



**KINGS RIVER FISHERIES MANAGEMENT PROGRAM
ANNUAL TECHNICAL REPORT
Water Year 2021-2022**



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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 between October 2021 and September 2022 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 2022 (October 1, 2021- September 30, 2022) and CDFW stocking activity for Calendar year 2022.

Key Elements of the program in recent years includes:

- Most instream flow targets met as outlined in the Framework Agreement, with most days greatly exceeding these targets;
- Kings River Fisheries Management Program website improved and maintained;
- Incubated 220,000 rainbow trout eggs in the incubator building;
- Continued implementation of a supplemental Rainbow Trout stocking plan in addition to CDFW annual budgeted stocking program;
- Accepted into the program a technical memorandum and 30% concept designs created by Cramer Fish Sciences for two of the sixteen habitat enhancement projects identified in their 2019 report, *Lower Kings River Habitat Characterization and Identification for habitat Enhancement Opportunities* – Cramer Fish Sciences;

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 2021 and September 2022 and CDFW stocking in 2022 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;
- Routine fish stocking by the CDFW, KRFMP 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 are 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, 2021 through September 30, 2022; KRWA (Table 1-1), KRCD (Table 1-2), CDFW (Table 1-3). Estimated in-kind support from agencies for the KRFMP was 3,244 hours or about 1.56 Full-Time Equivalent (FTE). Additionally, volunteers involved with assisting the KRFMP are vital for the program success, providing approximately 710 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 2022, the CDFW allotment for the Kings River included approximately \$130,321 or 29,220 pounds of catchable size trout to the Lower Kings River, Avocado Lake, and Pine Flat Reservoir. Fish stocking by CDFW also included approximately \$37,165 or 8,333.5 pounds of fish in fingerling, and super-catchable size trout. Section 2 outlines hydrologic conditions for Water Year 2021. The temperature control pool has been maintained above 100,000 acre-feet, a storage volume unavailable to water users.

Table 1-1: Estimate of KRWA In-Kind Support for the KRFMP, October 1, 2021 - September 30, 2022

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	120	15.0	0.06
River Access Improvement Project	40	5.0	0.02
River Clean-Up	60	7.5	0.03
River Operations	375	46.9	0.18
Reservoir Operations	65	8.1	0.03
Internal Water Accounting	104	13.0	0.05
Administrative Activities	420	52.5	0.20
Total In-Kind Support	1429	178.6	0.69

Table 1-2: Estimate of KRCD In-Kind Support for the KRFMP, October 1, 2021 -September 30, 2022

KRFMP Support Activity	Hours/Year	Days/Year	FTE
Administrative	457	57.1	0.22
Education Outreach	1	0.1	0.00
Fall Electrofishing Survey	297	37.1	0.14
Fishing Access Maintenance	12	1.5	0.01
Incubator Fry Release	14	1.8	0.01
Incubator Maintenance	1	0.1	0.00
Incubator Operation	282	35.3	0.14
Pine Flat Reservoir Profile	105	13.1	0.05
Public Relations/Outreach	62	7.8	0.03
Total In-Kind Support	1231	153.9	0.59

Table 1-3: Estimate of CDFW In-Kind Support for the KRFMP, October 1, 2021 - September 30, 2022

KRFMP Support Activity	Hours/Year	Days/Year	FTE
Fall Electrofishing Survey	200	25	0.10
Administrative Activities	384	48	0.18
Total In-Kind Support	584	73	0.28

Table 1-4: Estimate of Volunteer Hours for the KRFMP, October 1, 2021 -September 30, 2022

KRFMP Support Activity	Hours/Year	Days/Year	FTE
Fall Electrofishing Survey	270	33.8	0.13
Incubator Fry Release	29	3.6	0.01
Incubator Operation	55	6.9	0.03
Public Advisory Group	51	6.4	0.02
River Clean-up	305	38.1	0.15
Total In-Kind Support	710	88.7	0.34

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

2.1 RESERVOIR INFLOW

Daily average inflow into Pine Flat Reservoir from hydrologic year 2021, October 1, 2022 through September 30, 2022, are shown in Figure 2-1. Inflow into Pine Flat Reservoir is characterized by high seasonal and inter-annual variability reflecting variation in precipitation, snowpack, and runoff within the watershed. Kings River basin discharge averaged 1,037 cfs, ranging from 54 to 3,692 cfs. Table 2-1 shows the Kings River calculated annual runoff and the corresponding percent water year for the past 22 years; years included in this report are in bold text.

Table 2-1: Kings River basin calculated annual runoff by Water Year, October-September

Water Year (Oct-Sept)	Annual Runnof (TAF)	Percent Water Year
2000	1,534	91%
2001	1,010	60%
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	80%
2010	2,062	122%
2011	3,318	196%
2012	826	49%
2013	691	41%
2014	537	32%
2015	361	21%
2016	1,253	74%
2017	4,096	242%
2018	1,275	75%
2019	2,177	171%
2020	913	54%
2021	396	23%
2022	786	47%

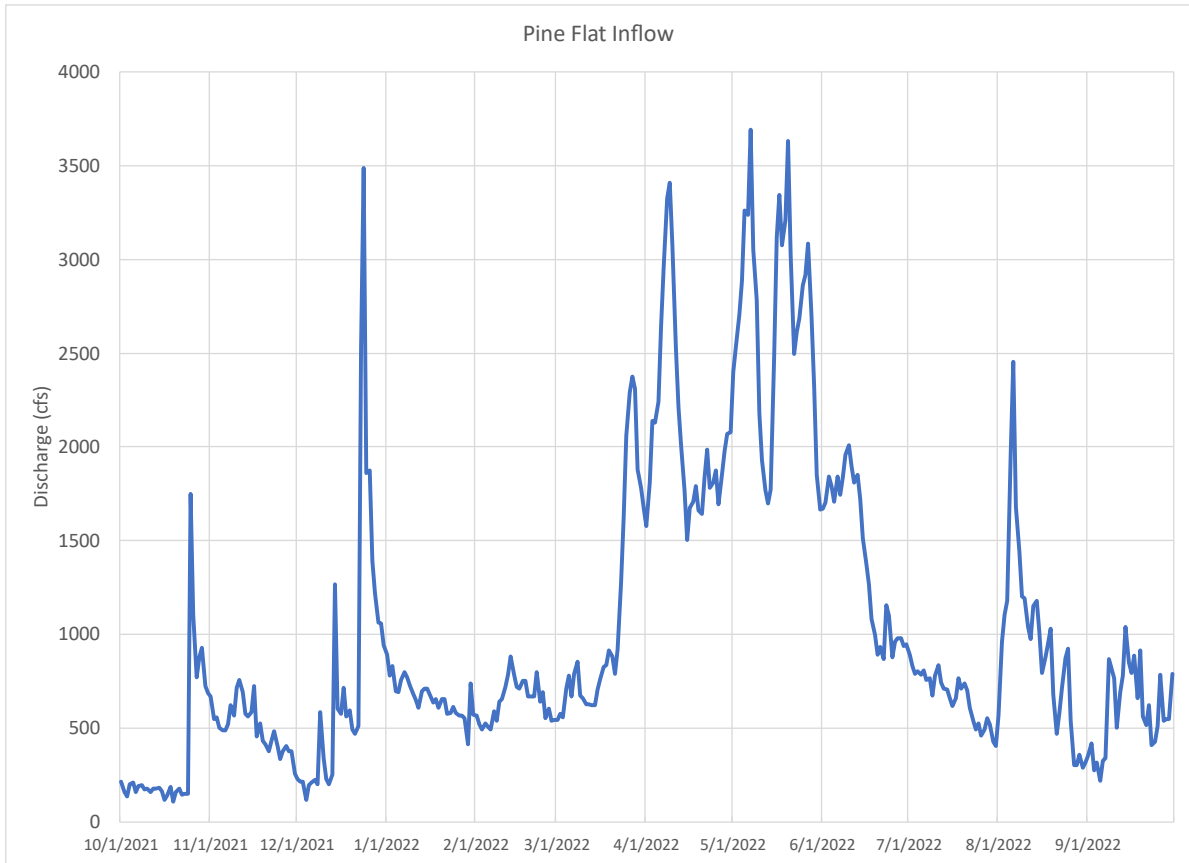


Figure 2-1: The annual inflow into Pine Flat Reservoir from October 1, 2021 through September 30, 2022

2.2 RESERVOIR STORAGE

Daily reservoir water storage volume in Pine Flat Reservoir from October 1, 2021 through September 30, 2022 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.

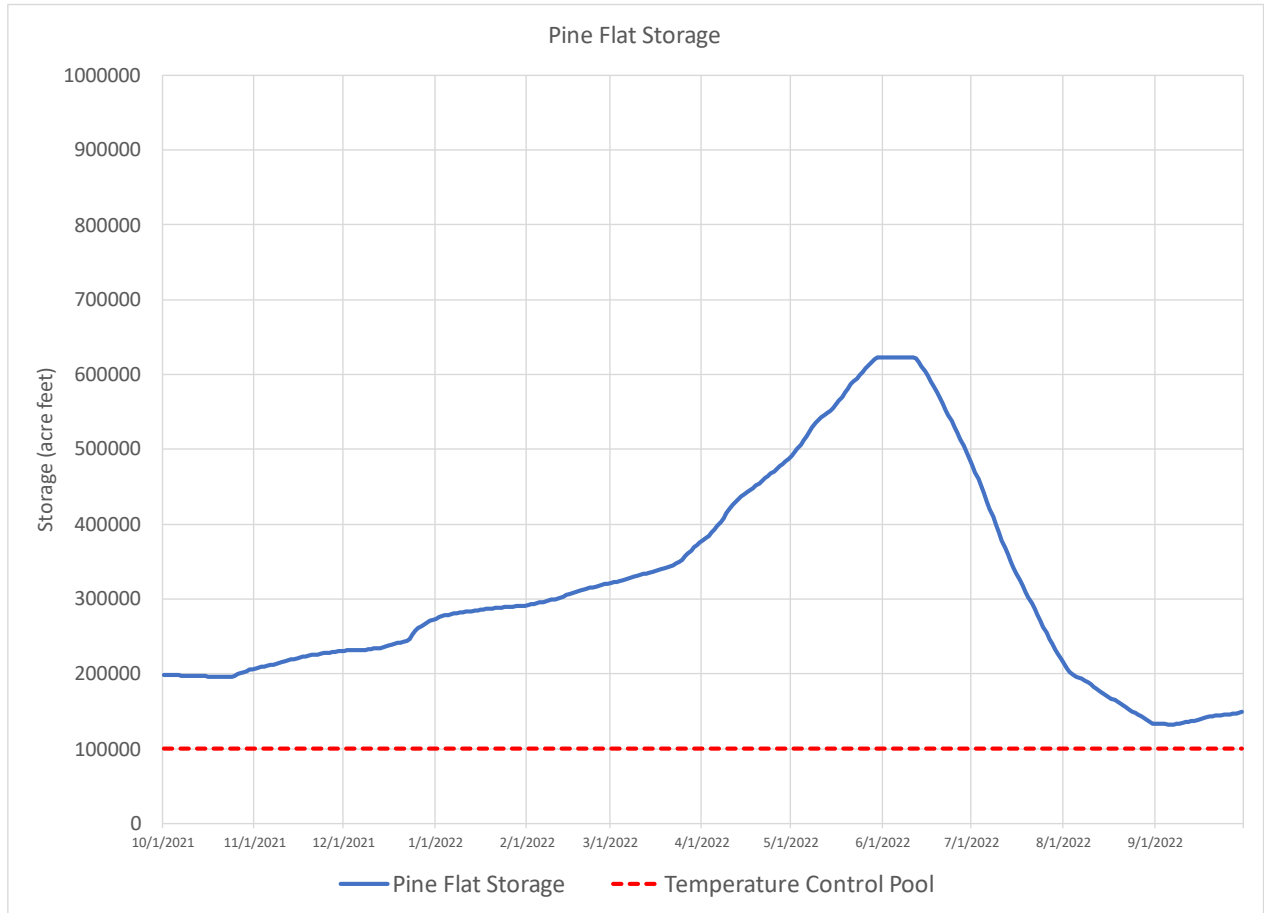


Figure 2-2: Average daily storage in Pine Flat from October 1, 2021 through September 30, 2022

2.3 RESERVOIR RELEASES

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 show high variability within the year as shown in Figure 2-3. Average daily discharge from Pine Flat in the lower Kings River from October 1, 2021 through September 30, 2022 ranged from 54 to 5,955 cfs, all above target flows. Average discharge from Pine Flat was 1,089 cfs during the report period.

Daily average Kings River flow at Piedra from October 1, 2021 through September 30, 2022 ranged from 100 to 5,955 cfs, all above target flows. Flow at Piedra averaged 1,092 cfs during the report period.

Daily average flow at Dennis Cut from October 1, 2021 through September 30, 2022 ranged from 6 to 87 cfs, all above target flows. Flow at Dennis Cut averaged 43 cfs during the report period. (Figure 2-5).

Target flow to Fresno Weir followed ‘Exhibit C’ flow schedule (Table 2-2) in WY 2022, due to preceding year conditions in WY 2021. Daily average Kings River flow to Fresno Weir from October 1, 2021 through September 30, 2022 was 860 cfs, ranging from 90 to 4,833 cfs (Figure 2-6). Several departures from target flows occurred in WY 2022. November 6, 2021 through December 23, 2021, and December 29 and 30, 2021, and January 1 and 2, 2022, flow at Fresno Weir averaged 93 cfs for these dates, but averaged 96 cfs for the 63 day period from November 1-January 2 time period. These occurred immediately following a reduction in Dennis Cut irrigation flow when the bifurcation structure at Dennis Cut was being adjusted for the low-flow time period. Average flow at Dennis Cut during the same time period was 8 cfs, ranging from 7 to 21 cfs. Additionally, March 10-12, 2022 had daily average flow of 94 cfs, immediately following changes in upstream diversions. The average for the month of March was 101 cfs at Fresno Weir.

Daily average flow below Fresno Weir from October 1, 2021 through September 30, 2022 ranged from 35 to 2,501 cfs (Figure 2-7). Flow below Fresno Weir averaged 356 cfs during the report period, all above target flows.

