

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

## **Fish Population Monitoring Plan**



Placer County Water Agency  
P.O. Box 6570  
Auburn, CA 95604

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**TABLE OF CONTENTS**

	Page
1.0 Introduction.....	1
2.0 FPMP Organization .....	1
3.0 FPMP Objectives.....	1
4.0 Monitoring Approach.....	2
4.1 General Purpose Monitoring.....	2
4.1.1 Monitoring Locations and Schedule.....	2
4.1.2 Monitoring Methods .....	2
4.1.2.1 Electrofishing.....	3
4.1.2.2 Snorkeling .....	3
4.1.2.3 Physical Conditions.....	3
4.1.3 Analysis Methods.....	3
4.1.3.1 Fish Abundance (Standing Crop) .....	4
4.1.3.2 Biomass .....	4
4.1.3.3 Age Structure and Condition Factor .....	4
4.2 Special Purpose Monitoring.....	5
4.2.1 Peaking Reach YOY and Juvenile Fish Monitoring .....	5
4.2.1.1 Monitoring Locations and Schedule .....	5
4.2.1.2 Monitoring Methods.....	5
4.2.1.3 Analyses Methods.....	5
4.2.2 Ralston Afterbay Hardhead Movement.....	5
4.2.2.1 Monitoring Locations and Schedule .....	5
4.2.2.2 Monitoring Methods.....	6
4.2.2.3 Analyses Methods.....	7
4.3 Electronic Databases.....	7
5.0 Reporting and Consultation .....	7
6.0 Literature Cited .....	7

**List of Tables**

FPMP Table 1. Fish Population Monitoring Locations.

**List of Maps**

FPMP Map 1. Fish Population Monitoring Locations.

**List of Attachments**

Attachment A. Fish Population Monitoring Data Forms.

**List of Acronyms**

CDFG	California Department of Fish and Game
CO <sub>2</sub>	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
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 [2007–2009] [AQ 2 – TSR]) (PCWA 2011).

The FPMP also includes two special purpose monitoring studies including: (1) young-of-the-year (YOY) and juvenile fish monitoring in the peaking reach; and (2) Ralston Afterbay hardhead movement monitoring.

If passage above Nimbus and Folsom dams is created for anadromous salmonids or lamprey then they will need to be considered for future monitoring.

## 2.0 FPMP ORGANIZATION

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
  - 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

- Conduct YOY and juvenile fish-targeted sampling in the Middle Fork American River peaking reach; and
- Monitor hardhead movement in Ralston Afterbay in relation to Project operations.

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). 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 in year 4 and 5 of every subsequent ten-year period for the term of the license except for the last ten year period. Monitoring efforts in the last ten year period of the license will include data collection for three consecutive years immediately prior to the filing of a NOI to provide baseline information for the next relicensing process.

In addition, the Rubicon River in the vicinity of Ellicott Bridge (R20.9), at a location agreed to by the resource agencies, will be monitored annually for the first ten years after license issuance. The purpose of the annual monitoring is to understand between year variability and identify any unusual population deviations that may occur during the years general fish population monitoring does not occur. At the end of the ten years, the annual monitoring will be reviewed. Based on the observed variability, the agencies and PCWA will determine whether to continue the monitoring and/or modify the monitoring location.

###### **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). 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<sub>2</sub>), 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. (2010) and those followed during relicensing studies conducted 2007–2009.

Multi-pass electrofishing will consist of a minimum of two electrofishing depletions with equal sampling effort. If depletions do not result in an overall trout population estimate with a confidence interval of  $\pm 15\%$  or less, then a third depletion, if needed, 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 ( $\geq 1.5$  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. (2010) 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). 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

$$K = \text{weight (g)} \times 100,000 / (\text{fork length [mm]})^3$$

The average condition factor for adult trout at each site will also be calculated. The results from each site 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) during each sampling year (Section 4.1.1).

#### **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 the first sampling year, 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 seven years following license issuance and encompass at least two annual maintenance outage events. Following the first year of the study, PCWA will provide the agencies with a progress update and consult on adjustments to the methodology in year two if deemed necessary.

The first year of monitoring will start prior to a combined fall sediment removal and maintenance outage event if a sediment removal event occurs within the first 5 years. If a sediment removal event does not occur within the first 5 years, hardhead monitoring will start in year 6 and will continue through year 7. If one year of hardhead monitoring includes a sediment removal event, this monitoring will meet the requirements of the hardhead monitoring in the Sediment Management Plan (Section 5.1.2.4) (note that

sediment removal events occur at the same time as fall maintenance outage events, and flows and Ralston Afterbay water levels are the similar during sediment removal events and fall maintenance outage events). If one of the two years of hardhead monitoring does not include a sediment removal event, PCWA will conduct hardhead monitoring pursuant to the Sediment Management Plan unless it is determined to be unnecessary by the USDA-FS, State Water Board, and CDFG.

