

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

FLOW AND RESERVOIR MONITORING PLAN



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List of Acronyms

CDFG	California Department of Fish and Game
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
FERC	Federal Energy Regulatory Commission
FRMP	Flow and Reservoir Monitoring Plan
MFP	Middle Fork American River Project
PCWA	Placer County Water Agency
Project	Middle Fork American River Project
QA/QC	Quality Assurance/Quality Control
RP	Recreation Plan
SCADA	supervisory control and data acquisition
SD	Supporting Document
State Water Board	State Water Resources Control Board
USDA-FS	United States Department of Agriculture-Forest Service
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey

1.0 INTRODUCTION

This Flow and Reservoir Monitoring Plan (FRMP) was developed for the Placer County Water Agency's (PCWA) Middle Fork American River Project (MFP) located on the west slope of the Sierra Nevada range primarily in Placer County, California. The new Federal Energy Regulatory Commission (FERC) License Order (License) specifies the following instream flow requirements:

- Minimum instream flows in the bypass and peaking reaches;
- Pulse flows in the bypass reaches;
- Recreation flow releases in the peaking reach;
- Ramping rates and maximum flow releases for Oxbow Powerhouse;
- Down ramping for spills from Hell Hole Dam and French Meadows Dam; and
- Minimum pool requirements in Hell Hole and French Meadows reservoirs.

This FRMP identifies the methods used to document compliance and reporting of instream flow releases and reservoir levels specified in the new FERC License. Requirements for dissemination of real-time flow and reservoir water surface elevations to the public are addressed in the Recreation Plan (RP) (PCWA 2011a; Supporting Document [SD] A) and are not discussed further in this plan. Compliance for all the other flow- and reservoir-related requirements is included in this FRMP.

2.0 FRMP ORGANIZATION

The FRMP is organized into the following sections:

Section 3.0 FRMP Objective: This section defines the purpose of the FRMP.

Section 4.0 Instream Flow Release Requirements: This section describes the criteria and monitoring for documenting compliance with the instream flow releases specified in the new License.

Section 5.0 Reservoir Pool Requirements: This section describes the criteria and monitoring for documenting compliance with minimum pool requirements specified in the new License.

Section 6.0 Reporting: This section outlines reporting of deviations from the compliance criteria, annual flow and reservoir data, and documentation and implementation of the FRMP that will be required over the term of the License.

3.0 FRMP OBJECTIVE

The objective of the FRMP is to define the criteria and monitoring approach for documenting compliance with instream flow and reservoir minimum pool requirements described in the new FERC License for the MFP. These requirements are described in the Instream Flow and Reservoir Minimum Pool Measure provided in PCWA 2011b; SD A.

4.0 INSTREAM FLOW RELEASE REQUIREMENTS

This section describes: (1) compliance criteria; and (2) associated monitoring for documenting compliance with instream flow requirements specified in the MFP FERC License.

4.1 COMPLIANCE

4.1.1 Implementation of Instream Flow Release License Requirements

Instream flow release requirements include minimum instream flows, pulse flows, down ramp of spill flows, operations of Oxbow Powerhouse, and recreation flows, which will be implemented at the following locations in the bypass and peaking reaches:

Instream Flow Release Locations	Minimum Instream Flows	Pulse Flows	Down Ramp of Spill Flow	Operations of Oxbow Powerhouse	Recreation Flows
Bypass Reaches					
Rubicon River below Hell Hole Dam	X	X	X		
Middle Fork American River below French Meadows Dam	X	X	X		
Middle Fork American River below Middle Fork Interbay Dam	X	X			
Middle Fork American River Immediately Below Ralston Afterbay Dam	X				
Duncan Creek below Diversion Dam	X	X			
North Fork Long Canyon Creek below Diversion Dam	X	X			
South Fork Long Canyon Creek below Diversion Dam	X	X			
Peaking Reach					
Middle Fork American River below Oxbow Powerhouse	X	X		X	X

Implementation of several instream flow release requirements for the MFP require infrastructure modifications to existing MFP facilities (e.g., outlet works) and/or construction of new MFP facilities (e.g., stream gages). The implementation schedule

for the new FERC License instream flow release requirements and for interim license requirements is shown in FRMP Table 1. Infrastructure modifications/construction will affect implementation timing of minimum instream flow releases at five locations, pulse flows at all locations, down ramping of spills from Hell Hole Dam and French Meadows Dam, operations of Oxbow Powerhouse, and the extended recreation flow component of the recreation flows (FRMP Table 1).