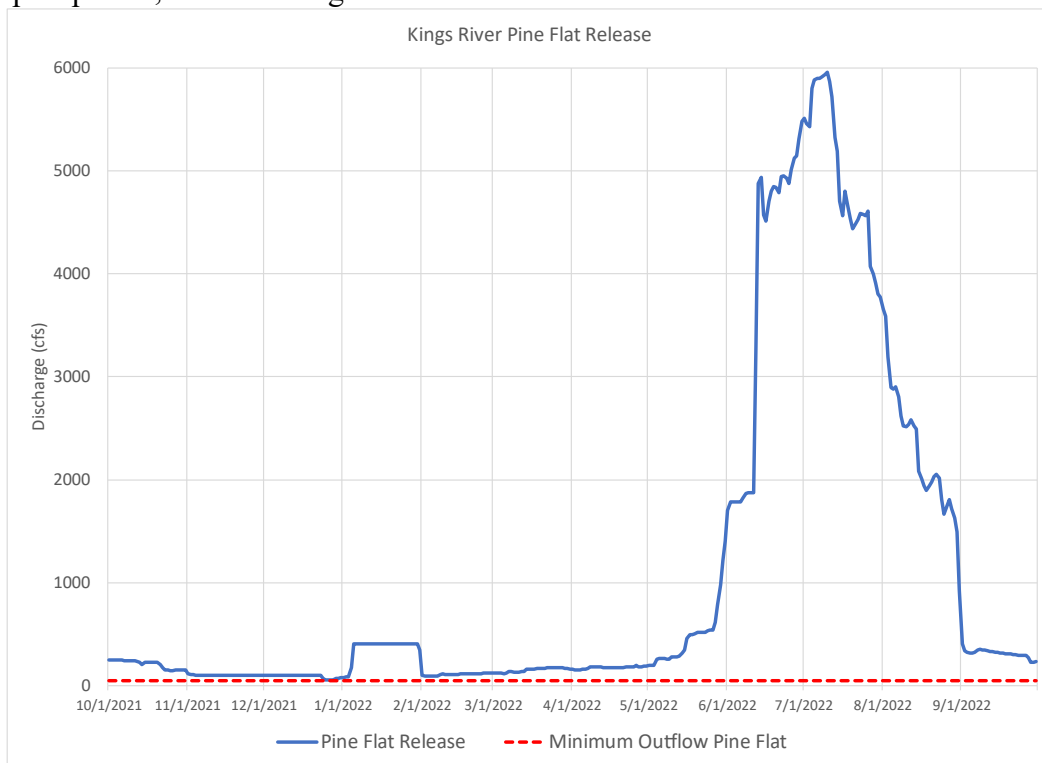


Figure 2-3: Average daily discharge from Pine Flat into the Kings River from October 1, 2021 through September 30, 2022

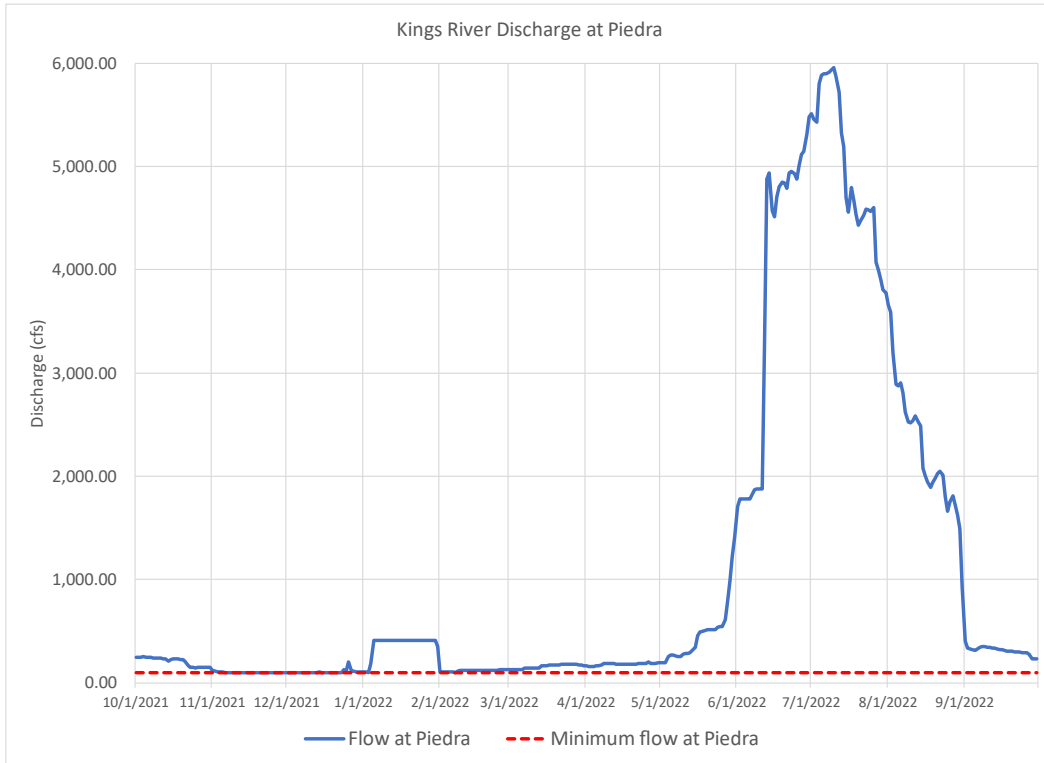


Figure 2-4: Average daily flow of Kings River at Piedra from October 1, 2021 through September 30, 2022

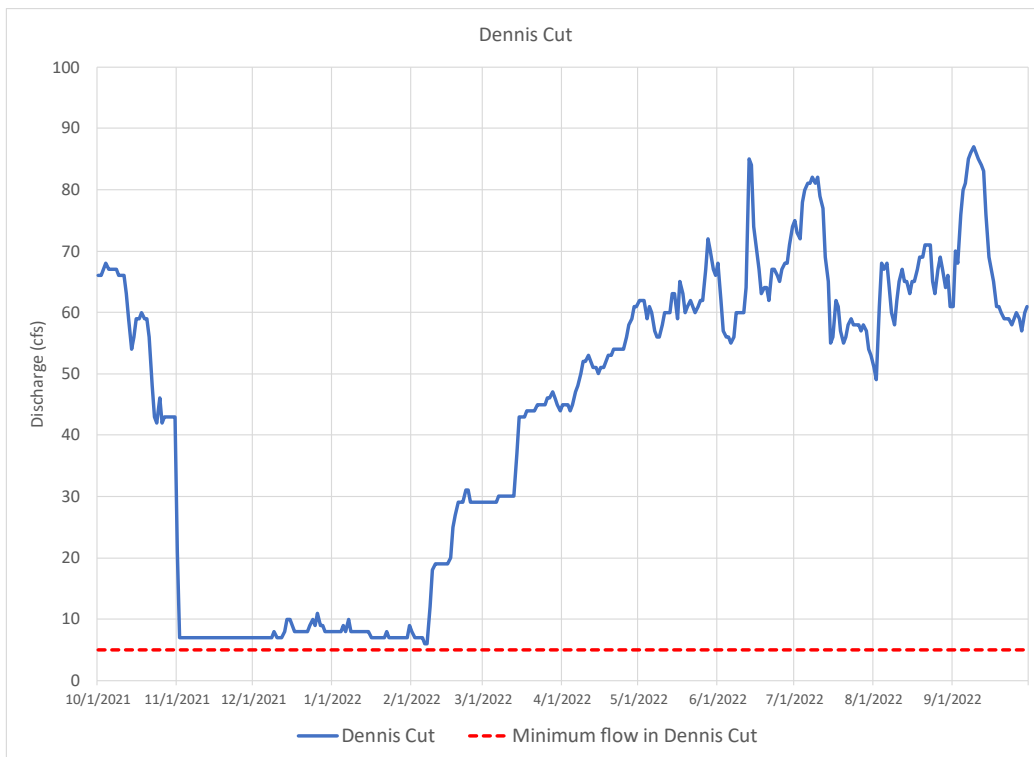


Figure 2-5: Average daily flow in Dennis Cut from October 1, 2021 through September 30, 2022

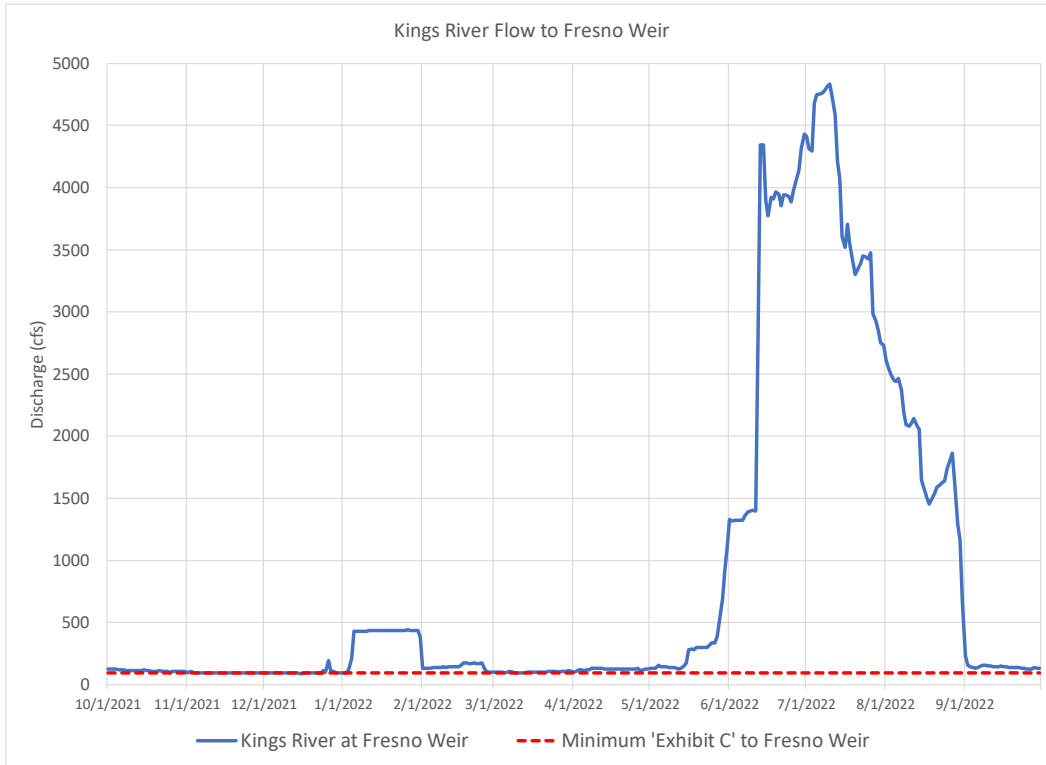


Figure 2-6: Average daily flow of Kings River at Fresno Weir from October 1, 2021 through September 30, 2022

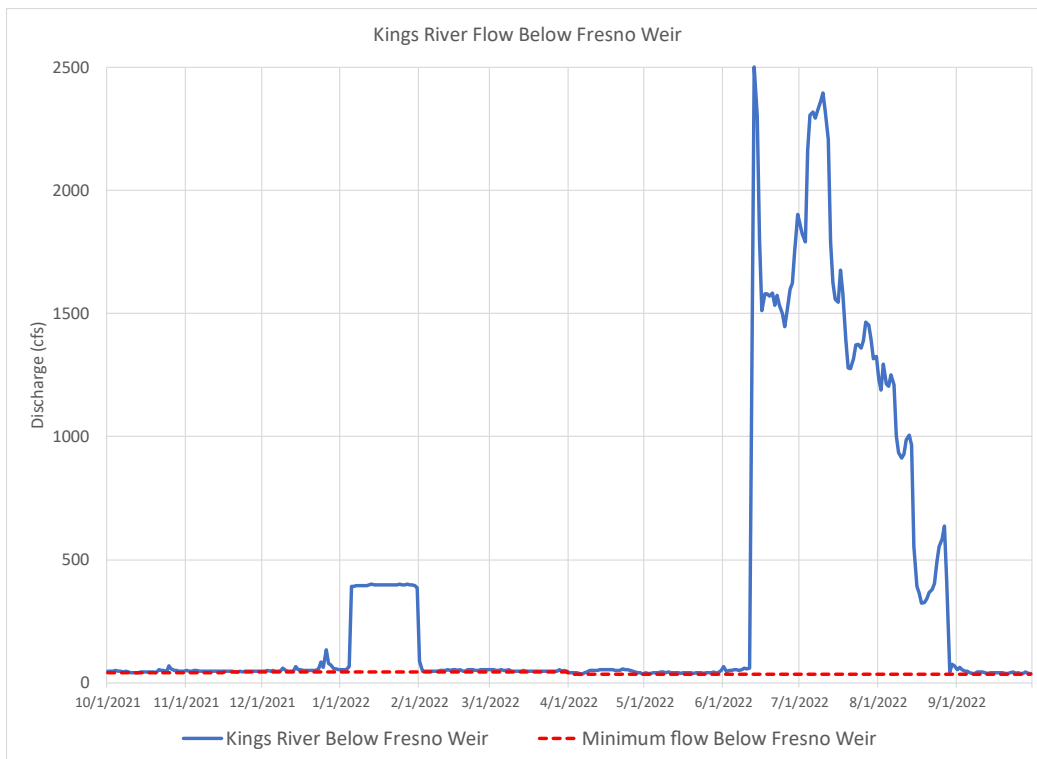


Figure 2-7: Average daily flow of Kings River below Fresno Weir from October 1, 2021 through September 30, 2022

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 affect habitat quality for trout within the lower river. The real-time water temperature monitoring system complements 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 biota within the river.

2.5 EXHIBIT C AND D FLOWS

Minimum flow targets are dependent on prior water year volumes. Exhibit “D” flows were not required. Target flows observed were ‘Exhibit C’ flows for the entire Water Year (Table 2-2).

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

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

2.6 SUMMARY

Hydrologic conditions, Pine Flat Reservoir operations and flows within the lower river during Water Year 2022 are characterized by high seasonal variability characteristic of the Kings River watershed and water supply operations for the 16th driest Water Year on record. Additionally, Water Years 2020-2022 ranked 4th for the driest 3-consecutive years on record. Additionally, Water Years 2021-2022 ranked 3rd for the driest 2-consecutive years on record. 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, flow in Dennis Cut, 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;
- 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 “C” flow schedule was observed during WY 2021, however, water orders often exceeded these requirements;
- Kings River 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.

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 from the low-level sluices and turbine bypass were utilized between August 7 and September 27.

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 the late fall and winter, the water temperature in the reservoir becomes almost uniform. Reservoir profiles indicate thermal stratification occurred in October-November, and June through September (Appendix A). Destratification began in December, and temperatures were nearly isothermal through March (Appendix A). 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 also indicated dissolved oxygen levels greater than 7.0 mg/L occurred throughout the reservoir during the winter and remained above 6.0 mg/L through June. By early August, levels greater than 7.0 mg/L existed only within the epilimnion and by late August approached 0 mg/L throughout all but the epilimnion for the remainder of the water year.

PINE FLAT RESERVOIR 10/5/2021 (Time: 0956-1053) New Buoy Line Placement
 (0.57 miles upstream of Dam) Reservoir Elevation in Feet = 758.85

