Placer County Water Agency
Middle Fork American River Project
(FERC Project No. 2079)

FISH POPULATION MONITORING PLAN

Placer County Water Agency
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List of Acronyms

CDFG	California Department of Fish and Game
CO_2	Carbon Dioxide
CPUE	catch-per-unit-effort
FPMP	Fish Population Monitoring Plan
GPS	Global Positioning System
MFP	Middle Fork American River Project
PCWA	Placer County Water Agency
Project	Middle Fork American River Project
SD	Supporting Document
State Water Board	State Water Resources Control Board
TSR	Technical Study Report
USDA-FS	United States Department of Agriculture-Forest Service
YOY	young-of-year

1.0   INTRODUCTION

This Fish Population Monitoring Plan (FPMP) was developed for the Placer County Water Agency's (PCWA) Middle Fork American River Project (MFP or Project) located on the west slope of the Sierra Nevada range primarily in Placer County, California.

The goal of the FPMP is to obtain, for comparative purposes, periodic information on fish populations in selected bypass and peaking reaches associated with the MFP under the flow regimes specified in the new license (general purpose monitoring). This information will also be compared to historical fish population data collected during 2007, 2008, and 2009 for MFP relicensing (AQ 2 – Fish Population Technical Study Report [TSR] [2007–2009] [AQ 2 – TSR]; Supporting Document [SD] B) (PCWA 2011; SD B).

The FPMP also includes three shorter-term special purpose monitoring studies including: (1) young-of-the-year (YOY) and juvenile fish monitoring in the peaking reach; (2) Ralston Afterbay hardhead movement monitoring; (3) fish entrainment monitoring at the Ralston Powerhouse and Oxbow Powerhouse intakes.

2.0   FPMP ORGANIZATON

The FPMP is organized into the following sections:

Section 3.0 FPMP Objectives: This section defines the purpose of the FPMP.

Section 4.0 Monitoring Approach: This section describes the approach for general purpose monitoring of fish populations over the term of the new license, including monitoring locations and schedule, and sampling and analyses methods. The section also includes a description of the special purpose monitoring studies.

Section 5.0 Reporting and Consultation: This section outlines reporting that will be required over the term of the new license and describes agency consultation that would be conducted following the completion of each monitoring period.

Section 6.0 Literature Cited: This section provides a list of documents or other resources that are referenced in the FPMP.

3.0   FPMP OBJECTIVES

The objectives of the FPMP are to:

- General Purpose Monitoring

  o Monitor fish species composition, abundance, condition factor, and population age class structure at select sites in the bypass and peaking reaches associated with the MFP over the term of the license;

- Special Purpose Monitoring

o   Conduct YOY and juvenile fish-targeted sampling in the Middle Fork American River peaking reach;

o   Monitor hardhead movement in Ralston Afterbay in relation to Project operations; and

o   Monitor fish entrainment at the Ralston Powerhouse and Oxbow Powerhouse intakes.

This information will be used to characterize the fisheries in the peaking and bypass reaches throughout implementation of the new License.

4.0   MONITORING APPROACH

This section describes the approach for general purpose monitoring and special purpose monitoring over the term of the license, including monitoring locations and schedule, and sampling and analytical methods.

4.1   GENERAL PURPOSE MONITORING

4.1.1   Monitoring Locations and Schedule

Fish population monitoring in the peaking and bypass reaches will be conducted at locations that were sampled in 2007–2009 as part of relicensing studies completed for the MFP (AQ 2 – TSR) (PCWA 2011; SD B). The specific fish population monitoring locations are provided in FPMP Table 1 and are depicted on FPMP Map 1.

General fish population monitoring will be conducted following license issuance at each of the monitoring sites in years 2, 3, 7, 8, 13, 14, and thereafter for two consecutive years during every ten-year period for the term of the license (FPMP Table 1). This schedule is consistent with the other aquatic monitoring plans, including water temperature, foothill yellow-legged frogs, and geomorphology/riparian.