The instream flow releases specified in the FERC License will be provided within 30 days of issuance of the License at the locations where existing infrastructure and stream gages can provide and measure the new releases. For the locations requiring infrastructure modifications and/or new facilities, the FERC License instream flow releases will be provided and monitored by PCWA within 30 days following completion of the required facility modifications/construction. FRMP Table 2 identifies the gages that will be used to monitor compliance of the License instream flow releases. The table also shows the time period the gages will be used. Some of the gages will be used as interim gages and will be replaced with new gages. FRMP Table 2 also briefly identifies the facility modifications or construction required to implement the new License.

PCWA will promptly notify the FERC, State Water Resources Control Board (State Water Board), United States Department of Agriculture-Forest Service (USDA-FS), California Department of Fish and Game (CDFG), and United States Fish and Wildlife Service (USFWS) if any issues emerge during engineering design, permitting, or construction that may delay implementation of the required instream flow releases beyond the implementation schedule identified in FRMP Table 1.

At the locations where the FERC License instream flows cannot be released until facility modifications/construction occur, the previous FERC License minimum instream flow and ramping rate requirements, including the water year type designation, will remain in effect until the modifications/construction are completed. These requirements are identified in FRMP Table 3. FRMP Table 4 shows the locations (and time periods) where the interim minimum flow and ramping rate requirements will be in effect and the gages that will be used for compliance. Additionally, the voluntary release of approximately 3 cfs from Ralston Afterbay Dam into the Middle Fork American River immediately below Ralston Afterbay Dam will continue until required flow gaging infrastructure is constructed.

The instream flow releases may be temporarily modified for short periods in response to operational emergencies, directives from California Independent System Operator (ISO), actions beyond the control of PCWA (including, but not limited to "acts of God" and natural events), or upon agreement between PCWA, USDA-FS, State Water Board, USFWS, CDFG, and the FERC. For deviations associated with operational emergencies, directives by the ISO, or actions beyond the control of PCWA, PCWA will promptly (within five working days) notify the aforementioned agencies regarding the cause of the temporary suspension of flow releases, actions implemented, and the anticipated schedule for resumption of instream flow requirements.

The following sections describe the compliance criteria for each type of instream flow release. Deviations beyond those described below will be considered non-compliance with the License and require reporting within 30 days to the FERC, State Water Board, USDA-FS, CDFG, and USFWS. The report will identify the deviation and corrective action taken.

4.1.2 Minimum Instream Flows

Compliance with the minimum instream flows specified in the License requires that PCWA meet two metrics: (1) instantaneous flow; and (2) 24-hour average of daily flow, as described in the following. The instantaneous flow is the flow measured at each compliance gage in 15-minute time increments. The 24-hour average daily flow is the average of the instantaneous flows measured from midnight of one day to midnight of the next day. The compliance gages for each minimum instream flow release location are shown in FRMP Tables 2 and 4 and FRMP Map 1. To be in compliance, PCWA must meet the following conditions:

- Minimum instream flows must be released within five days of the dates specified in the License unless access to the instream flow release infrastructure is prohibited by weather or hazardous conditions. If this occurs then the minimum instream flows must be released as soon practicable;
- Instantaneous flow must at all times be no less than 90% of the required minimum instream flow; and
- Daily average flow must at all time be no less than 90% of the required minimum instream flow. Deviations that are less than 10% of the required minimum instream flow must be addressed by PCWA within three days of discovery by releasing the equivalent volume of under-release flow into the affected stream reach. If PCWA releases the appropriate amount of water, then PCWA will be considered to be in compliance with conditions specified in the License.

4.1.3 Pulse Flows

The compliance gages for each pulse flow release location are shown in FRMP Table 2 and FRMP Map 1. Compliance with the pulse flows specified in the License requires that PCWA must meet the following conditions:

- Pulse flows must be initiated within five days of the date specified in the License and subsequent flow changes must be made at the corresponding times specified in the License unless access to the instream flow release infrastructure is prohibited by weather or hazardous conditions. If this occurs, then the pulse flows must be released as soon practicable. If initiation of the pulse flow occurs on a day other than the date specified in the License, then all dates in the pulse flow schedule will be shifted accordingly.

- Pulse flows must be maintained for at least the number of days (duration) identified in the License. The pulse flow, including each step in the pulse flow down ramp, can have a duration greater than that specified;
- Once initiated, instantaneous pulse flows must at all times be no less than 90% of the required pulse flow; and
- Daily average pulse flow must at all time be no less than 90% of the required instream flow. Deviations that are less than 10% must be addressed by extending the end of the pulse flow releases such that an equivalent volume of the under-release flow is released into the affected stream reach. If PCWA releases the appropriate amount of water, then PCWA will be considered to be in compliance with conditions specified in the License.