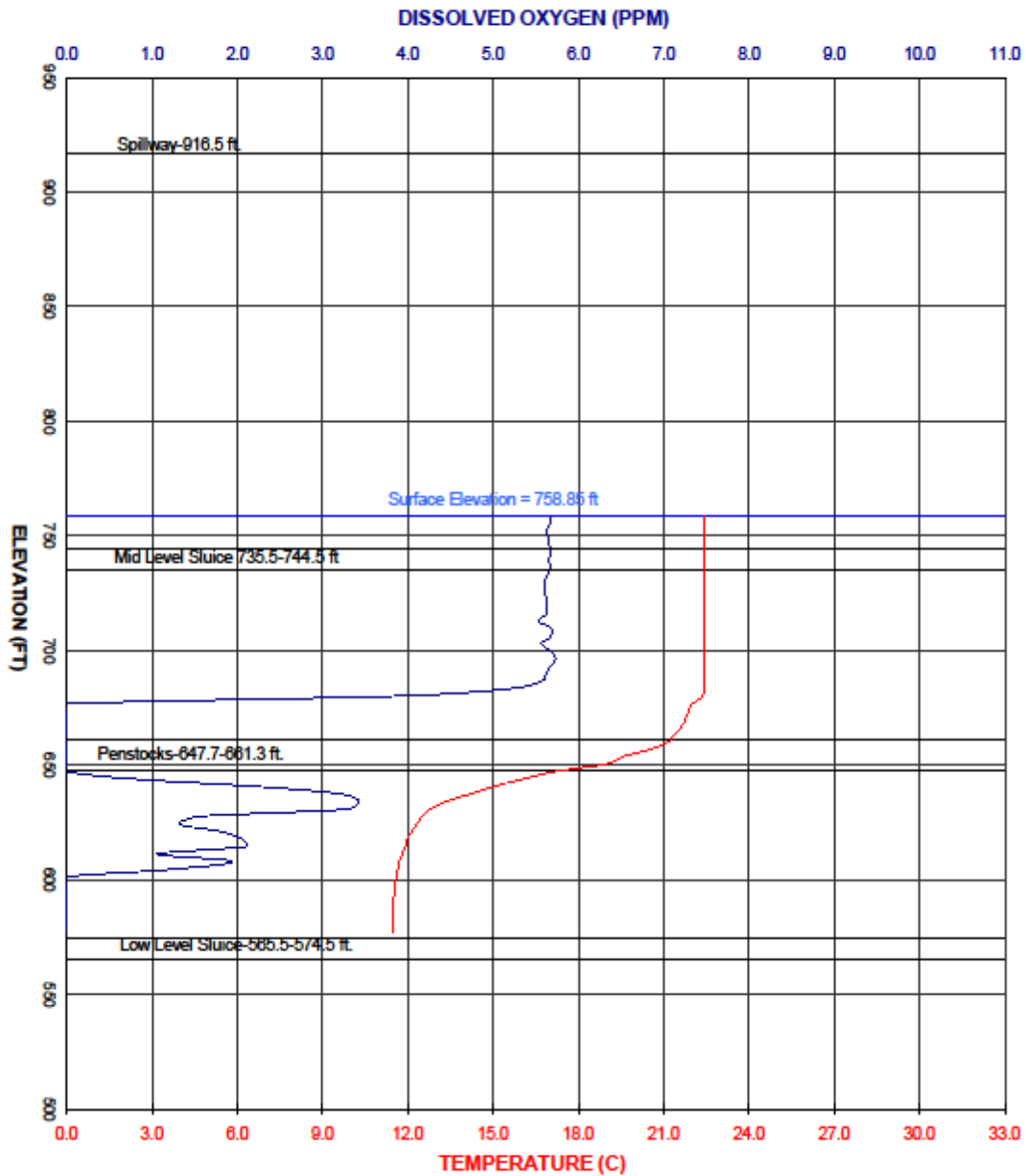


Figure 3-1: Pine Flat Reservoir profile taken 10/5/2021

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 by a Eureka Manta. 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 7.8°C, 22.2°C, and 13.4°C respectively. The daily minimum, maximum, and average temperatures recorded at Fresno Weir were 10.2°C, 25.6°C, and 16.3°C. Throughout the season, daily average water temperature at Fresno Weir were approximately 2.9 °C higher than at ACOE Bridge. However, daily average water temperature at Fresno Weir were recorded as much as 8.8 °C higher and 2.1 °C lower than at ACOE Bridge. Efforts were made to keep temperatures below Pine Flat Dam suitable for the tailwater trout fishery. Water releases which blended cold water from the low-level sluices along with the turbine bypass and mid-level sluices was initiated on August 7 and continued through September 27, when all releases were moved to the turbine bypass for the remainder of the water year. Daily average water temperatures exceeded 20.0°C for the last six days of the water year, with a daily average range of 20.1 to 21.1°C.

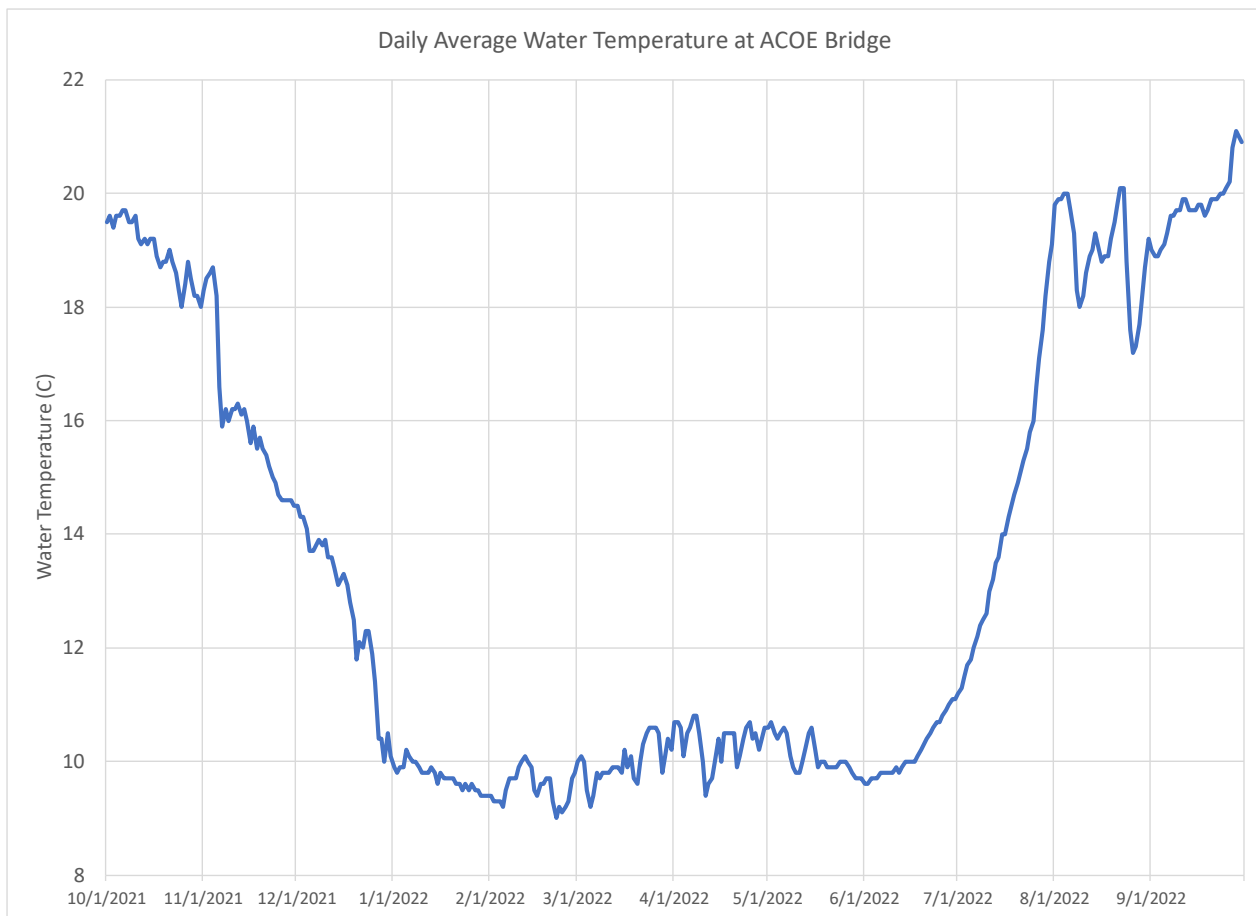


Figure 3-2: Daily average water temperature at the ACOE Bridge October 1, 2021 through September 30, 2022.

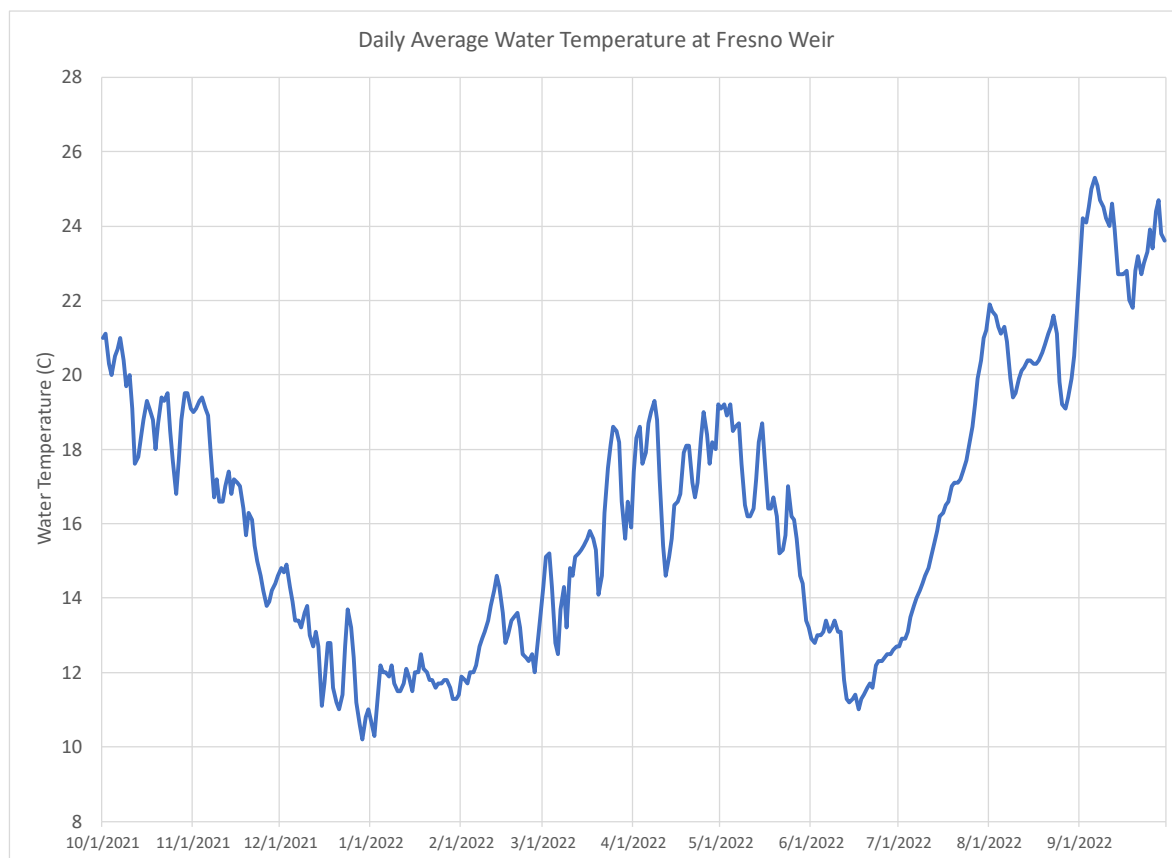


Figure 3-3: Daily average water temperature at Fresno Weir October 1, 2021 through September 30, 2022

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.

During the 2021-2022 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 2021 through September 2022 is presented in Figure 3-4. The Manta dissolved oxygen meter used for monitoring has an accuracy of ± 0.1 mg/L. Minimum and maximum dissolved oxygen content recorded during this reporting period was 6.1 mg/L and 11.7 mg/L respectively. The daily average dissolved oxygen content exceeded 7.0 mg/L throughout this reporting period, with an annual average of 9.2 mg/L.

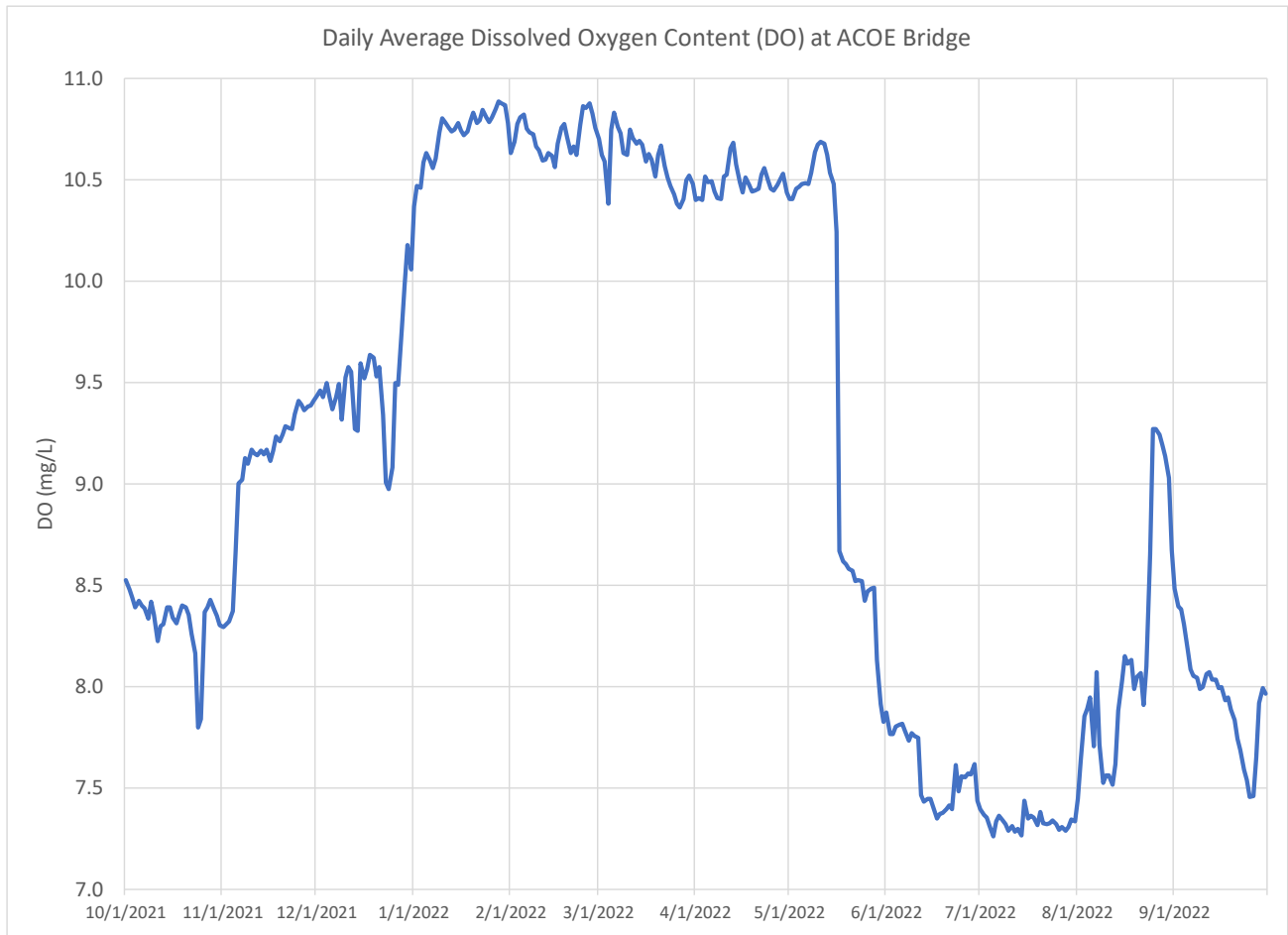


Figure 3-4: Daily average dissolved oxygen content at the ACOE Bridge October 1, 2021 through September 30, 2022

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 did briefly drop below 7.0 mg/L (Table 3-1). During the June 23 low dissolved oxygen event spill was increased to remedy the situation. The low dissolved oxygen event on July 27 occurred when the USACE initiated a gate change between mid-level sluice gates when one gate was completely closed before the other was opened. Corrective action was not necessary as dissolved oxygen stabilized above 7.0 once the gate change was complete. The July 29 event was triggered when power plant operations changed, with two turbines taken offline and one brought on-line. Once the change was complete, dissolved oxygen levels stabilized. The August 24 event occurred briefly when the power plant was taken fully off-line.

Table 3-1. Dissolved oxygen events < 7.0 mg/L for Pine Flat Power Plant (Project No. 2741) in 2022.

Date	Reporting Periods DO < 7.0 mg/L	Duration of Event ¹ (minutes)	Minimum DO (mg/L)	Average DO Over Duration (mg/L)
June 23	7	90	6.8	6.9
July 27	10	120	6.4	6.6
July 29	3	50	6.8	6.8
August 24	3	50	6.1	6.3

¹ 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

Several tools for managing water temperature in the lower river 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. Water quality monitoring within Pine Flat Reservoir and the lower Kings River during Water Year 2022 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 the late fall and winter. During the 2021-2022 water year reservoir profiles indicate thermal stratification occurred in the early fall and summer months. Destratification began in December and occurred throughout the winter into early spring. Pine Flat Reservoir did not experience lake turnover during the reporting period. Reservoir profiles also indicated dissolved oxygen levels greater than 7.0 mg/L occurred throughout the reservoir during the winter and remained above 6.0 mg/L through June. By early August, levels greater than 7.0 mg/L existed only within the epilimnion and by late August approached 0 mg/L throughout all but the epilimnion for the remainder of the water year.
- The temperature of water released from the reservoir into the lower river can be managed through selective operation of different outlet works, including the turbine bypass. The ability to manage water temperatures is limited by the availability of cold water in Pine Flat Reservoir at release points during critical times. The program successfully utilized releases from the low-level sluices for the benefit of the tailwater trout fishery beginning August 7 through September 27. at the end of the prior water year and continuing through the first 22 days of this reporting period. Cooler water provided by these releases was successful in maintaining daily average water temperatures in the upper portion of the tailwater below 20°C except for the last six days of the water year, with a daily average range of 20.1 to 21.1°C.
- 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.