4.1.2   Monitoring Methods

A combination of electrofishing (shallow water, <1.5 m) and/or snorkeling (deep water, ≥1.5 m) will be conducted to collect fish population data during the late summer/early fall base flow period of each monitoring period (FPMP Table 1). Sampling methods and field data forms will be consistent with those used during the 2007–2009 relicensing studies (AQ 2 – TSR) (PCWA 2011; SD B). Data forms are provided in Attachment A. The monitoring site lengths and the proportion of habitat types will be similar to those sampled in 2007–2009. The monitoring sites will be at least 328 feet long. The sites that include snorkeling will typically be much longer to include multiple habitat types (e.g., at least 1,000 feet in length). Where possible, the sites will be the same as those sampled in 2007–2009.

4.1.2.1 Electrofishing

Multi-pass electrofishing (e.g., Reynolds 1996; Van Deventer and Platts 1989; Rexstad and Burnham 1992) will be used to sample and estimate fish populations in shallow stream habitats (<1.5 m) at each monitoring site. The monitoring sites will be partitioned into mesohabitat types using block nets. Captured fish from each pass will be kept in separate live wells or buckets. Fish will be anesthetized (CO_2), enumerated, identified to species, and measured (fork length) and a subset of weights from various sizes of fish will be obtained. Fish will be returned to the monitoring site when the sampling is completed. Sampling protocols will be consistent with those in Flosi et al. 1998 and those followed during relicensing studies conducted 2007–2009.

Multi-pass electrofishing will consist of a minimum of two very thorough electrofishing passes with equal sampling effort. Each individual pass will consist of an upstream shocking sweep and then a downstream shocking sweep that will be used to collect missed fish (missed during the upstream sweep), particularly fish that may collect near or on the downstream blocking net. If depletions do not exceed approximately 65% between pass one and pass two, then a third pass will be completed.

4.1.2.2 Snorkeling

Snorkeling (e.g., Dolloff et al. 1996) will be used to assess fish populations in deep water habitats (≥1.5 m) at the monitoring sites. Snorkelers will survey in lanes along the river and identify, count, and estimate the length of each fish observed. Fish will be grouped into five size classes (0–3, 3–6, 6–12, 12–18, and >18+ inches). Fish data will be recorded by habitat unit type. Snorkeling protocols and field data forms will be consistent with those in Flosi et al. 1998 and those followed during relicensing studies conducted 2007–2009. Juvenile minnows (i.e., hardhead, Sacramento pikeminnow, and/or California roach) will be recorded as a single category; mixed minnow guild, where identification is uncertain (e.g., <3 inches in size). Very small fish that cannot be identified to species will be recorded as fry.

4.1.2.3 Physical Conditions

Routine observations will be made of habitat and physical conditions in the monitoring sites. These observations will include physical measurements of water temperature and specific conductance. Length, width, and depth of the area sampled will also be recorded to calculate fish abundance by length and area of stream sampled. Mesohabitat type data consistent with those taken during the 2006 Aquatic Habitat Characterization Study (PCWA 2007) will be collected at the monitoring sites.

4.1.3   Analysis Methods

The following describes the fish abundance (standing crop), biomass, and age structure and condition factor analyses methods.

4.1.3.1 Fish Abundance (Standing Crop)

Fish standing crop estimates will be generated for each species at each monitoring site as density (fish per mile and fish per acre) and biomass (pounds per mile and pounds per acre). For each monitoring site, the estimated number of fish (or biomass) will be divided by the length (or area) of the monitoring site to calculate fish standing crop estimates. Population estimates will be calculated for each mesohabitat unit sampled within each site and then summed to obtain a total for each site. Multi-pass electrofishing population estimates for shallow mesohabitat units will be calculated using the Van Deventer (1989) maximum likelihood method. For deep water mesohabitat units that will be sampled, the number of fish observed during snorkeling will be used to visually estimate fish abundance. The results will be presented along with those from previous sampling periods, including 2007–2009 sampling conducted for the MFP relicensing studies.