4.1.4 Down Ramp of Spill Flow

The compliance gages for each spill flow down ramp location are shown in FRMP Table 2 and FRMP Map 1. Compliance with the down ramp of spill flows specified in the License requires that PCWA must meet the following conditions:

4.1.4.1 Hell Hole Dam and French Meadows Dam

- Down ramp of spill flows must occur during the months specified in the License;
- Initiation of down ramp flows must be made on the days specified in the License unless access to the instream flow release infrastructure is prohibited by weather or hazardous conditions. If this occurs, then the initiation of down ramp flows must be released as soon practicable;
- Down ramp of spill flow must be maintained for at least the number of days (duration) identified in each down ramp step. Each step of the down ramp can have a duration greater than that specified;
- Once set, daily average flow must at all times be no less than 80% of the required instream flow releases for the first three down ramp events implemented under the new License. For subsequent down ramp events, daily average flow must at all times be no less than 90% of the required down ramp of spill flow releases; and
- Deviations that are less than 20% for the first three events of the new License period and 10% for subsequent events must be addressed by extending the end of the down ramp such that an equivalent volume of under-release flow is released into the affected stream reach. If PCWA releases the appropriate amount of water, then PCWA will be considered to be in compliance with conditions specified in the License.

- Down ramp of spill flows at Hell Hole Dam will be made, in part, using new crest gates on the Hell Hole Dam Spillway to be installed as part of the Hell Hole Seasonal Storage Improvement. The crest gates have limited ability to precisely control flow releases given their configuration and daily/hourly changes in reservoir inflow and reservoir water surface elevation. As such, a rating curve for the spillway crest gates will be developed as part of the Improvement and used for compliance. The gates will be adjusted once every 24 hours. PCWA will use the water surface elevation at that time to set the gate position (according to the rating table) to meet the required flow release for the subsequent 24-hour period.

4.1.5 Operations of Oxbow Powerhouse

Compliance with the flow releases from Oxbow Powerhouse specified in the License requires that PCWA must meet the ramping rate and maximum flow release conditions below:

4.1.5.1 Ramping Rate

- The Oxbow Powerhouse release (Oxbow Powerhouse Penstock Gage) shall not exceed the hourly flow change, given the flow present at the Middle Fork American River near Foresthill USGS Gage (No. 11433300), as specified in the License.

4.1.5.2 Maximum Flow Release

- The maximum flow release provision at Oxbow Powerhouse is applicable during the water years and the time period specified in the License; and
- The instantaneous flow release from Oxbow Powerhouse must at all times be no greater than 105% of the required maximum flow release condition specified in the License, as measured in the Oxbow Powerhouse Penstock Gage.

4.1.6 Recreation Flows

Compliance with the recreation flow releases specified in the License requires that PCWA must meet the following conditions:

- The recreation flow releases must be provided at the time specified in the License; and
- Once initiated, instantaneous flow must at all time be no less than 95% of the required recreation instream flow releases.

The compliance location for the recreation flow releases, both magnitude and timing, is the Middle Fork American River near Foresthill Gage (MFAR nr Foresthill) (USGS Gage No. 11433300).

The magnitude of the Saturday Extended Recreation flow release, however, is to be set based on the target flow specified in the license at the North Fork American River above American River Pump Station Gage (new MFP gage) (NFAR abv ARPS). Therefore, the magnitude of the Saturday Extended Recreation flow release at the MFAR nr Foresthill Gage is as follows:

Extended Saturday Flow Release = Target Flow – NFAR abv ARPS Gage Base Flow

where:

Extended Saturday Flow Release	=	Flow to be released as measured at the MFAR nr Foresthill Gage
Target Flow	=	Flow specified in the License at the NFAR abv ARPS Gage
NFAR abv ARPS Gage Base Flow	=	Daily minimum 15-min flow at the NFAR abv ARPS Gage for the 24-hour period on the Thursday immediately preceding

4.2 MONITORING

This section includes a description of: (1) each compliance gage (existing, upgraded, and new gages) used to document compliance with instream flow releases and ramping rates specified in the License; and (2) operations and maintenance of the gages.

4.2.1 Gage Description

The gage locations used for measuring flows specified in the new License are identified in FRMP Tables 2 and 4 and are depicted on FRMP Map 1. FRMP Tables 2 and 4 also specify the type of instream flow release measured at each compliance gage location.

4.2.1.1 Existing Gages

PCWA currently operates numerous flow gages associated with the MFP to document compliance with the existing instream flow requirements. Compliance with existing instream flow requirements is currently measured at either stream gages or gages at the flow release infrastructures. Descriptions of the existing compliance gages and location of flow measurement are included in FRMP Table 5. All the existing gages record 15-minute flow data. Data is downloaded manually and all gages are equipped with supervisory control and data acquisition (SCADA) back up.