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 this reporting period.

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 ACOE staff has been instrumental in helping the program discern the size, type, and locations of such projects. In addition, the ACOE has provided the necessary personnel and

logistic resources needed to ensure project completion. In the spring of 2022, after consultation between the ACOE and CDFW Reservoir Biologist, it was recommended that prefabricated fish habitat structures be purchased from Pond King for installation into the reservoir. CDFW proceeded to purchase the structures but installation is still pending. The KRFMP plans to continue working with the ACOE through the foreseeable future.

5.0 FISH STOCKING

CDFW transitioned from stocking triploid rainbow trout into the lower Kings River in favor of diploid rainbow trout at the start of 2018. In 2022, catchable and super-catchable rainbow trout were planted in the Lower Kings River, below Pine Flat Dam. Brook trout were planted in the catchable and super-catchable size classes and fingerling brown trout were also planted in the Kings River, below Pine Flat Dam. The upper Kings River, above Pine Flat Reservoir, received a fingerling brown trout allotment. Pine Flat Reservoir received a catchable rainbow trout and fingerling brown trout allotment. No fingerling Chinook salmon were planted in Pine Flat Reservoir in 2022. Avocado Lake received a catchable allotment of rainbow trout. In addition, rainbow trout eggs were incubated by KRCD and released in the lower river. The supplemental rainbow trout stocking program initiated by the KRFMP in the fall of 2018 was continued during this reporting period.

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 only diploid trout 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. Additionally, the reinstatement of stocking diploid trout provides the potential for holdover trout to spawn and contribute to the resident population when and where conditions are suitable. 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 lbs) to 50,000 (16,600 lbs) catchable diploid rainbow trout between October and March each year. Catchable sized trout measure between 9- and 10-inches fork length and weigh 3 fish per pound. As in the 2021 water year KRCD also purchased supplemental fish for the Kings River from CTF in addition to those purchased by the KRFMP. Due to unfavorable water conditions for trout during the late summer and early fall on the Merced River in 2020 CTF experienced high fish mortality of catchable sized trout making the contracted size class unavailable. As a substitute, they provided the next smallest size class they had available, fish between 11- and 14-inches fork length which weighed on average 0.75 pounds per fish for both the KRFMP and KRCD funded supplemental stocking. Increased fuel, fish feed, and oxygen costs led to an unanticipated price increase which caused the KRFMP to purchase fewer pounds than originally anticipated. Supplemental stocking was delayed until November 2021 due to unfavorable water temperatures for trout which existed in the river in October. Stocking was planned to extend through May but concluded in mid-April when unfavorable water conditions developed in the Merced River. CTF increased the load size and frequency of deliveries in April in line with their plan to evacuate the hatchery and shut down until favorable water conditions returned in the fall of 2022. Despite the shutdown, the total number of pounds budgeted by both the KRFMP and KRCD for were delivered.

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 67%. Reach 1 and 33% Reach 2. These targets were met in 2022 and are reported in Tables 5-

1.

Table 5-1: Summary of 2021-2022 KRFMP and KRCD supplemental stocking by Calaveras Trout Farm.

Month	Reach 1				Reach 2				KRFMP & KRCD		
	KRFMP		KRCD		KRFMP		KRCD		Total		Average
	# lbs	# fish	# lbs	# fish	# lbs	# fish	# lbs	# fish	# lbs	# fish	lbs/fish
November	1,725	2,301	1,268	1,688	575	767	634	844	4,202	5,600	0.75
December	1,875	2,502	1,268	1,688	625	834	634	844	4,402	5,868	0.75
January	2,625	3,501	1,268	1,690	875	1,167	634	845	5,402	7,203	0.75
February	1,875	2,502	1,268	1,690	625	834	634	845	4,402	5,871	0.75
March	2,250	3,000	734	978	750	1,000	367	489	4,101	5,467	0.75
April	1,125	1,500	1,333	1,777	375	500	667	889	3,500	4,666	0.75
Total	11,475	15,306	7,139	9,511	3,825	5,102	3,570	4,756	26,009	34,675	0.75

Due to the shutdown of CTF in spring of 2022 a new provider for supplemental trout was sought for the 2023 water year. In June 2022, Desert Springs Trout Farm, located in Summer Lake Oregon, signed a contract with KRCD to provide both diploid and triploid catchable-sized rainbow trout between November and March.

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 2021 – 2022 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 2021 – 2022. 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.

Incubation Period	Number of Eggs	Estimated Hatch	Estimated Fry	Put & Take	Catch & Release
	Incubated	Rate	Released	Zone	Zone
1/4/2022-2/17/2022	120,000	94%	100,000	48%	52%
2/22/2022-4/7/2022	100,000	92%	67,000	55%	45%

During the January 4 to February 17 rearing period conditions remained optimal for successful trout rearing and the eggs were in good condition upon arrival. Overall, the hatch was good and estimated at 94%.

Average water temperatures 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). On January 31, twenty-eight days after the initiation of this rearing period the sac-fry were observed transitioning to the swim-up stage. Mortalities throughout this period were low, with anywhere from 30 to 200 reported daily.

It is known that some fry escaped the incubator prior to release as they were observable 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. While this channel does provide some of the best rearing habitat on the river, it is disconnected from the river except when instream flows exceed 3,000 cfs. The KRFMP should consider expanding this channel so that even at 50 cfs it is always fully connected to the river with visible flow throughout. Under the current configuration, this channel completely dries out when outflows from the incubator stop. During dry water years the incubator pumps must remain in operation beyond the final fry release of the season, and with sufficient flows from the incubator, to maintain thousands of 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 22 to April 7 rearing period, eggs were observed to be in mixed condition upon arrival. While color was good, in most of the shipping trays the eggs were soft, and evidence of hatch was found in one of the trays. Eggs which hatch in shipment result in mortality. These losses were believed to be less than 1%. Despite the condition of the eggs, the overall hatch was good, and estimated at 92%.

Average water temperatures within the incubator during this rearing period remained within the range Woyanovich 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). On March 18, twenty-five days after the initiation of this rearing period the sac-fry were observed transitioning to the swim-up stage. Mortalities remained low throughout most of this rearing period, with an increase of 300-400 fish per day in the final two weeks prior to release. In addition to observed mortalities, fry also escaped the incubator through the drains into the high-water channel prior to release.

It is unclear why the losses occurred. While average daily water temperatures were within the range considered optimal for trout fry in all stages, on six days the maximum recorded temperature was within the range considered lethal. These temperatures were only experienced for 1 to 3 hours each day they occurred, and the increased thermal stress may have contributed to some of the observed losses, but the temperature increases were not sudden, thus providing fish the opportunity to acclimate to the increase in temperature. It is more likely that mortalities stemmed from either a failure to transition to exogenous feeding, underfeeding of fish by staff, reduced carrying capacity due to growth spurts the fish were experiencing, or likely a combination of these factors. It is not uncommon for underfeeding to be an issue with the trout fry. In the early days as they make that transition the fish will show little interest in food, thus leading to reduced offerings to not foul the raceways with excess uneaten food which will accumulate on their bottoms. Once the fish show an increased interest in feeding, they are often fed to satiation, but only while somebody is present at the building. Attempts at using automatic feed stations have proven to be unreliable for feeding starter mash, and in discussions with other hatcheries, it is not necessary to provide multiple small feedings a day, if the fish are still adequately fed. Typically, while working within the building, food will be offered multiple times, allowing more food to be offered over an extended time period, and potentially providing the opportunity for more fish to feed or acquire sufficient caloric intake for the day.

5.3 CDFW STOCKING

The CDFW annual stocking between January 1 – December 31, 2022 are summarized here. CDFW provided hatchery grown salmonids in several different size categories to the Kings River below Pine Flat Reservoir (109,303 fish, 20,544 pounds), the upper Kings River, above Pine Flat Reservoir (110,126 fish, 538.5 pounds), Pine Flat Reservoir (32,750 fish, 11,670 pounds), and Avocado Lake (9,160 fish, 4,800 pounds). 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. Fingerling brown trout were stocked in the lower Kings River (below Pine Flat Reservoir) the upper Kings River (above Pine Flat Reservoir) and in Pine Flat reservoir in 2022. Table 5-3 details stocking of fingerling trout. A total of 3,132.5 pounds (200,207 fish) of fingerling brown trout were stocked in 2022.

Table 5-3: CDFW fingerling trout stocked in 2022.

Water	Species	Fingerlings	
		Year	
		2022	
		# Trout	Pounds
Kings River below Pine Flat Reservoir	Brown Trout	80,031	1,924.0
Pine Flat Reservoir	Brown Trout	10,050	670.0
Upper Kings River, above Pine Flat Reservoir	Brown Trout	110,126	538.5
Total		200,207	3,132.5

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. Sub-catchable trout were not stocked in any of the reaches in 2022.

Table 5-4: CDFW sub-catchable trout stocked 2022.

Water	Species	Sub-Catchables	
		Year	
		2022	
		# Trout	Pounds
Kings River below Pine Flat Reservoir	Brook Trout	0	0
	Rainbow Trout	0	0
Pine Flat Reservoir	Brown Trout	0	0
	Rainbow Trout	0	0
Total		0	0

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 13,420 pounds (26,310 fish) of catchable size rainbow trout were stocked in the lower Kings River during 2022. Pine Flat received a total of 11,000 pounds (22,700 catchable rainbow trout) and Avocado Lake received a total of 4,800 pounds (9,160 catchable rainbow trout) during this same period. No catchable brook trout were stocked during this period.

Table 5-5: CDFW catchable sized trout stocked 2021.

Water	Species	Catchables	
		Year	
		2022	
		# Trout	Pounds
Kings River below Pine Flat Reservoir	Brook Trout	0	0
	Rainbow Trout	26,310	13,420
Pine Flat Reservoir	Rainbow Trout	22,700	11,000
Avocado Lake	Rainbow Trout	9,160	4,800
Total		58,170	29,220

5.3.4 Super Catchables

Super-catchable size trout are defined as trout greater than one pound. Table 5-6 details stocking of super-catchable size trout. Kings River below Pine Flat Reservoir received a total of 5,200 pounds (2,962 fish) of super-catchable trout in 2022.

Table 5-6: CDFW super-catchable sized trout stocked 2022.

Water	Species	Super-Catchables	
		Year	
		2022	
		# Trout	Pounds
Kings River below Pine Flat Reservoir	Brook Trout	1,012	1,600.0
	Rainbow Trout	1,950	3,600.0
Pine Flat Reservoir	Rainbow Trout	0	0.0
Avocado Lake	Rainbow Trout	0	0.0
Total		2,962	5,200.0

5.3.5 Trophy Trout

No trophy size trout were stocked in 2022.

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 trout 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. After a one-year hiatus due to the ongoing Covid-19 pandemic the annual fish population survey returned in the fall of 2021.

Electro-fishing surveys 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-and-take 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 Fall Population Electro-fishing Surveys can be found on the KRFMP website: <http://krfmp.org/resources/reports-documents/>.

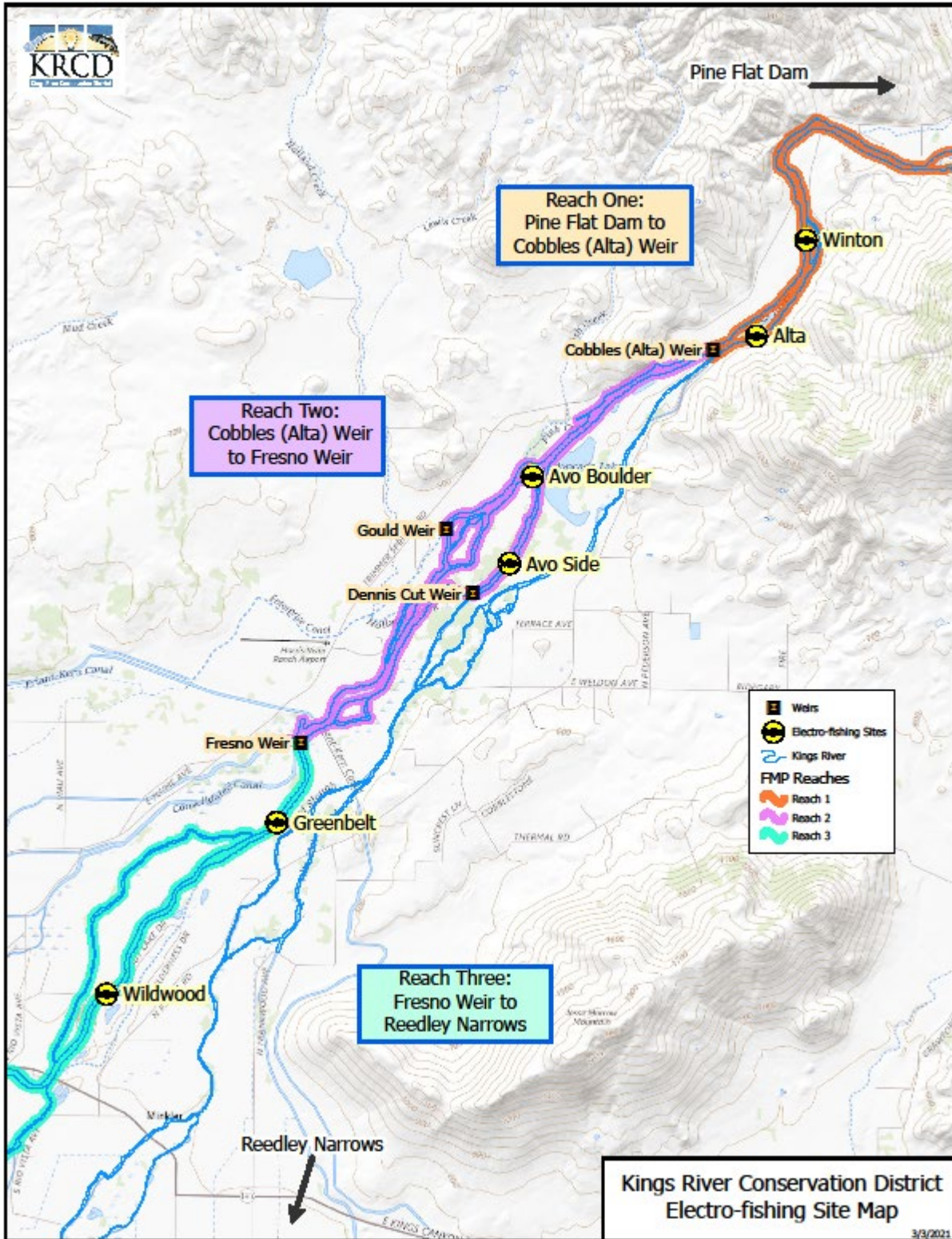


Figure 6-1: Electro-fishing sites in the Kings River and their respective KRFMP management zones

During this reporting period electro-fishing surveys were conducted at all six sample sites between November 29 and December 7 (Figure 6-1). A total of 5,738 fish were collected, with complete data collected for 4,391 fish and entered into MicroFish 3.0 for further analysis. In two sites, Winton and Wildwood, both quantity of collected fish and time restraints due to the onset of sunset forced surveyors to resort to tallying fish. As a result, 79% of the fish collected at Winton and 47% of the fish collected at Wildwood were fully sampled. 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 (98.5%) and biomass (95%), 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, and sculpin. These fish most accurately meet the criteria of the pikeminnow-hardhead-sucker assemblage as described by Moyle (2002). While deep-bodied fishes were present, they made up less than one 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 both juvenile and adult life stages were collected for most taxa during the survey. Exceptions being the lack of immature three-spine stickleback and adult “wild” rainbow trout captured on the survey. 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. A lack of adult “wild” rainbow trout should not be interpreted to mean they are absent from the river below Pine Flat Dam as only 2.7% of the river is sampled between the dam and Highway 180 leaving most of the river unsampled, thus missing “wild” trout which may be present within the unsampled area. Catch results suggested that introduced non-native bass and catfish were able to successfully reproduce 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 2021 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.