4.1.3.2 Biomass

The biomass of rainbow trout, brown trout, and combined trout per acre will be calculated for each site. The biomass of other species will not be calculated because too few fish were collected in past survey efforts to develop meaningful biomass estimates. Trout biomass (rainbow trout, brown trout, and combined rainbow and brown trout) will be calculated as the average fish weight at a site multiplied by the estimated number of fish at the site. If fish are not weighed (only length measured) at a site, then their weight will be calculated using a length-weight regression developed for the site. If an accurate site specific length-weight regression is not available, then a general study-wide data set length-weight regression will be used. For snorkeling sites, the midpoint length of each fish size class bin will be used to calculate average biomass using the study-wide length-weight regression (e.g., AQ 2 – TSR; PCWA 2011; SD B). Snorkeling biomass estimated will be used as relative measures of biomass between snorkeling sites and between snorkeling and electrofishing sites. The estimates likely will not be as accurate as those at electrofishing only sites, as the fish were categorized into fish size bins using visual estimates (underwater visual observations calibrated with a ruler). The results will be compared to previous sampling periods, including 2007–2009 sampling conducted for the MFP relicensing studies.

4.1.3.3 Age Structure and Condition Factor

Age structure will be determined using length-frequency histograms for each fish species at each monitoring site. Fulton's condition factor (Ricker 1975) will be calculated for each trout species. Individual condition factors (K) will be calculated by

K = weight (g) x 100,000 / (fork length [mm])^3

The average condition factor for adult trout at each site will also be calculated. The results will be compared to previous sampling periods and compared between monitoring sites.

4.2   SPECIAL PURPOSE MONITORING

Special purpose monitoring includes YOY and juvenile fish population surveys in the peaking reach and hardhead movement surveys in Ralston Afterbay.

4.2.1   Peaking Reach YOY and Juvenile Fish Monitoring

4.2.1.1 Monitoring Locations and Schedule

YOY and juvenile monitoring will be conducted at the fish monitoring sites in the peaking reach (FPMP Table 1). The monitoring will occur in years 2, 3, and 4 following issuance of the MFP license.

4.2.1.2 Monitoring Methods

Fish population surveys focused on detecting and quantifying YOY and juvenile fish will be conducted concurrently with general purpose monitoring during the annual maintenance outage (FPMP Table 1). The sampling will focus on areas along the stream margins, at creek mouths, backwaters, and/or other locations within the monitoring sites that contain relatively low velocity water (especially with cover) that is used by YOY and juvenile fish. A combination of electrofishing along a minimum of 328 feet of stream margin, snorkeling along a minimum length of 1,000 feet of stream, and 6 minnow traps will be used for sampling. In Year 2, the specific sampling locations within the overall monitoring sites will be identified and recorded with a Global Positioning System (GPS). These locations will then be re-sampled in subsequent monitoring years.

4.2.1.3 Analyses Methods

The numbers by species of YOY and juvenile fish captured, the catch-per-unit-effort (CPUE), and size of the fish will be reported. Maps showing the location of sampling for each monitoring method at each monitoring site will be provided.

4.2.2   Ralston Afterbay Hardhead Movement

4.2.2.1 Monitoring Locations and Schedule

A tagging (acoustic or radio) study to monitor hardhead movement will be conducted at Ralston Afterbay. The study will be conducted for two consecutive years within the first five years following license issuance and encompass at least two annual maintenance outage events. These outage events may include sediment management activities.

4.2.2.2 Monitoring Methods

Individual hardhead in Ralston Afterbay (including the river inlets to Ralston Afterbay) will be tracked to characterize movement in relation to season, hydrology, and MFP operations, including the annual maintenance outage. For two consecutive years, PCWA will capture and tag approximately 10 to 20 hardhead each year. PCWA will attempt to capture all the hardhead from Ralston Afterbay, but may also need to capture

fish from the Rubicon River and/or Middle Fork American River near their inlets to Ralston Afterbay if a sufficient number of larger fish[1] are not caught in Ralston Afterbay. The fish will be captured and tagged prior to the annual maintenance outage.