4.2.1.2 Required Upgrades and New Gages

In order to comply with the minimum instream and pulse flow releases specified in the License, PCWA will upgrade or install new flow measurement equipment at numerous

compliance locations. The new flow implementation schedule and measurement equipment are described in FRMP Tables 1 and 5. Infrastructure modifications required to release the required flows or improvements to the diversions by compliance location are briefly described in FRMP Table 2. Details of the infrastructure modifications are provided in Section 4, Proposed Action. All the upgraded and new flow gages will record 15-minute flow data. Data will be downloaded manually and all flow gages will be equipped with supervisory control and data acquisition (SCADA) back up.

4.2.2 Operations and Maintenance of Flow Gages

All compliance gages will be maintained according to United States Geological Survey (USGS) protocols. The type and frequency of maintenance activity and the methods and frequency used to calibrate the flow measuring devices depends on the type of flow monitoring equipment and the quality assurance requirements of USGS. The gages and comments regarding the purpose (e.g., range of flows to measure) of the gages are described in FRMP Table 5 by gaging location.

5.0 RESERVOIR MINIMUM POOL REQUIREMENTS

This section describes: (1) compliance criteria; and (2) associated monitoring for the reservoir minimum pool requirements.

5.1 COMPLIANCE

5.1.1 Implementation of License Conditions

The reservoir minimum pool requirements specified in the FERC License for the MFP will take effect 30 days after issuance of the License.

5.1.2 Reservoir Minimum Pool Requirements

The compliance gage locations for measuring reservoir water surface elevations in French Meadows and Hell Hole reservoirs are identified in FRMP Table 2 and are shown on FRMP Map 1. Compliance with the reservoir minimum pool requirements specified in the License requires that PCWA must meet the following conditions:

- Average weekly reservoir water surface elevation as calculated from the daily average water surface elevations at the existing reservoir gages will be used to measure compliance; and
- Average weekly reservoir water surface elevations must at all times be no less than the minimum pool requirement.

5.2 MONITORING

This section includes a description of: (1) each compliance flow gage used to document compliance with minimum pool requirements; and (2) operations and maintenance of the gages.

5.2.1 Gage Description

The existing gaging equipment used to measure compliance at French Meadows and Hell Hole reservoir is described in FRMP Table 5.

5.2.2 Operations and Maintenance of Gages

All compliance gages will be maintained according to United States Geological Survey (USGS) protocols (FRMP Table 5). The type and frequency of maintenance activity and the methods and frequency used to calibrate the flow measuring devices depends on the type of flow monitoring equipment and the quality assurance requirements of USGS.

6.0 REPORTING

6.1 REPORTING OF DEVIATIONS FROM COMPLIANCE CRITERIA

PCWA will report deviations from the compliance criteria specified in Section 4.1 and 5.1 to the FERC, USDA-FS, State Water Board, CDFG, and USFWS as follows:

- **Deviations beyond the Control of PCWA:** Within 5 working days of identification of the deviation.
- **Other Flow Deviations:** Within 30 days of identification of the deviation.

6.2 ANNUAL FLOW AND RESERVOIR DATA REPORTING

PCWA will document all instream flow releases and reservoir elevations in readily accessible formats (e.g., Microsoft Excel or .txt). Fifteen-minute flow and reservoir elevation data collected by PCWA will be reviewed by PCWA (or contracted) hydrographers as part of its Quality Assurance/Quality Control (QA/QC) protocol. The 15-minute recordings will be used to construct the 24-hour-average flows and reservoir elevations, which will be available from PCWA upon request. Upon completion of the QA/QC process, the 24-hour-average flow and reservoir elevation data will be catalogued and made available the first quarter of each year in annual hydrology summary reports. Fifteen-minute stage and flow data will be available upon request for the Middle Fork American River near Foresthill Gage (USGS Gage No. 11433300). Turn-in and turn-out dates for small diversions also will be available upon request.

6.3 ANNUAL COMPLIANCE REPORTS

PCWA will prepare a brief annual report to document implementation of and compliance with the FRMP. The annual report will be distributed to the USDA-FS, State Water Board, CDFG, and USFWS and filed with the FERC within the first quarter of each year.

7.0 LITERATURE CITED

Placer County Water Agency (PCWA) 2011a. Recreation Plan. Available in PCWA's Application for New License – Supporting Document A.

_____. 2011b. Instream Flow and Reservoir Minimum Pool Measure. Available in PCWA's Application for New License – Supporting Document A.

TABLES

FRMP Table 1. Implementation Schedule for Instream Flow and Minimum Pool Compliance.