Table 6-1: Summary results, Fall Population Electro-fishing Survey, 2021.

Species Collected	Species Composition (%)	Range across Survey Sites			Captured Lengths (in)
		Population Estimates	Fish per Mile (estimated)	Biomass (lbs)	
Sacramento Pikeminnow	29.91	114-464	2,006-8,166	0.6-4	1-15
Sacramento Sucker	29.00	39-549	686-9,662	3-182	1-22
California Roach	16.77	3-307	53-5,403	0.01-2	1-5
Sculpin	10.65	29-239	510-4,206	0.4-3	1-5
Lamprey	6.01	4-249	70-4,382	0.01-0.7	1-6
Three-spine Stickleback	6.00	5-221	88-3,890	0.005-0.3	1-2
Rainbow Trout - Hatchery ^a	0.96	1-27	18-475	0.05-7	4-14
Bass ^a	0.33	0-12	0-211	0-0.1	2-6
Rainbow Trout - "Wild"	0.23	0-8	0-141	0-0.5	5-6
Western Mosquitofish ^a	0.07	0-2	0-35	0-0.002	1
Brook Trout ^a	0.05	0-3	0-53	0-2	12-13
Catfish ^a	0.03	0-2	0-35	0-0.4	2-9

^a Introduced (non-native to the watershed or trout of hatchery origin)

Condition factor of collected trout was also examined. Length-weight regression analysis and calculations using Fulton’s condition factor indicated both brook trout and hatchery rainbow trout were in good condition at the time of capture. Length-weight regression analysis and calculations using Fulton’s condition factor indicated “wild” rainbow trout were in poorer condition than hatchery rainbow trout at the time of capture. It is not surprising that the condition of the hatchery reared trout was better than that of the “wild” trout. It would be hypothesized that hatchery reared trout would be in good condition as they have reared in an environment where they are fed artificial diets daily before release. As “wild” trout are resident in the river, and thus best adapted to local conditions, it would be hypothesized that condition at time of capture is reflective of riverine conditions either recently experienced or ongoing, such as survival through recently unfavorable thermal conditions, reduced invertebrate prey availability, increased energetic expenditures, increased intraspecific interactions, increased predator avoidance or angler pressure, or some other unconsidered variable.

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.

6.2 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. Creel surveys were not performed in 2021-2022 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: <http://krfmp.org/>.

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 circulated monthly September – November 2021, a timeframe when reservoir outflow was being reduced from high irrigation levels and temperature blending of reservoir releases was used to provide flows to the lower Kings.

7.3 EDUCATIONAL TOURS

7.3.1 Incubator Building

Two tours were hosted at the incubator during the 2021-2022 rearing period (Table 7-1). Due to the Covid-19 pandemic the local school districts were not scheduling field trips during this reporting period. It is anticipated that school districts will resume field trips to the incubator, coordinated through the Kings River Conservancy’s Educational Director with KRCD staff, beginning in January 2023. 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 2021-2022 season.

Date	Organization
3/31/2022	Kings River Conservancy - Educational Director
4/4/2022	Fresno County Farm Bureau - Future Advocates for Agriculture Concerned About Tomorrow (FAACT) Class

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. The river cleanup effort has garnered interest from various groups including T-Mobile, local boy and girl scouts, local fly-fishing clubs, and Fresno State University environmental clubs. 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 2022 cleanup was originally scheduled for

September 17th but was moved to September 24th to support the ACOE’s annual Public Lands Day event. The partner agencies provided staff to support this one-day event. A summary of clean-up events is provided in Table 7-2.

Table 7 - 2: Location, number of volunteers, and quantity of trash removed during the 2021-2022 reporting period.

Date	Location	# Volunteers (Agency Staff & Public)	Trash Bags Collected
10/16/2021	Riverside of Avocado Lake	9	12 bags
11/20/2021	Cobbles Weir	16	16 bags
12/18/2021	Sycamore Point Public River Access Area	16	16 bags
1/15/2022	Westside Winton Park	25	23 bags, barb wires, metal car parts, 1 chair
2/19/2022	North Riverside Access Park including the southern riverbanks	16	9 bags
3/19/2022	Sycamore Point River Access Area and KRCD Fishing Access Area	32	9 bags
4/16/2022	Riverside of Avocado Lake	25	21 bags
5/21/2022	Piedra Bridge covering the north and south side of the river	8	8 bags, small mattress, 2 tires
6/18/2022	Sycamore Point Public River Access Area	13	13 bags
7/16/2022	North Riverside Access Park including the southern banks and KRCD Fishing Access Area	22	21 bags
8/20/2022	Winton Park and Westside of Winton Park	21	19 bags, 2 tires
9/24/2022	Kings River Wildlife Area	No Data	Activities included trash pickup, sign installation, graffiti removal, and securing picnic tables

7.5 FISHING REGULATION SIGNS

Signs for the general regulations were 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 in the summer of 2021. These signs are posted in locations where they were readily visible to any person using or entering the area and close to those areas where stocking trucks plant fish. To best assist law enforcement with enforcement of the regulations the KRFMP provides graffiti wipes to individuals whose responsibility area includes the Kings River and can replace signs which become damaged, unreadable, or missing.

8.0 MAINTENANCE ACTIVITIES

8.1 THORBURN CHANNEL

During this reporting period most of the tree cages and drip irrigation line which had been installed during creation of the Thorburn Channel was removed. Some tree cages could not be safely removed due to challenges presented by the terrain, while some sections of irrigation line were buried too deeply for removal or had become ensnared in roots. Where irrigation line could not be removed, the line was cut as close as possible to the section which could not be removed to maximize the amount removed. It was estimated that at least 100 tree cages and approximately one mile of irrigation line was removed, totaling 1,300 lbs (Figure 8-1). The cages had been installed to provide protection for young trees from damage by wildlife and to provide irrigation to the newly planted vegetation. In the twenty-two years since installation, many of the surviving trees were beginning to outgrow the tree cages; in many instances the cages were partially imbedded within their trunks, requiring the cages to be cut off. Supplemental irrigation had become obsolete at the channel once native vegetation was successfully established along the channel. Irrigation line was removed from the length of both sides of the channel, as well as multiple areas where it crisscrossed the island. Work was completed by KRCD staff over two days in the fall. Routine maintenance involving the clearing of downed vegetation did occur along the roadways and trail during this reporting period, but not of the channel itself as the headgate has remained closed since the fall of 2021 to allow the channel to remain in an as-is condition pending the outcome of further evaluation by Cramer Fish Sciences of a habitat enhancement project of the Thorburn Channel.



Figure 8-1: On left, tree growing inside wire cage prior to cage removal, and on right, trailer load of removed tree cages and drip irrigation line from the Thorburn Channel.

8.2 INCUBATOR BUILDING

While in service, daily operation and maintenance of the incubator facility is the responsibility of KRCD staff Monday thru 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 no building or equipment maintenance utilizing staff from the KRCD Pine Flat Power Plant was required.

Table 8 - 1: Number of volunteers and amount of time dedicated to the KRFMP Trout Incubator during the 2021-2022 season.

Incubation Period	Volunteers (#)	~ Time (Hours)
1/4/2022-2/17/2022	10	41
2/22/2022-4/7/2022	17	43

8.3 RIVER ACCESS

During this reporting period, in partnership with the Kings River Conservancy and Fresno County Parks, two areas were improved to prevent unnecessary vehicular access into the river channel. In November numerous boulders were placed around the entry gate and parking area at Eastern Choinumni Park (Sycamore Point) day use area (Figure 8-2) and similarly along the western bank of Winton Park. Boulders were of sufficient size that they could not be easily moved by typical river users and were placed close enough together that street legal vehicles could not pass between them. This work was in addition to the work which had been completed in both of those areas in 2019.



Figure 8-2: Boulders blocking access into the river channel from the Eastern Choinumni Park day use area.

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.

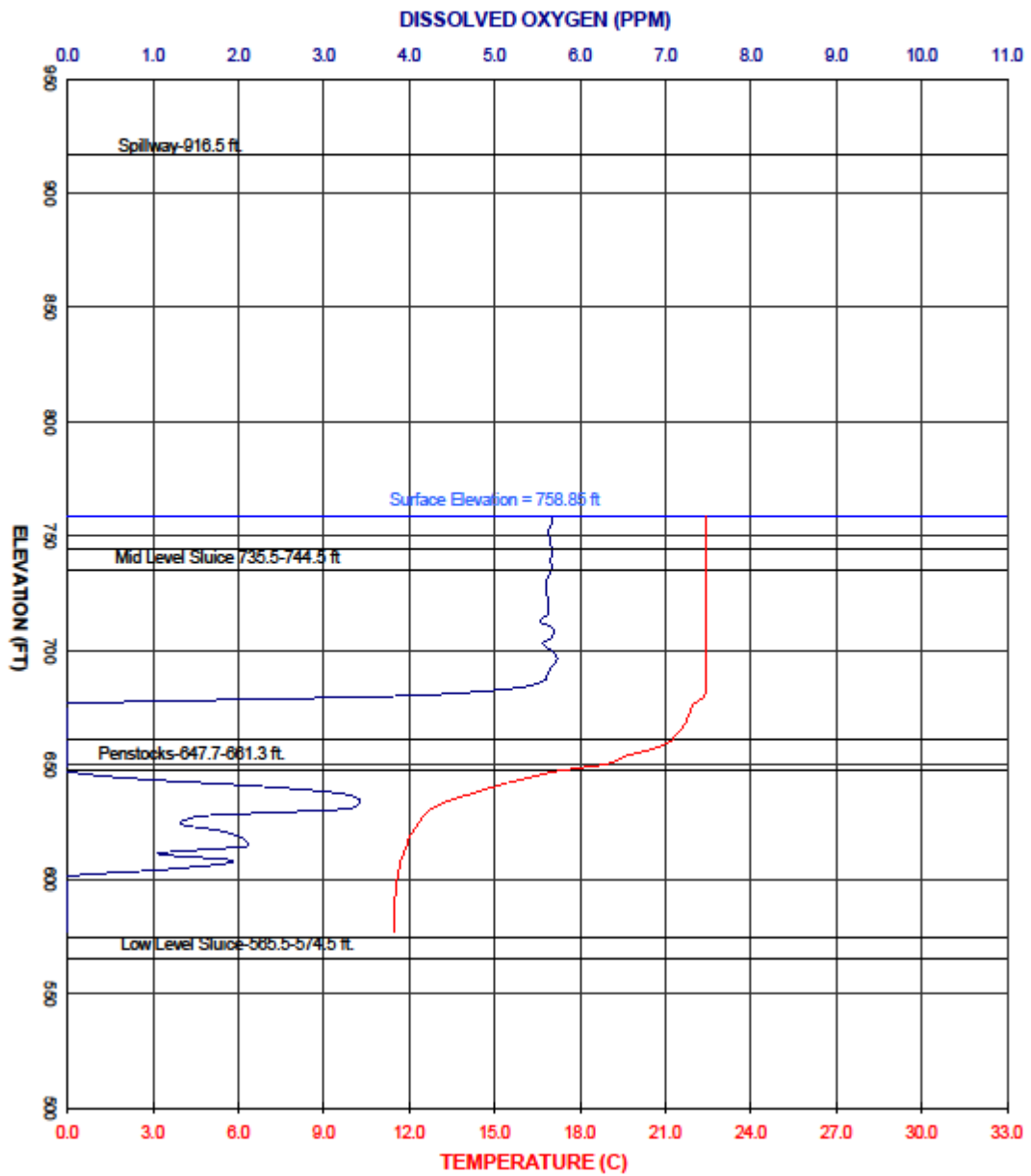
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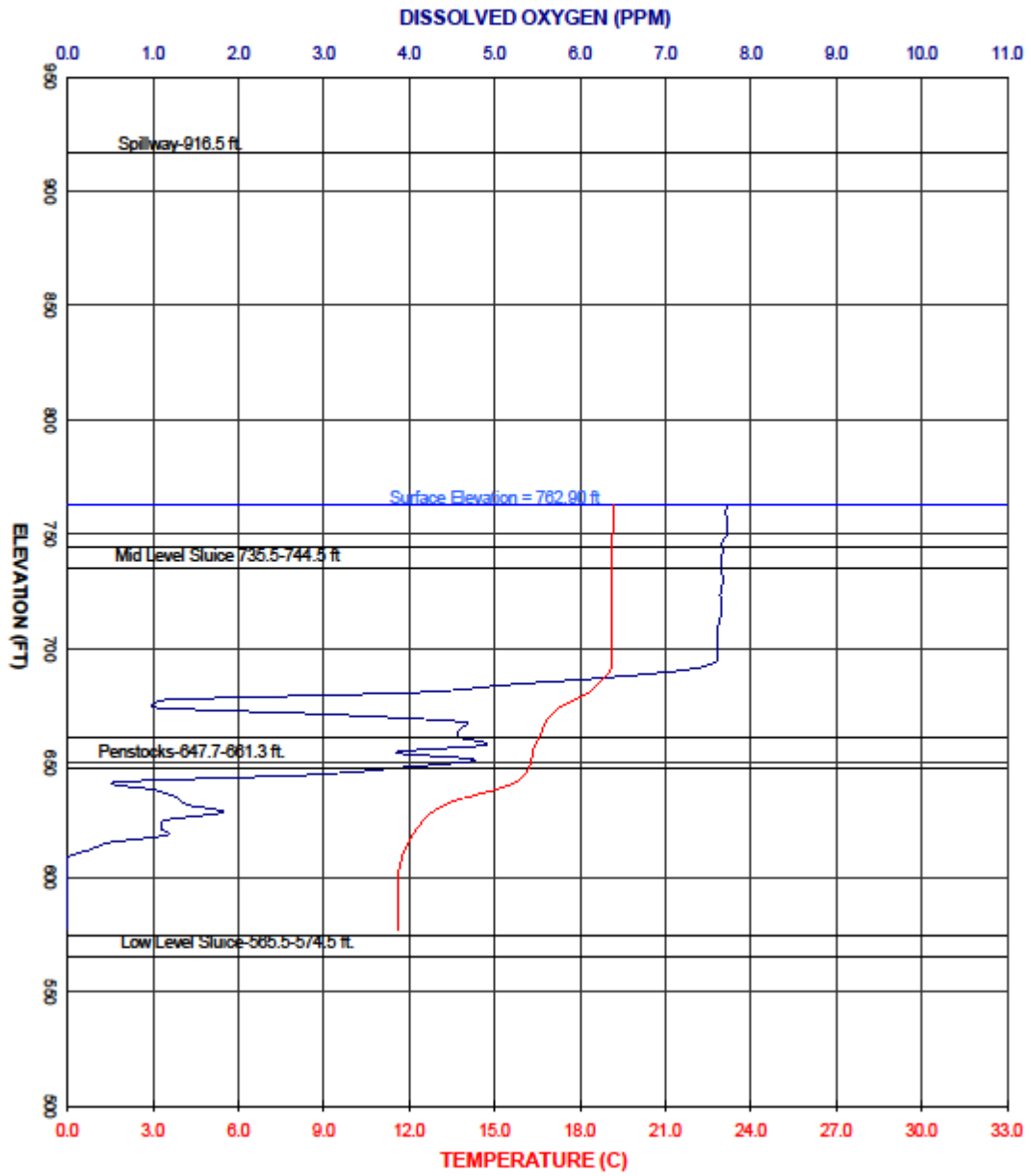
APPENDIX A

