.

 Table 8 - 1: Number of volunteers and amount of time dedicated to the KRFMP Trout Incubator during the FY23-24 season.

Incubation Period	Volunteers (#)	~ Time (Hours)
1/3/2024-2/22/2024	41	104
2/28/2024-4/18/2024	12	26

#### 9.0 DEVELOPMENT OF A LONG-TERM IMPLEMENTATION 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 Annual Implementation 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. The Long Term Implementation Plans (formerly 10 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 Long-Term Implementation Plan is a "living plan" that is reviewed by the TSC, Public and ExCom on an annual basis and revised as projects and elements of the program are implemented and as new scientific information becomes available.

#### REFERENCES

- California Department of Fish and Wildlife (CDFW). 2010. Appendix L, Glossary of Terms "native trout", "non-native trout", and "wild trout". Pages L1-L9 in Final CDFW Hatchery EIR/EIS. <u>https://wildlife.ca.gov/Fishing/Hatcheries/EIR</u>
- Cramer Fish Sciences (CFS). 2019. Lower Kings River fishery habitat characterization and identification of habitat enhancement opportunities: A study by Cramer Fish Sciences for the Kings River Fishery Management Program. September 27, 2019.
- Kings River Fisheries Management Program (KRFMP). 1999. Kings River Fisheries Management Program Framework Agreement. <u>http://krfmp.org/ pdf fmp/FMP FrameworkAgreement1999.pdf</u>
- Moyle, P. B. 2002. Inland Fishes of California: Revised and Expanded. University of California Press. Berkeley, California. 502 pp.
- Woynarovich, A., G. Hoitsy, and T. Moth-Poulsen. 2011. Small-scale rainbow trout Farming. FAO Fisheries and Aquaculture Technical Paper 561.

# **APPENDIX A**

Pine Flat Reservoir Temperature and Dissolved Oxygen Profiles October 2023 – September 2024



PINE FLAT RESERVOIR 10/3/2023 (Time: 1029-1152) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 885.46



#### PINE FLAT RESERVOIR 11/7/2023 (Time: 1025-1152) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 865.01



PINE FLAT RESERVOIR 12/21/2023 (Time: 1051-11236) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 872.22



PINE FLAT RESERVOIR 1/11/2024 (Time: 1031-1315) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 876.61



PINE FLAT RESERVOIR 2/15/2024 (Time: 1027-1150) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 891.43



PINE FLAT RESERVOIR 3/13/2024 (Time: 1023-1203) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 907.29



PINE FLAT RESERVOIR 4/10/2024 (Time: 1027-1229) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 919.35



PINE FLAT RESERVOIR 5/9/2024 (Time: 0950-1146) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 940.20



PINE FLAT RESERVOIR 6/4/2024 (Time: 0945-1125) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 948.55



PINE FLAT RESERVOIR 7/9/2024 (Time: 1004-1152) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 917.66



PINE FLAT RESERVOIR 8/6/2024 (Time: 0945-1100) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 861.76



PINE FLAT RESERVOIR 9/4/2024 (Time: 1033-1148) New Buoy Line Placement (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 824.90