Measure	Flow Compliance Location	Interim Conditions Time Period (after License Issuance)	New Conditions Time Period (after License Issuance)
Minimum Instream Flows			
	Rubicon River below Hell Hole Dam	Years 1 - 3	Year 4 - License Term
	Middle Fork American River below French Meadows Dam	Years 1 - 2	Year 3 - License Term
	Middle Fork American River below Middle Fork Interbay Dam	Years 1 - 2	Year 3 - License Term
	Middle Fork American River Immediately Below Ralston Afterbay Dam	Years 1 - 2	Year 3 - License Term
	Duncan Creek below Diversion Dam	Years 1 - 3	Year 4 - License Term
	North Fork Long Canyon Creek below Diversion Dam	Years 1 - 4	Year 5 - License Term
	South Fork Long Canyon Creek below Diversion Dam	Years 1 - 4	Year 5 - License Term
	Middle Fork American River below Oxbow Powerhouse	--	Within 30 days - License Term
Pulse Flows			
	Rubicon River below Hell Hole Dam	--	Year 6 - License Term
	Middle Fork American River below French Meadows Dam	--	Year 3 - License Term
	Middle Fork American River below Middle Fork Interbay Dam	--	Year 3 - License Term
	Duncan Creek below Diversion Dam	--	Year 4 - License Term
	North Fork Long Canyon Creek below Diversion Dam	--	Year 5 - License Term
	South Fork Long Canyon Creek below Diversion Dam	--	Year 5 - License Term
Down Ramp of Spill Flows			
	Rubicon River below Hell Hole Dam	--	Year 6 - License Term
	Middle Fork American River below French Meadows Dam	--	Year 3 - License Term
Operations of Oxbow Powerhouse			
	Middle Fork American River below Oxbow Powerhouse		
	• Ramping Rate Condition	Years 1 - 2	Year 3 - License Term
	• Maximum Flow Release Condition	--	Year 3 - License Term
Recreation Flow Releases			
	Middle Fork American River below Oxbow Powerhouse		
	• Early Saturday Releases	--	Year 3 - License Term
	• All Other Releases	--	Within 30 days - License Term
Reservoir Minimum Pool			
	Hell Hole Reservoir	--	Within 30 days - License Term
	French Meadows Reservoir	--	Within 30 days - License Term

FRMP Table 2. New FERC License Instream Flow and Minimum Pool Measure Compliance Gage Locations and Time Period.

Measure	Flow Compliance Location	Compliance Gage(s)				
		Interim		Final		
		Gage	Time Period (after License Issuance)	Gage	Time Period (after License Issuance)	Modifications/Upgrades
Minimum Instream Flows						
	Rubicon River below Hell Hole Dam	Rubicon River below Hell Hole Dam (USGS Gage No. 11428800)	Years 1 - 3	Rubicon River Gages at Hell Hole Dam (new)	Year 3 - License Term	Modify outlet works. Install new AVM on the outlet works.
	Middle Fork American River below French Meadows Dam	Middle Fork American River below French Meadows Dam (USGS Gage No. 11427500)	Years 1 - 2	Middle Fork American River at French Meadows Dam (new)	Year 2 - License Term	Modify outlet works for minimum flow releases. Install new AVM on the outlet works.
	Middle Fork American River below Middle Fork Interbay Dam	--	--	Middle Fork American River below Middle Fork Interbay Dam (new)	Year 3 - License Term	Install new stream gage.
	Middle Fork American River Immediately Below Ralston Afterbay Dam	--	--	Middle Fork American River at Ralston Afterbay Dam (new)	Year 3 - License Term	--
	Duncan Creek below Diversion Dam	--	--	Duncan Creek below Diversion Dam (USGS Gage No. 11427750) Duncan Creek Diversion Tunnel (new)	Year 4 - License Term	Modify outlet works as part of diversion improvement project. Install new flow gaging equipment to measure diversion flow through the tunnel.
	North Fork Long Canyon Creek below Diversion Dam	--	--	North Fork Long Canyon Creek Diversion Tunnel (USGS Gage No. 11433080) (modified) North Fork Long Canyon Creek below Diversion Dam (new)	Year 5 - License Term	Modify outlet works as part of diversion improvement project. Install new stream gage.
	South Fork Long Canyon Creek below Diversion Dam	--	--	South Fork Long Canyon Creek Diversion Tunnel (USGS Gage No. 11433060) (modified) South Fork Long Canyon Creek below Diversion Dam (new)	Year 5 - License Term	Modify outlet works as part of diversion improvement project. Install new stream gage.
	Middle Fork American River below Oxbow Powerhouse	--	--	Middle Fork American River near Foresthill (USGS Gage No. 11433300)	Within 30 days - License Term	--
Pulse Flows						
	Rubicon River below Hell Hole Dam	--	--	Rubicon River at Hell Hole Dam Spillway (new) Rubicon River at Hell Hole Dam (new)	Year 6 - License Term	Install new gage and weir . Install new AVM on the outlet works. Modify Howell-Bunger (HB) valve shroud. Enlarge channel downstream of dam to accommodate pulse flow. Hell Hole Reservoir Storage Increase Improvement – modify existing spillway weir and install new spillway crest gates. Construct new road (Hell Hole Dam Spillway Gates Road).
	Middle Fork American River below French Meadows Dam	--	--	Middle Fork American River below French Meadows Dam (USGS Gage No. 11427500) Middle Fork American River at French Meadows Dam (new)	Year 3 - License Term	Install new AVM on the outlet works.
	Middle Fork American River below Middle Fork Interbay Dam	--	--	Middle Fork American River below Middle Fork Interbay Dam (new)	Year 3 - License Term	Install new stream gage.
	Duncan Creek below Diversion Dam	--	--	Duncan Creek below Diversion Dam (USGS Gage No. 11427750)	Year 4 - License Term	Modify outlet works as part of diversion improvement project.
	North Fork Long Canyon Creek below Diversion Dam	--	--	North Fork Long Canyon Creek below Diversion Dam (new)	Year 5 - License Term	Modify outlet works as part of diversion improvement project. Install new stream gage.
	South Fork Long Canyon Creek below Diversion Dam	--	--	South Fork Long Canyon Creek below Diversion Dam (new)	Year 5 - License Term	Modify outlet works as part of diversion improvement project. Install new stream gage.