Pine Flat Reservoir Temperature and Dissolved Oxygen Profiles
October 2021 – September 2022

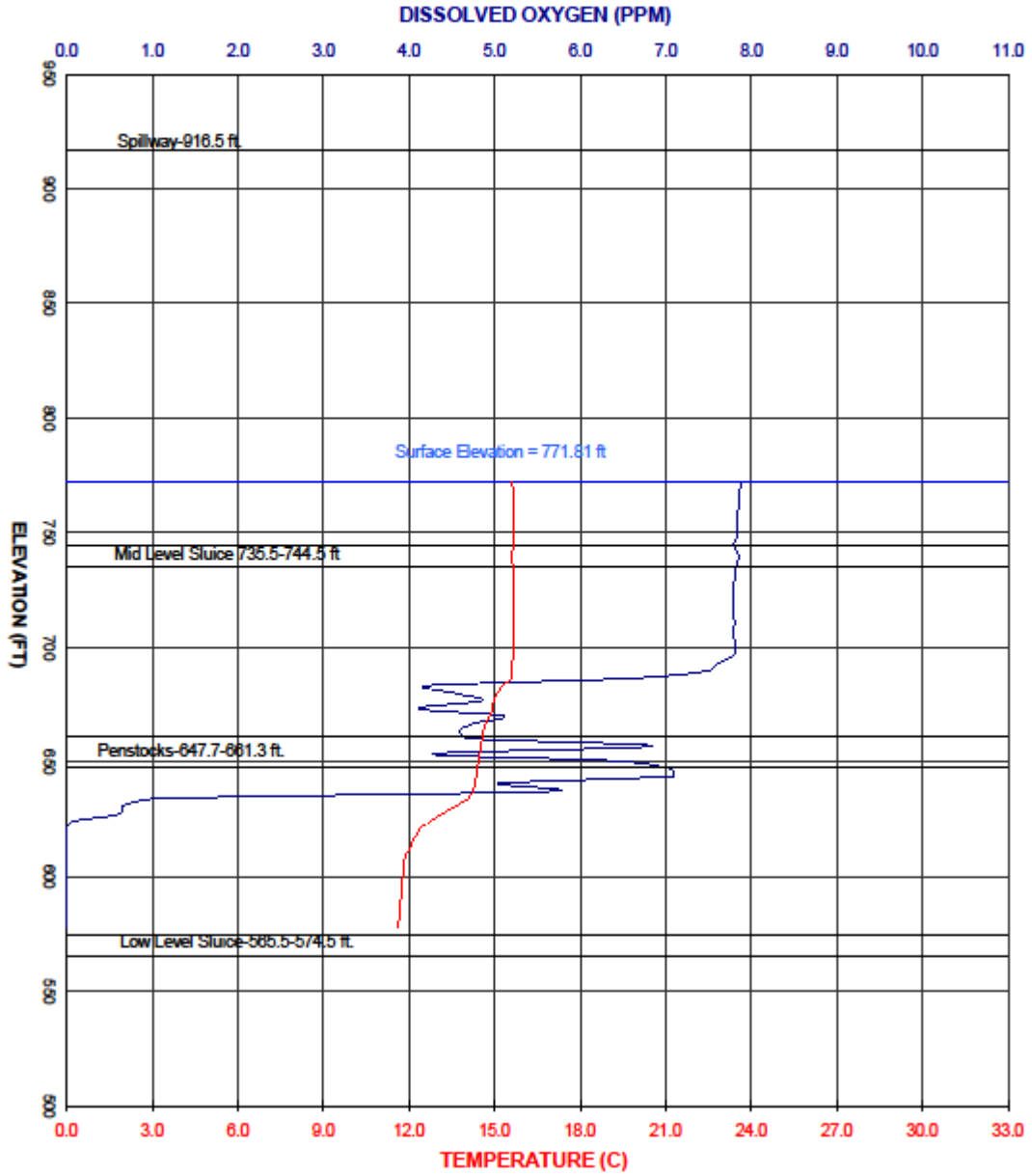
PINE FLAT RESERVOIR 10/5/2021 (Time: 0956-1053) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 758.85



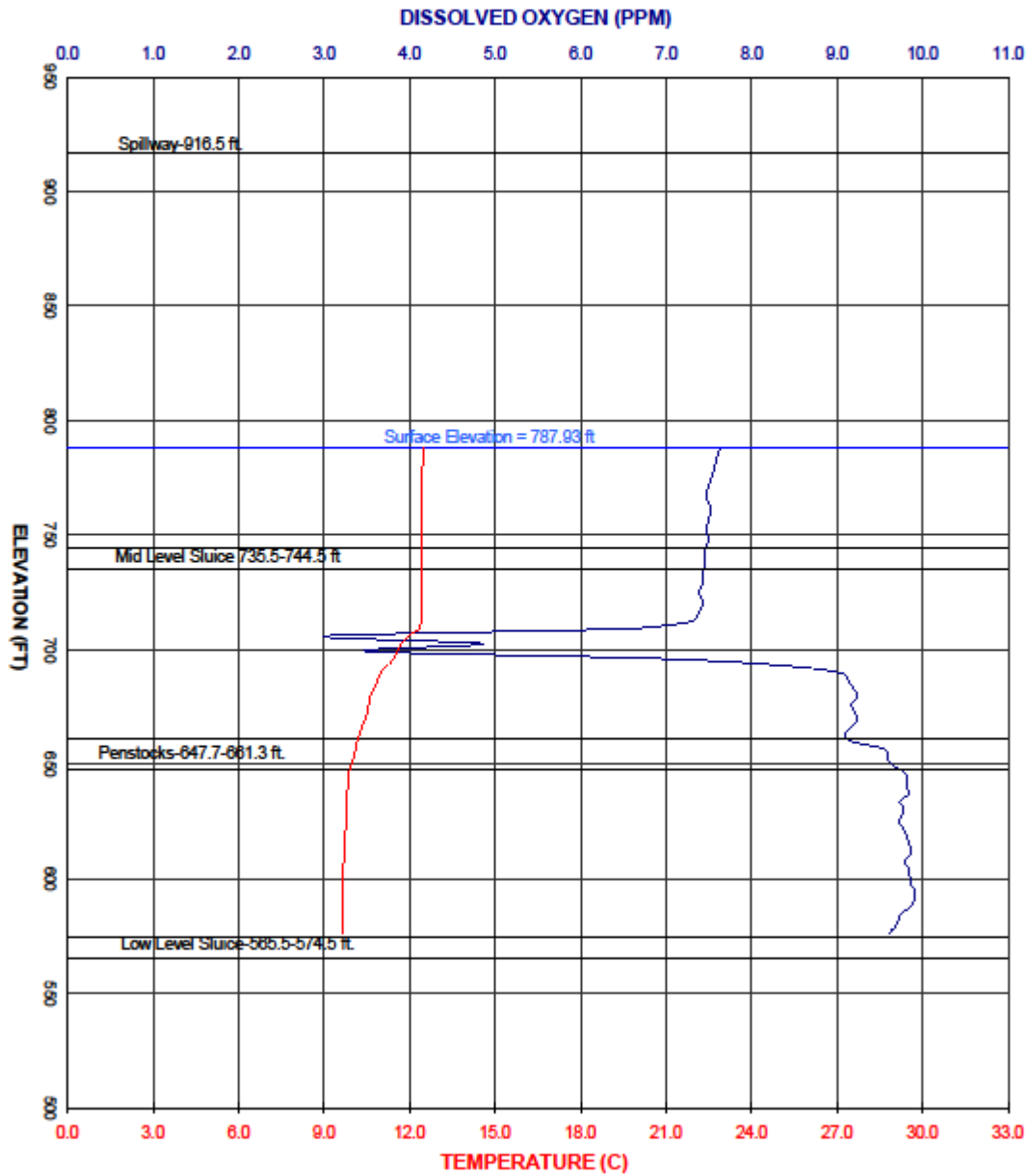
PINE FLAT RESERVOIR 11/2/2021 (Time: 1047-1144) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 762.90



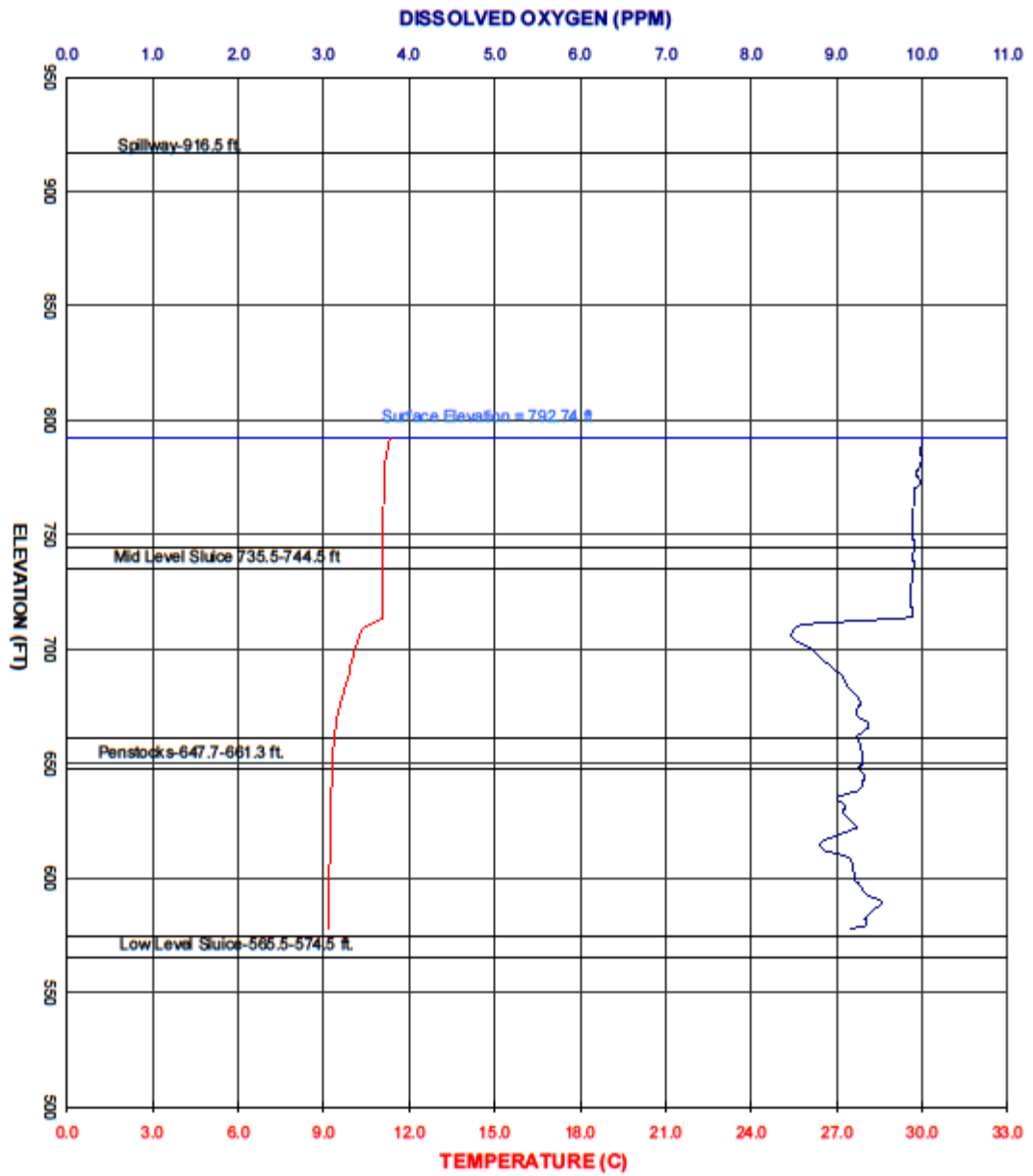
PINE FLAT RESERVOIR 12/7/2021 (Time: 1008-1103) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 771.81



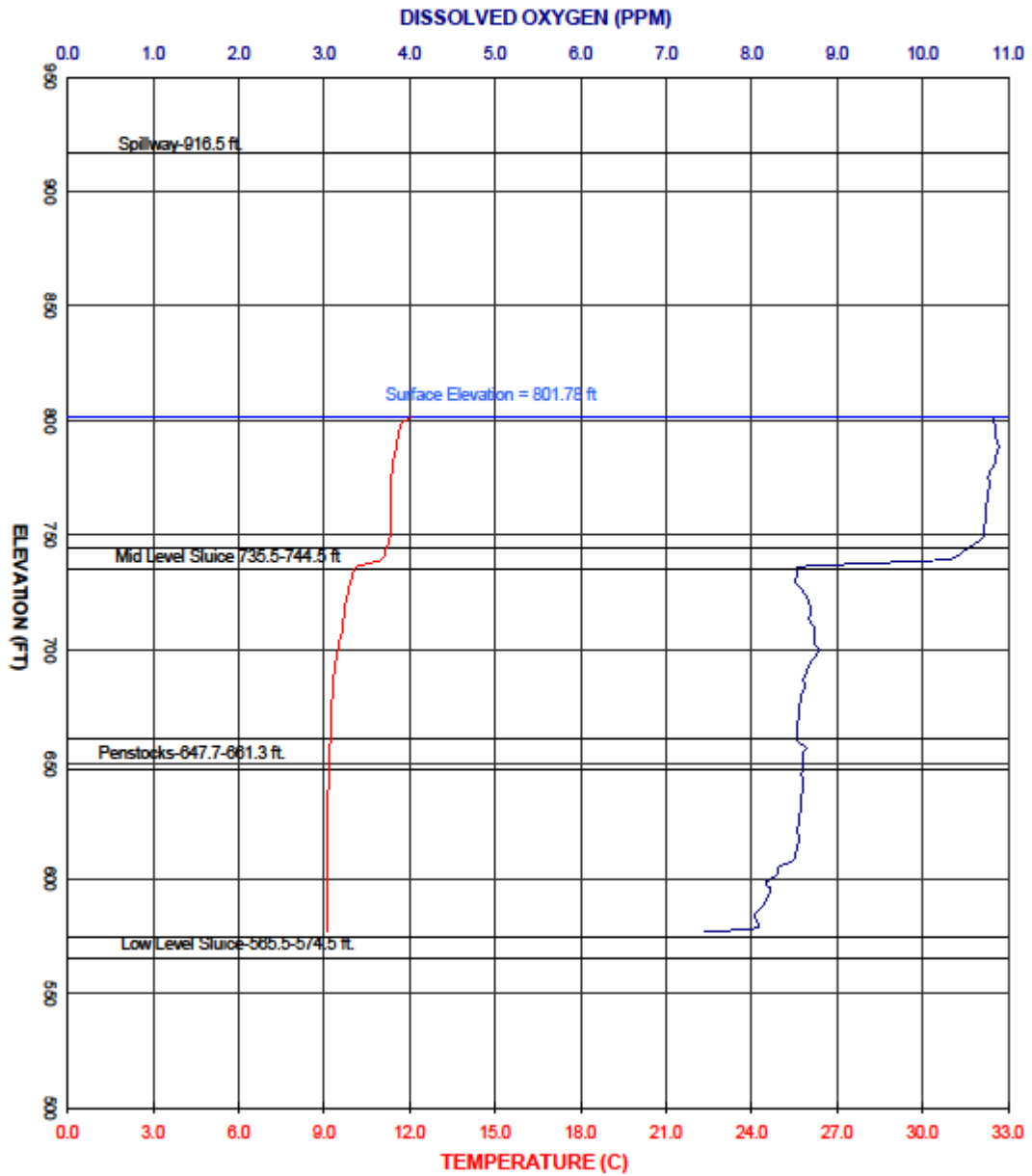
PINE FLAT RESERVOIR 1/4/2022 (Time: 1113-1231) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 787.93