#### **4.2.2.2 Monitoring Methods**

Individual hardhead captured and radio-tagged in Ralston Afterbay (including the Rubicon River and Middle Fork American 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 attempt to capture and tag 20 hardhead each year. The maximum level of sampling effort required per year will be 3 hours of actual shocking time for two consecutive nights and 4 hours active netting or 8 hours of passive netting/angling on two consecutive days. If 20 hardhead are not captured, the number captured will be tagged. Prior to initiation of sampling, PCWA will consult with the resource agencies to determine the preferred tag battery life and minimum fish size<sup>1</sup>. Additionally, following the first night and day of sampling effort, PCWA will contact a designated USDA-FS representative to determine fish size tag distribution targets for the remaining effort. 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. The fish will be captured and tagged prior to the annual fall maintenance outage.

Hardhead movements will be continuously monitored with stationary receivers (with data loggers) and monitored monthly with mobile receivers. Monitoring will occur through the fall, winter, spring, and early summer each year of the study, 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 upstream of 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)

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<sup>1</sup> Tags typically should weigh less than 4% of the fish body weight.

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, in areas that can provide security from theft or vandalism.

Mobile surveys with a portable receiver and antenna will be used to supplement the stationary monitoring. A team will make observations using a portable receiver and antenna to 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 upstream to the impassable barriers on the Middle Fork American River (0.5 miles) and Rubicon River (6.0 miles). A thorough attempt will be made to relocate and map every radio tagged fish. 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. Raw data and survey forms will be provided to USDA-FS, CDFG and/or others upon request.

### **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). 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.

## **6.0 LITERATURE CITED**

Dolloff, A., J. Kershner, and R. Thurow. 1996. Underwater Observation. Pages 533–554 in B.R. Murphy and D.W. Willis, editors. Fisheries techniques, 2nd edition. American Fisheries Society, Bethesda, Maryland.

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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 <sup>1</sup> and Juvenile Fish Population Monitoring	Ralston Afterbay Hardhead Movement
<b>Middle Fork American River Downstream of Ralston Afterbay</b>						
Middle Fork American River from confluence of Canyon Creek to confluence with North Fork American River	MF4.8	•		•	•	
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 and upstream on MFAR and Rubicon River to barriers	Reservoir		•			•
<b>Middle Fork American River from Middle Fork Interbay to Ralston Afterbay</b>						
Middle Fork American River from Middle Fork Interbay to Ralston Afterbay	MF26.2		•	•		
<b>Middle Fork American River Upstream of Middle Fork Interbay</b>						
Middle Fork American River from confluence with Duncan Creek to Middle Fork Interbay	MF36.2		•	•		
Middle Fork American River from French Meadows to confluence with Duncan Creek	MF44.7		•	•		
<b>Rubicon River</b>						
Rubicon River from Long Canyon Creek confluence to Ralston Afterbay	R3.5		•	•		
Rubicon River from Deer Creek to Long Canyon Creek confluence	R20.9 <sup>2</sup>		•	•		
Rubicon River from Hell Hole Reservoir to Deer Creek	R25.7		•	•		
<b>South Fork Long Canyon Creek</b>						
South Fork Long Canyon Creek from Diversion to confluence with Long Canyon Creek	SFLC2.3		•	•		
<b>North Fork Long Canyon Creek</b>						
North Fork Long Canyon Creek from Diversion to confluence with Long Canyon Creek	NFLC1.9		•	•		
<b>Duncan Creek</b>						
Duncan Creek from Diversion to confluence with Middle Fork American River	D6.3		•	•		