FRMP Table 2. New FERC License Instream Flow and Minimum Pool Measure Compliance Gage Locations and Time Period (continued).

Measure	Flow Compliance Location	Compliance Gage(s)				
		Interim		Final		
		Gage	Time Period (after License Issuance)	Gage	Time Period (after License Issuance)	Modifications/Upgrades
Down Ramp of Spill Flows						
	Rubicon River below Hell Hole Dam	--	--	Rubicon River at Hell Hole Dam Spillway (new)	Year 6 - License Term	Install new gage and weir.
				Rubicon River at Hell Hole Dam (new)		Install new AVMs on outlet works.
						Modify Howell-Bunger (HB) valve shroud.
						Enlarge channel downstream of dam to allow for safe discharge of infrequent emergency water releases.
						Hell Hole Reservoir Storage Increase Improvement – modify existing spillway weir and install new spillway crest gates.
						Construct new road (Hell Hole Dam Spillway Gates Road).
	Middle Fork American River below French Meadows Dam	--	--	Middle Fork American River below French Meadows Dam (USGS Gage No. 11427500)	Year 3 - License Term	Install new AVM on the outlet works.
				Middle Fork American River at French Meadows Dam (new)		
Operations of Oxbow Powerhouse						
	Middle Fork American River below Oxbow Powerhouse					
	• Ramping Rate Condition	--	--	Oxbow Powerhouse Penstock (new)	Year 3 - License Term	Install new AVM on the penstock.
	• Maximum Flow Release Condition	--	--			
Recreation Flow Releases						
	Middle Fork American River below Oxbow Powerhouse					
	• Early Saturday Releases	--	--	North Fork American River above American River Pump Station (new)	Year 3 - License Term	Install new stream gage.
				Middle Fork American River near Foresthill (USGS Gage No. 11433300)		
	• All Other Releases	--	--	Middle Fork American River near Foresthill (USGS Gage No. 11433300)	Within 30 days - License Term	--
Reservoir Minimum Pool						
	Hell Hole Reservoir	--	--	Hell Hole Reservoir (USGS Gage No. 11428700)	Within 30 days - License Term	--
	French Meadows Reservoir	--	--	French Meadows Reservoir (USGS Gage No. 11427400)	Within 30 days - License Term	--

FRMP Table 3. Interim Minimum Instream Flow Requirements (Previous FERC License).

New License Flow Compliance Location	Existing License Facility	License Requirement	
Middle Fork American River below Middle Fork Interbay Dam	Middle Fork Interbay	Forecast / Folsom Reservoir ¹ > 1,000,000 ac-ft < 1,000,000 ac-ft	Release (cfs) lesser of 23 or natural flow lesser of 12 or natural flow
Duncan Creek below Diversion Dam	Duncan Diversion Dam	Forecast / Folsom Reservoir ¹ > 1,000,000 ac-ft < 1,000,000 ac-ft	Release (cfs) lesser of 8 or natural flow lesser of 4 or natural flow
North Fork Long Canyon Creek below Diversion Dam	North Fork Long Canyon Diversion Dam	Releases to maintain stream flow of 2 cfs or the natural flow, whichever is less, shall be made at all times.	
South Fork Long Canyon Creek below Diversion Dam	South Fork Long Canyon Diversion Dam	Forecast / Folsom Reservoir ¹ > 1,000,000 ac-ft < 1,000,000 ac-ft	Release (cfs) lesser of 5 or natural flow lesser of 2.5 or natural flow
Middle Fork American River below Oxbow Powerhouse	Oxbow Powerhouse	Releases shall not cause vertical fluctuations (measured in representative section) greater than 3 feet per hour.	