Hardhead movements will be continuously monitored with remote receivers with data loggers through the subsequent fall, winter, spring, and early summer each year of the study using stationary tag receivers, or as long as tag battery life permits. Tags preferably with a battery life of 9 to 12 months will be used to ensure that signals are available for tracking through early summer the following year.

Stationary receivers will be installed to detect fish movement at:

- Middle Fork American River near the Middle Fork American River near Foresthill gage (USGS Gage No. 11433300)

- Ralston Afterbay at Ralston Afterbay Dam

- Middle Fork American River upstream of Ralston Afterbay (at the streamflow gage)

- Rubicon River immediately above Ralston Afterbay (at the streamflow gage)

Additional stationary receiver(s) may be installed as needed, based on observed fish movements. The stationary receivers will be installed at existing structures, where possible, or on the stream banks.

A mobile survey with a portable receiver and antenna will also be used to supplement the remote monitoring. A team will make observations using a portable receiver and antenna to more accurately locate tagged fish approximately once each month. The team will survey the entire length of Ralston Afterbay (from the floating debris boom upstream to Ralston Powerhouse) and survey approximately 0.5 miles in the Middle Fork American River upstream to the impassible upstream fish barrier, and approximately 1 mile upstream in the Rubicon River. A team will also survey from Ralston Dam to Tunnel Chute. Locations of fish observations will be recorded using a GPS unit.

4.2.2.3 Analyses Methods

Hardhead movements observed during the study will be summarized. The daily, seasonal, and annual movements will be summarized in relation to operations at Ralston Afterbay and hydrology.

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[1] Tags should weigh less than 4% of the fish body weight.

4.2.3   Fish Entrainment

4.2.3.1 Monitoring Locations and Schedule

A study plan to further study fish entrainment at the Ralston Powerhouse and Oxbow Powerhouse intakes will be developed in consultation with the USDA-FS, State Water Board, and CDFG. PCWA will meet with these agencies prior to license issuance to collaboratively develop a study plan. PCWA will implement the study based on the schedule developed in the study plan.

4.2.3.2 Monitoring Methods

PCWA will meet with USDA-FS, State Water Board, and CDFG and discuss potential fish entrainment study approaches. Based on these discussions, PCWA will develop a draft study plan and distribute it to the resource agencies for review and comment. Once concurrence is reached on the study plan, PCWA will implement the study. The study plan could entail, for example, the following alternative approaches for sampling entrainment:

- A combination of video and high resolution sonar (e.g., DIDSON, ARIS) monitoring of entrainment at the powerhouse intakes;

- Direct netting/sampling of the powerhouse tailraces; and/or

- Radio or accoustic tagging of fish and monitoring of entrainment.

4.2.3.3 Analyses Methods

Analysis methods will be developed in consultation with the USDA-FS, State Water Board, and CDFG and will be included as part of the study plan (see above).

4.3   ELECTRONIC DATABASES

All fish sampling data (date, locations, fish species, fish size, sampling pass, etc) will be entered and stored in electronic databases (Excel spreadsheet or similar).   The databases will be provided to resources agencies upon request.

5.0   REPORTING AND CONSULTATION

The General Purpose Monitoring Reports and the Special Purpose Fish Population Monitoring reports will be prepared by PCWA and distributed to the USDA-FS, State Water Board, and CDFG for review and comment within 120 days following the completion of each monitoring year.   The reports, where appropriate, will follow the general presentation layout for fish sampling data provided in the AQ 2 – TSR (PCWA 2011; SD B). A 60-day review period will be provided to the agencies. Based on the results of the monitoring and/or comments received during the review process, PCWA and the agencies may call a meeting to discuss the results or modify the ongoing monitoring programs. Within 60 days of receipt of comments, or 60 days following any

meeting, comments will be addressed and the final report will be filed by PCWA with the agencies (USDA-FS, State Water Board, and CDFG) and FERC.