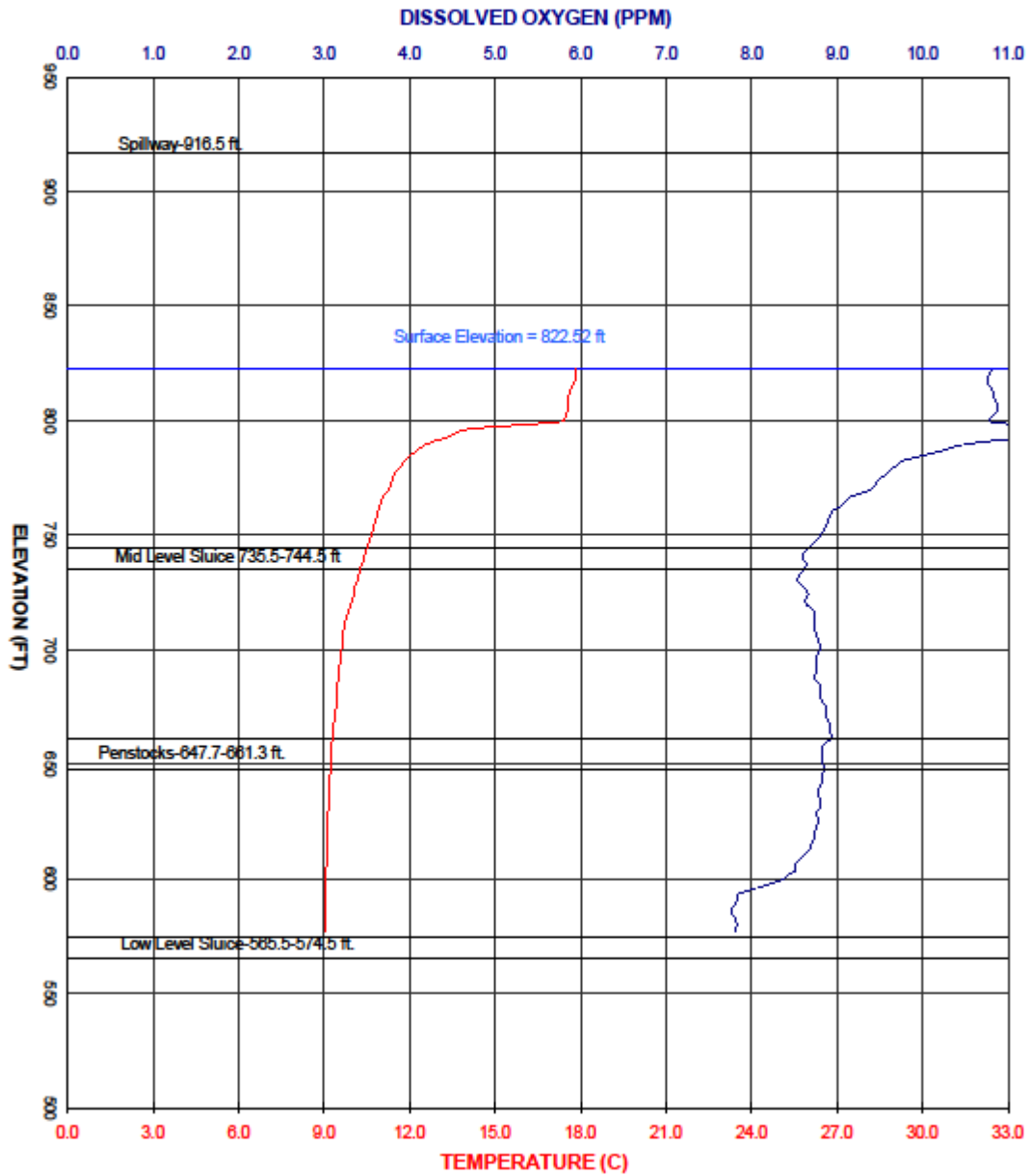
**PINE FLAT RESERVOIR 2/2/2022 (Time: 1118-1232) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 792.74**



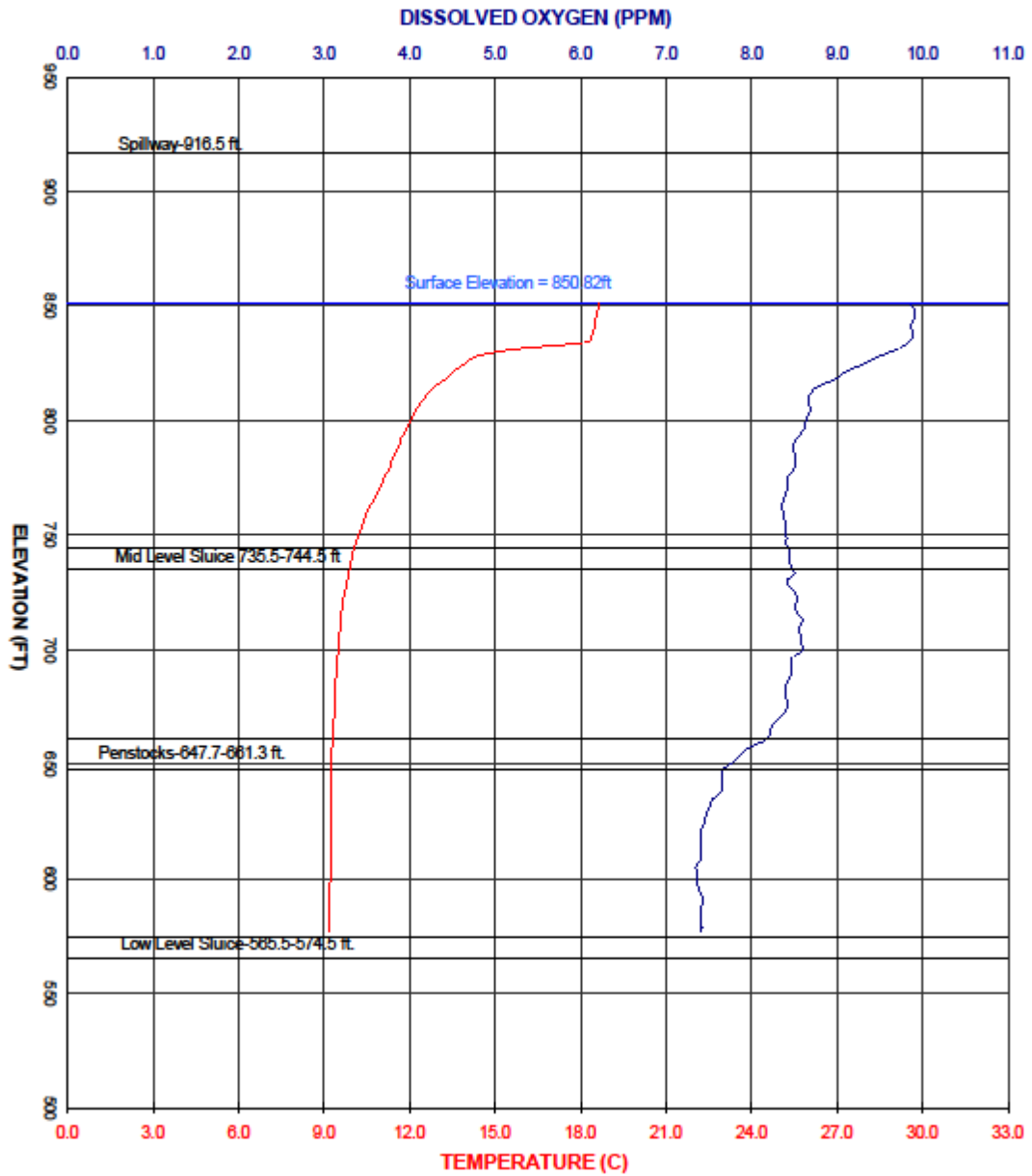
**PINE FLAT RESERVOIR 3/1/2022 (Time: 1037-1212) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 801.78**



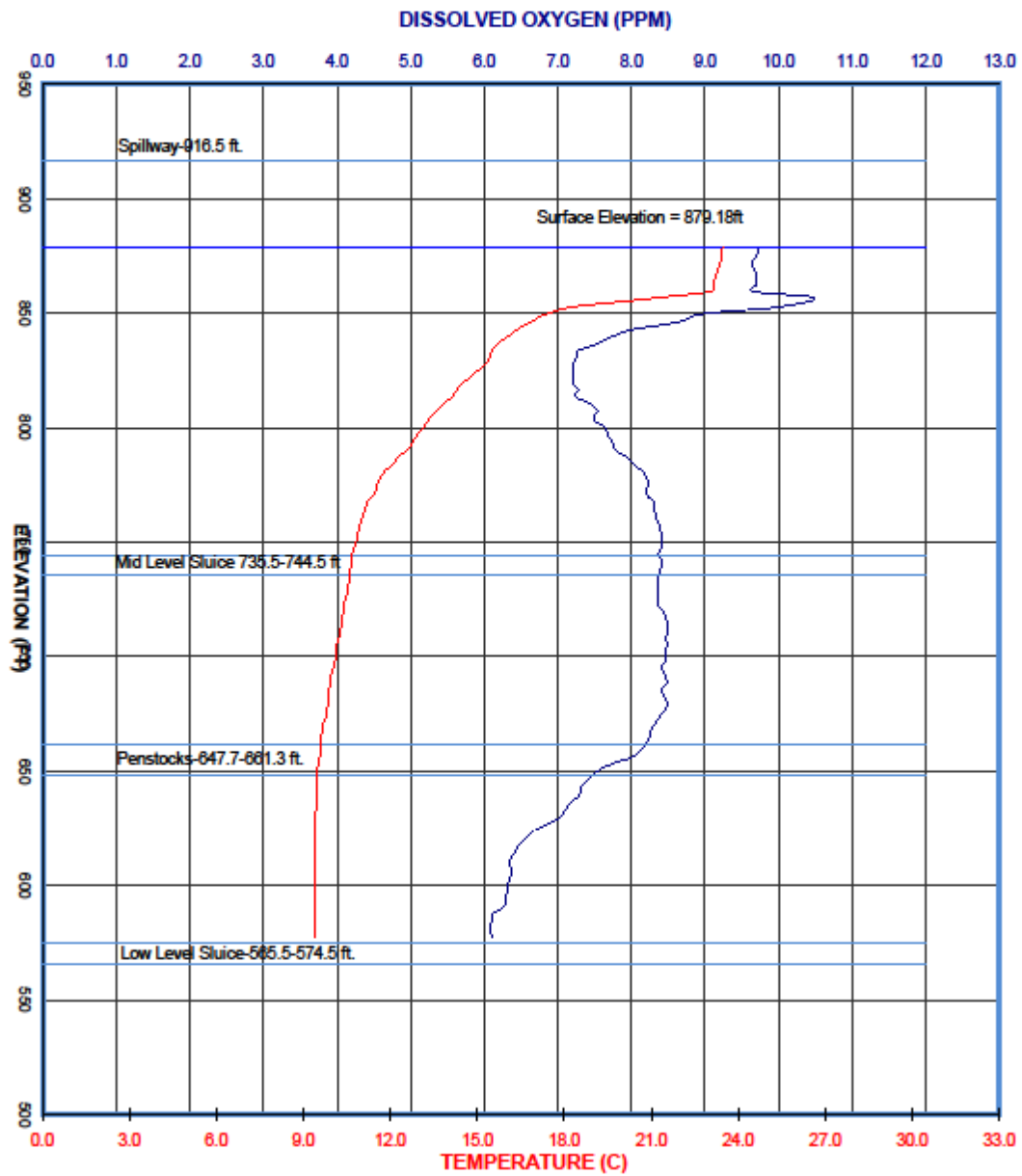
**PINE FLAT RESERVOIR 4/5/2022 (Time: 1031-1156) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 822.52**



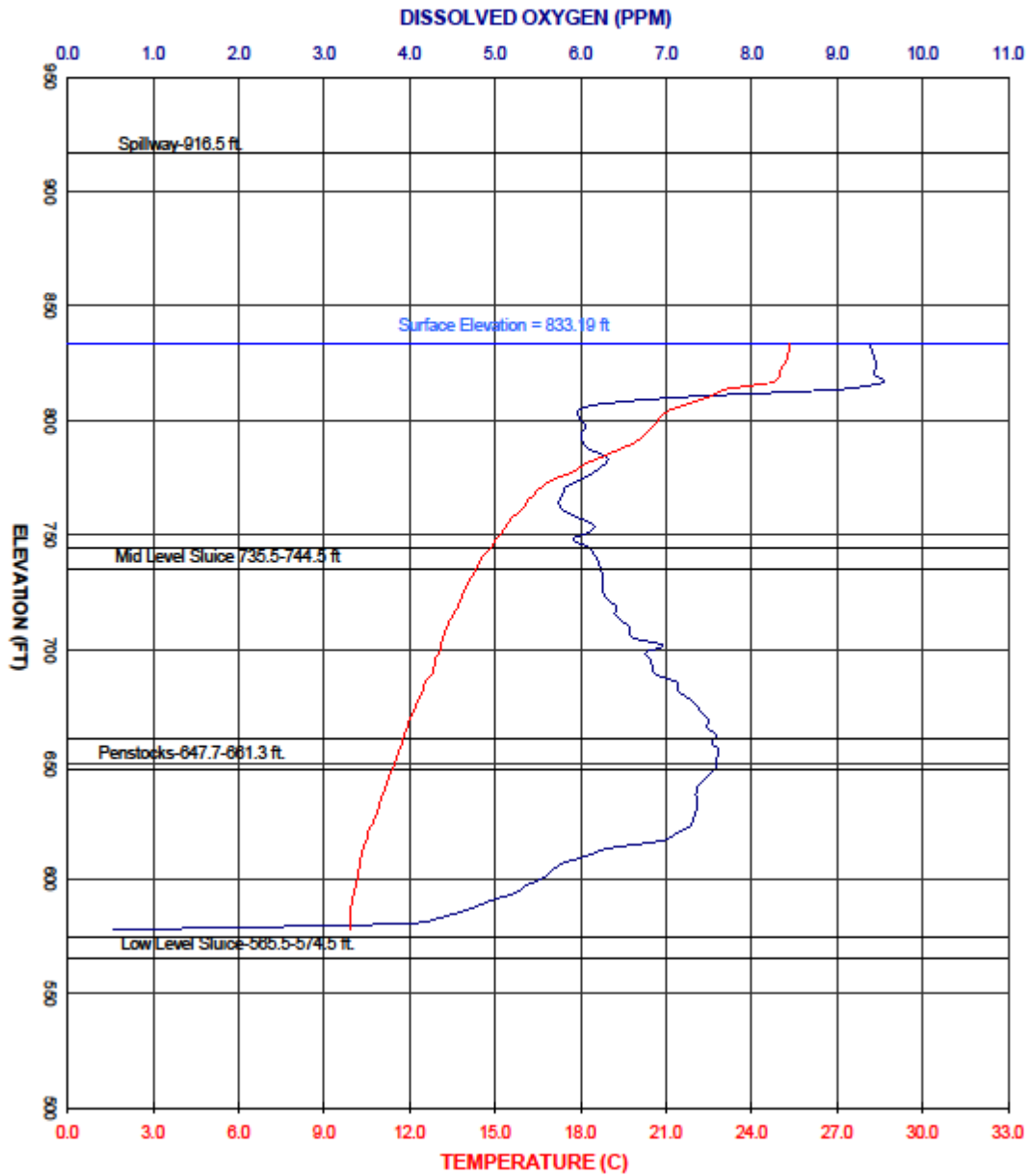
PINE FLAT RESERVOIR 5/3/2022 (Time: 1026-1155) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 850.82