¹Forecast / Folsom Reservoir = CDWR current year April forecast of unimpeded run-off of the American River to Folsom Reservoir.

FRMP Table 4. Interim¹ Instream Flow Requirement Compliance Gage Locations and Time Period.

Measure	Flow Compliance Location	Compliance Gage(s)	Time Period (after License Issuance)
Minimum Instream Flows			
	Middle Fork American River Immediately Below Ralston Afterbay Dam	Voluntary release of approximately 3 cfs, no gage.	Years 1 - 2
	Duncan Creek below Diversion Dam	Duncan Creek above Diversion Dam (USGS Gage No. 11427700) Duncan Creek below Diversion Dam (USGS Gage No. 11427750)	Years 1 - 3
	North Fork Long Canyon Creek below Diversion Dam	North Fork Long Canyon Creek below Diversion Dam (USGS Gage No. 11433085) North Fork Long Canyon Creek Diversion Tunnel (USGS Gage No. 11433080)	Years 1 - 4
	South Fork Long Canyon Creek below Diversion Dam	South Fork Long Canyon Creek below Diversion Dam (USGS Gage No. 11433065) South Fork Long Canyon Creek Diversion Tunnel (USGS Gage No. 11433060)	Years 1 - 4
Operations of Oxbow Powerhouse			
	Middle Fork American River below Oxbow Powerhouse • Interim Ramping Rate Condition	Middle Fork American River near Foresthill (USGS Gage No. 11433300)	Years 1 - 2

¹Interim instream flow requirements for locations where new License conditions cannot be implemented until infrastructure or gages are modified.

FRMP Table 5. Description of Existing, Interim, and New Compliance Stream Gages.

Compliance Gage Location and Name	Existing Gage Number	Interim ¹ , Existing ² , or New Gage	Gage Description ³	Implementation Schedule of New License Condition (after License Issuance)	Comments
Rubicon River below Hell Hole Dam					
Rubicon River below Hell Hole Dam	USGS No. 11428800	Interim	Lat 39° 03'24", Long 120° 24'25" referenced to North American Datum of 1927, in NE ¼ NE ¼ sec.21, T.14 N., R.14 E., Placer County, CA, Hydrologic Unit 18020128, in Eldorado National Forest. Located on right bank, 600 ft downstream from outlet of dam.	-	Spill is calculated by using the spillway curve and recorded reservoir water surface elevations, added to the recorded minimum instream flow.
Rubicon River at Hell Hole Dam		New	Flow measuring equipment will be installed on the stream pipe and the low level outlet.	2-3 years	
Rubicon River at Hell Hole Dam Spillway	USGS No. 11428800 (new)	New	Site to be determined.	3-5 years	
Middle Fork American River below French Meadows Dam					
Middle Fork American River below French Meadows Dam	USGS No. 11427500	Interim/ Existing	Lat 39° 06'35", Long 120° 28'49" referenced to North American Datum of 1927, in SW ¼ NW ¼ sec.36, T.15 N., R.13 E., Placer County, CA, Hydrologic Unit 18020128, in Tahoe National Forest. Located on left bank, 0.6 mi downstream from French Meadows Dam.	-	
Middle Fork American River at French Meadows Dam		New	AVMs will be installed on instream flow release pipe and the low level outlet.	1-2 years	
Middle Fork American River below Middle Fork Interbay Dam					
Middle Fork American River at Middle Fork Interbay Dam	USGS No. 11427770	Existing	Lat 39° 01'35", Long 120° 36'09" referenced to North American Datum of 1927, in SW ¼ SE ¼ sec.26, T.14 N., R.12 E., Placer County, CA, Hydrologic Unit 18020128, in Tahoe National Forest. Located on stream pipe on left bank at Middle Fork Interbay Dam.	-	Measures required minimum instream flows only.
Middle Fork American River below Interbay Dam		New	Site to be determined.	1-2 years	
Middle Fork American River Immediately Below Ralston Afterbay Dam					
Middle Fork American River at Ralston Afterbay Dam		New	To be determined.	1-2 years	
Duncan Creek below Diversion Dam					
Duncan Creek above Diversion Dam	USGS No. 11427700	Interim	Lat 39°08'09", Long 120° 28'39" referenced to North American Datum of 1927, in NE ¼ NW ¼ sec.24, T.15 N., R.13 E., Placer County, CA, Hydrologic Unit 18020128, in Tahoe National Forest. Located on left bank, 0.2 mi upstream from diversion dam, and 0.5 mi downstream from Little Duncan Creek.	-	Used to document compliance when inflows are less than required minimum instream flows.
Duncan Creek below Diversion Dam	USGS No. 11427750	Existing	Lat 39° 07'59", Long 120° 28'58" referenced to North American Datum of 1927, in NE ¼ SE ¼ sec.23, T.15 N., R.13 E., Placer County, CA, Hydrologic Unit 18020128, in Tahoe National Forest. Located on right bank, 1,000 ft downstream from Duncan Canyon Creek Diversion Dam.	-	
Duncan Creek Diversion Tunnel		New	To be determined.	2-3 years	Will be used to document compliance when inflows are less than required minimum instream flows and pulse flows.