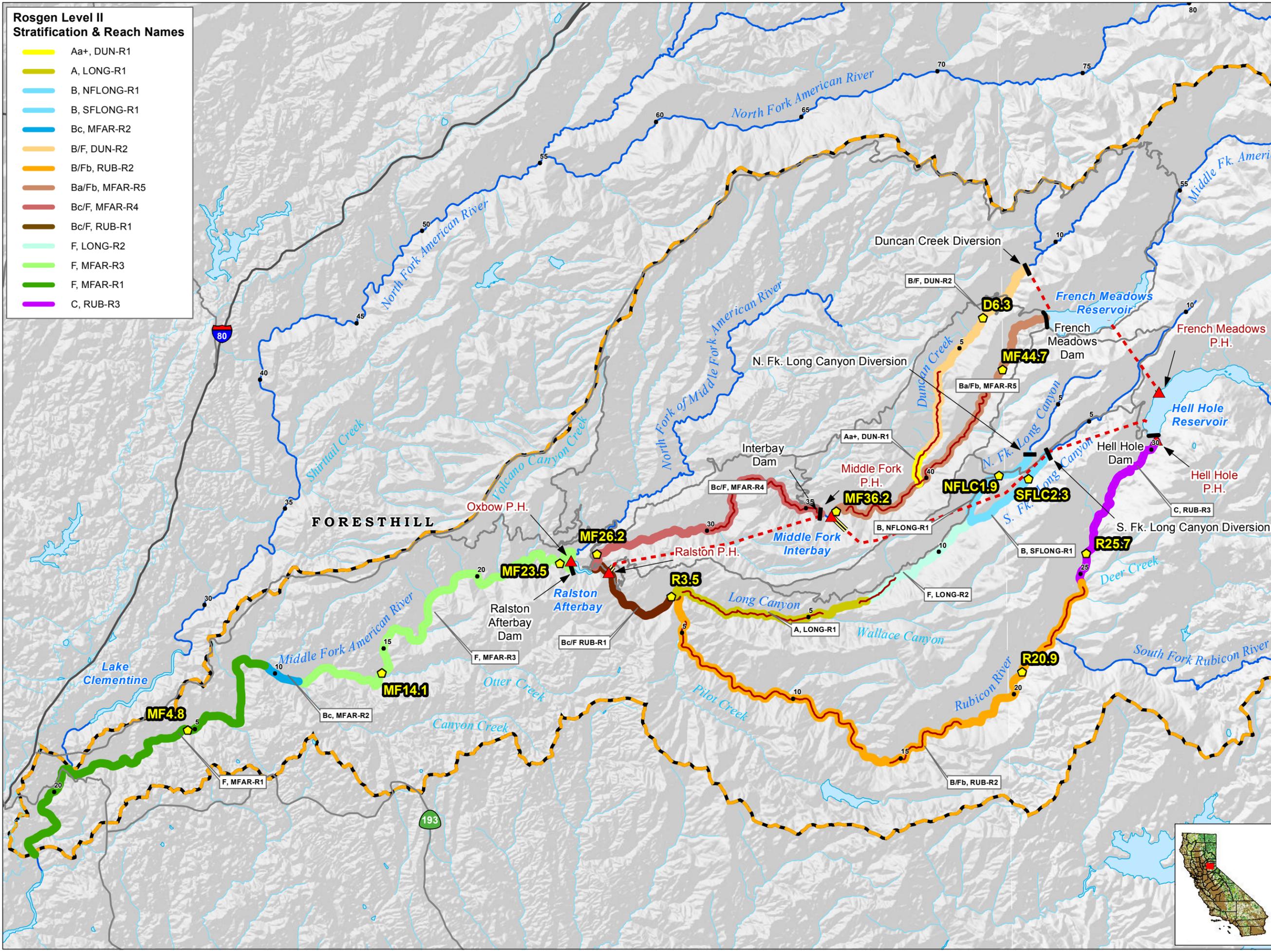
<sup>1</sup>YOY: young-of-the-year<sup>2</sup>At a location agreed to by the resource agencies, with consideration of potential angling or other anthropogenic influences.

**MAPS**

- ### Rosgen Level II Stratification & Reach Names
- Aa+, DUN-R1
  - A, LONG-R1
  - B, NFLONG-R1
  - B, SFLONG-R1
  - Bc, MFAR-R2
  - B/F, DUN-R2
  - B/Fb, RUB-R2
  - Ba/Fb, MFAR-R5
  - Bc/F, MFAR-R4
  - Bc/F, RUB-R1
  - F, LONG-R2
  - F, MFAR-R3
  - F, MFAR-R1
  - C, RUB-R3

- ### Project Facilities
- Powerhouse
  - Dam
  - Tunnel
  - Penstock
- ### Transportation
- Major Highway
  - Minor Highway
- ### Hydrography
- Watercourse with river miles (5 mi. increments)
  - Water Body
  - Middle Fork American River Watershed\*
  - Inaccessible Stream Segment
- \*Modified from Calwater Ver. 2.2 to represent drainage above high-water mark of Folsom Lake

- ### Monitoring Site Locations
- Fish Monitoring Location with ID





Placer County Water Agency  
Middle Fork American River Project

**FPMP Map 1**

**Fish Population Monitoring Locations**



Date: 10/26/11



Projection: CA State Plane, Zone 2  
Datum: NAD 83



**ATTACHMENT A**  
**Fish Population Monitoring Data Forms**



**Snorkeling Field Form**

Page \_\_\_\_\_

Site \_\_\_\_\_

Date \_\_\_\_\_

Team \_\_\_\_\_



Unit # _____	Time _____	Photos
Unit Type _____	Wypt. _____	
Mean Length _____	N _____	
Mean Width _____	E _____	
Mean Depth _____	Conductivity ( $\mu\text{s/cm}$ ) _____	
Max Depth _____	Temp. Water $^{\circ}$ _____	
	Air $^{\circ}$ _____	

Species	Size Class				

Species	Size Class				



Unit # _____	Time _____	Photos
Unit Type _____	Wypt. _____	
Mean Length _____	N _____	
Mean Width _____	E _____	
Mean Depth _____	Conductivity ( $\mu\text{s/cm}$ ) _____	
Max Depth _____	Temp. Water $^{\circ}$ _____	
	Air $^{\circ}$ _____	

Species	Size Class				

Species	Size Class				