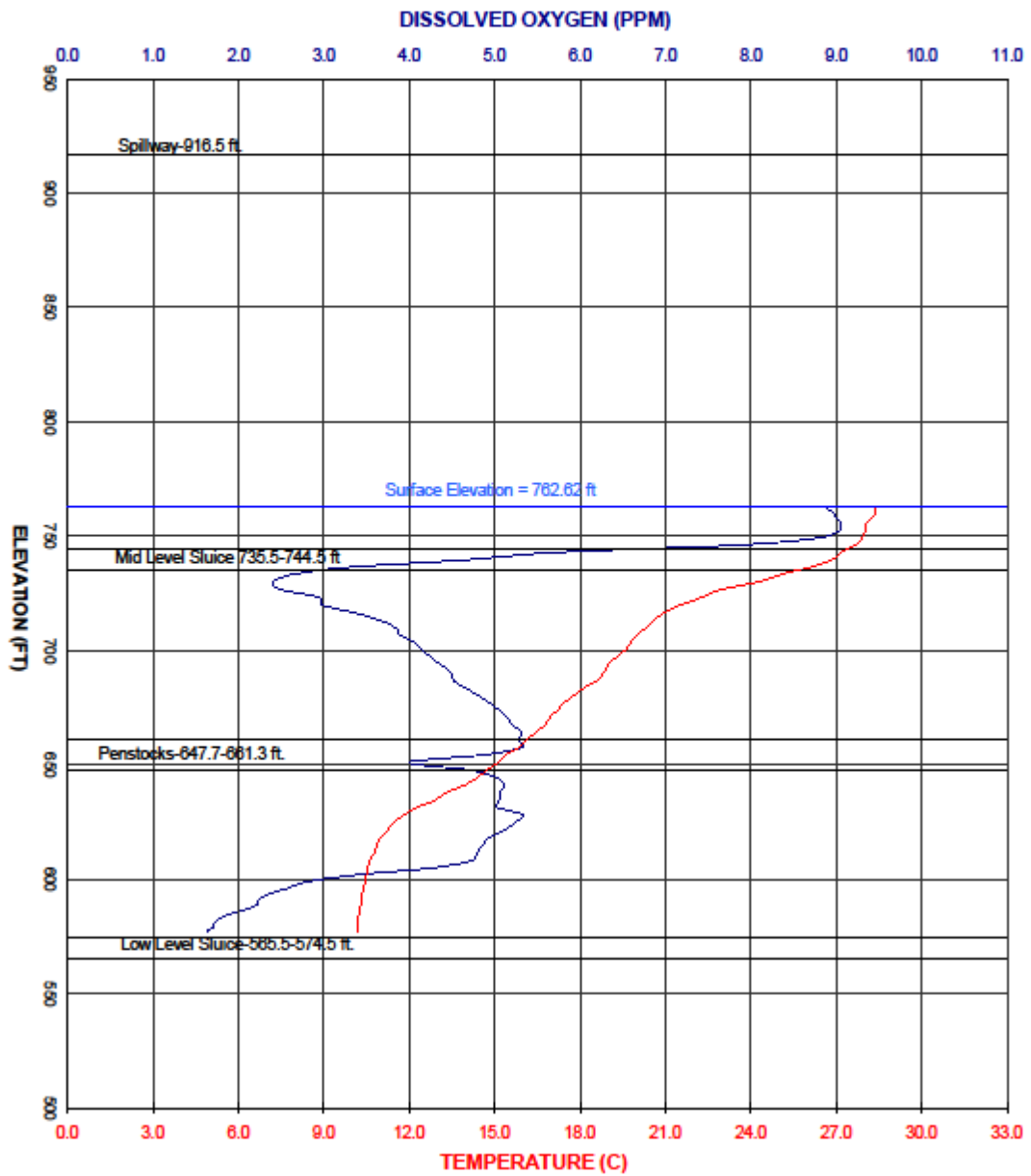
PINE FLAT RESERVOIR 06/07/2022 (Time: 0906-1053) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 879.18



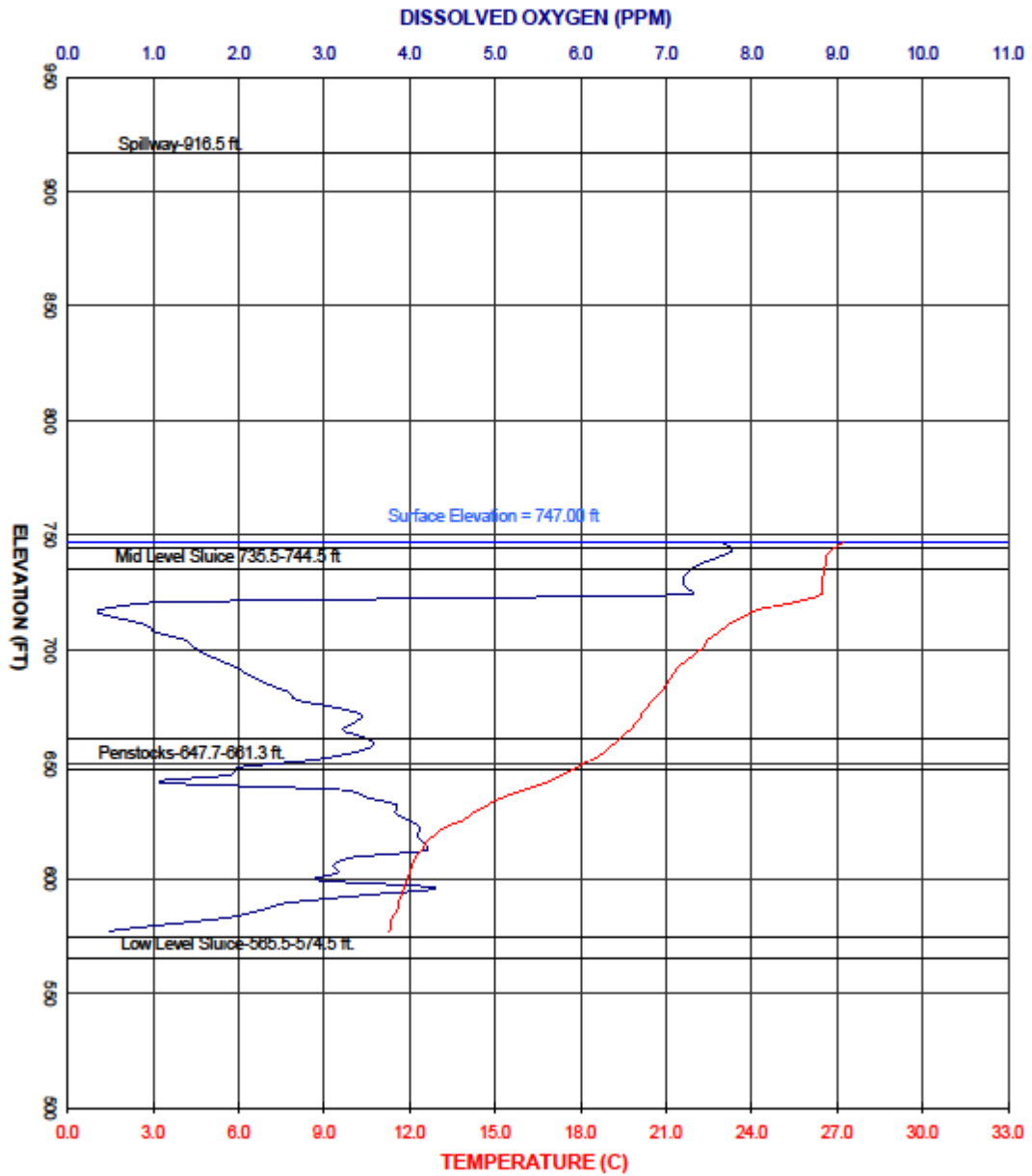
**PINE FLAT RESERVOIR 7/6/2022 (Time: 1146-1308) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 833.19**



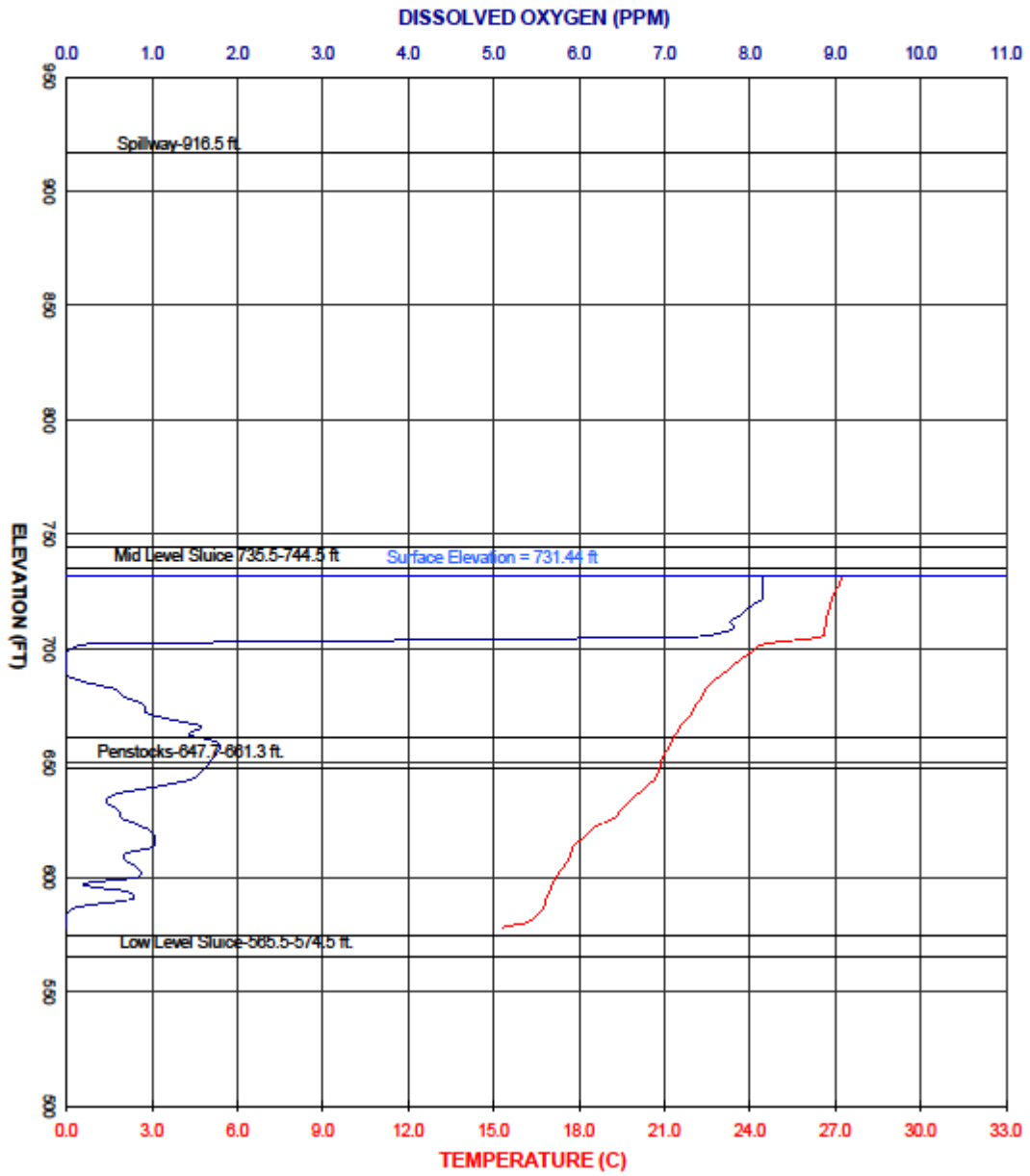
PINE FLAT RESERVOIR 8/2/2022 (Time: 1017-1123) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 762.62



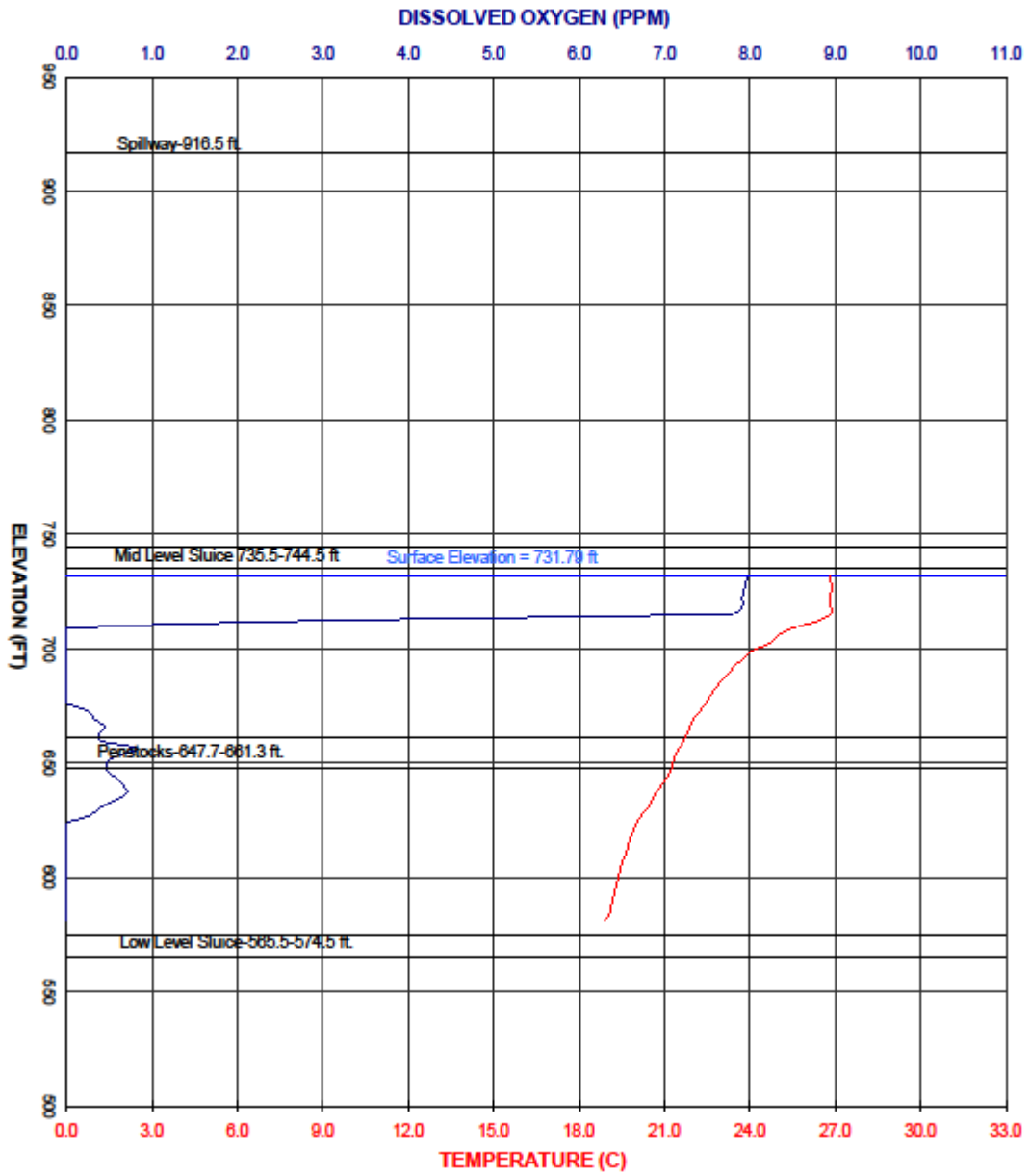
PINE FLAT RESERVOIR 8/16/2022 (Time: 1039-1133) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 747.00



**PINE FLAT RESERVOIR 8/30/2022 (Time: 1028-1121) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 731.44**



**PINE FLAT RESERVOIR 9/13/2022 (Time: 1002-1053) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 731.79**



PINE FLAT RESERVOIR 9/27/2022 (Time: 0932-1018) New Buoy Line Placement
(0.57 miles upstream of Dam) Reservoir Elevation in Feet = 736.72