The Fish Entrainment Special Purpose monitoring study, in addition to the reporting and consultation listed above, will require additional consultation with the USDA-FS, State Water Board, and CDFG. Consultation will occur during development of the study plan and after the final report is completed. Consultation during study plan development is discussed in Section 4.2.3.2.

6.0   LITERATURE CITED

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TABLES

FPMP Table 1. Fish Population Monitoring Locations.

Study Location Description	Monitoring Sites	Reach Type		General Purpose Monitoring	Special Purpose Monitoring	
		Peaking Reach	Bypass Reach		YOY[1] and Juvenile Fish Population Monitoring	Ralston Afterbay Hardhead Movement
Middle Fork American River Downstream of Ralston Afterbay						
Middle Fork American River from Volcano Canyon Creek confluence to Canyon Creek confluence	MF14.1	●		●	●	
Middle Fork American River from Ralston Afterbay to Volcano Canyon Creek confluence	MF23.5	●		●	●	
Ralston Afterbay	Reservoir					●
Middle Fork American River from Middle Fork Interbay to Ralston Afterbay						
Middle Fork American River from Middle Fork Interbay to Ralston Afterbay	MF26.2		●	●		
Middle Fork American River Upstream of Middle Fork Interbay						
Middle Fork American River from French Meadows to confluence with Duncan Creek	MF44.7		●	●		
Rubicon River						
Rubicon River from Long Canyon Creek confluence to Ralston Afterbay	R3.5		●	●	●	
Rubicon River from Deer Creek to Long Canyon Creek confluence	R20.9		●	●	●	
Rubicon River from Hell Hole Reservoir to Deer Creek	R25.7		●	●	●	
South Fork Long Canyon Creek						
South Fork Long Canyon Creek from Diversion to confluence with Long Canyon Creek	SFLC2.3		●	●		
North Fork Long Canyon Creek						
North Fork Long Canyon Creek from Diversion to confluence with Long Canyon Creek	NFLC1.9		●	●		
Duncan Creek						
Duncan Creek from Diversion to confluence with Middle Fork American River	D6.3		●	●		

[1]YOY: young-of-the-year

MAPS

ATTACHMENT A

Fish Population Monitoring Data Forms

Electrofishing Field Form

Page _____

Site _____   Date _____   Time _____

Team _____

Unit #	_____	Wypt.	_____	Pass	_____
Unit Type	_____	N	_____	Efforts	_____
Mean Length	_____	E	_____	Frequency	_____
Mean Width	_____				
Mean Depth	_____	Conductivity (µs/cm)	_____	Pass	_____
Max Depth	_____	Temp. Water°	_____	Efforts	_____
		Air°	_____	Frequency	_____

Photos

Pass	Species	Length (mm)	Weight (g)	Pass	Species	Length (mm)	Weight (g)	Pass	Species	Length (mm)	Weight (g)	Pass	Species	Length (mm)	Weight (g)

Notes:

Snorkeling Field Form   Page _____

Site _____   Date _____

Team _____

Unit # _____   Time _____

Unit Type _____

Mean Length _____   Wypt. _____

Mean Width _____   N _____

Mean Depth _____   E _____

Max Depth _____

                                   Conductivity (µs/cm) _____

                                   Temp.   Water° _____

                                           Air° _____

Photos

	Size Class				
Species					

	Size Class				
Species					

Unit # _____   Time _____

Unit Type _____

Mean Length _____   Wypt. _____

Mean Width _____   N _____

Mean Depth _____   E _____

Max Depth _____

                                   Conductivity (µs/cm) _____

                                   Temp.   Water° _____

                                           Air° _____

Photos

	Size Class				
Species					

	Size Class				
Species					