FRMP Table 5. Description of Existing, Interim, and New Compliance Stream Gages (continued).

Compliance Gage Location and Name	Existing Gage Number	Interim ¹ , Existing ² , or New Gage	Gage Description ³	Implementation Schedule of New License Condition (after License Issuance)	Comments
North Fork Long Canyon Creek below Diversion Dam					
North Fork Long Canyon Creek below Diversion Dam	USGS No. 11433085	Interim	Lat 39°02'57", Long 120°28'56" referenced to North American Datum of 1927, in SW ¼ NW ¼ sec.24, T.14 N., R.13 E., Placer County, CA, Hydrologic Unit 18020128, in Eldorado National Forest. Located on right bank, 26 ft below diversion dam, 3.2 mi upstream from confluence of North and South Forks of Long Canyon Creek.	-	Measures low flows and only when diverting.
North Fork Long Canyon Creek Diversion Tunnel	USGS No. 11433080	Existing	Lat 39°02'57", Long 120°28'56" referenced to North American Datum of 1927, in SW ¼ NW ¼ sec.24, T.14 N., R.13 E., Placer County, CA, Hydrologic Unit 18020128, in Eldorado National Forest. Located on left bank at diversion dam, 0.4 mi downstream from unnamed tributary, and 3.2 mi upstream from confluence of North and South Forks Long Canyon Creek.	3-4 years	Used to document compliance when inflows are less than required minimum instream flows.
North Fork Long Canyon Creek below Diversion Dam		New	Site to be determined.		
South Fork Long Canyon Creek below Diversion Dam					
South Fork Long Canyon Creek below Diversion Dam	USGS No. 11433065	Interim	Lat 39° 03'04", Long 120° 28'14" referenced to North American Datum of 1927, in SW ¼ NE ¼ sec.24, T.14 N., R.13 E., Placer County, CA, Hydrologic Unit 18020128, in Eldorado National Forest. Located on right bank, 21 ft below diversion dam, 3.3 mi upstream from confluence of North and South Forks of Long Canyon Creek.	-	Measures low flows and only when diverting.
South Fork Long Canyon Creek Diversion Tunnel	USGS No. 11433060	Existing	Lat 39°03'04", Long 120°28'14" referenced to North American Datum of 1927, in SW ¼ NE ¼ sec.24, T.14 N., R.13 E., Placer County, CA, Hydrologic Unit 18020128, in Eldorado National Forest. Located on right bank at diversion dam, 0.5 mi upstream from unnamed tributary, and 3.3 mi upstream from confluence with North and South Forks Long Canyon Creek.	3-4 years	Used to document compliance when inflows are less than required minimum instream flows.
South Fork Long Canyon Creek below Diversion Dam		New	Site to be determined.		

FRMP Table 5. Description of Existing, Interim, and New Compliance Stream Gages (continued).

Compliance Gage Location and Name	Existing Gage Number	Interim ¹ , Existing ² , or New Gage	Gage Description ³	Implementation Schedule of New License Condition (after License Issuance)	Comments
Middle Fork American River below Oxbow Powerhouse					
Oxbow Powerhouse Penstock		New	Flow measurement equipment will be installed on penstock.	1-2 years	
Middle Fork American River near Foresthill	USGS No. 11433300	Existing	Lat 39° 00'22", Long 120° 45'35" referenced to North American Datum of 1927, in NW ¼ NW ¼ sec.4, T.13 N., R.11 E., Placer County, CA, Hydrologic Unit 18020128, in Tahoe National Forest. Located on right bank, 1.6 mi downstream from Oxbow Powerhouse.	Within 30 days	
North Fork American River above American River Pump Station		New	Located in the North Fork American River, upstream of American River Pump Station.	Within 30 days	
Reservoirs					
Hell Hole Reservoir	USGS No. 11428700	Existing	Lat 39° 03'54", Long 120° 24'50" referenced to North American Datum of 1927, in SE ¼ NW ¼ sec.16, T.14 N., R.14 E., Placer County, CA, Hydrologic Unit 18020128, in Eldorado National Forest. Located at Hell Hole-Middle Fork Tunnel intake on right bank, 0.3 mi upstream from Hell Hole Dam on Rubicon River.	Within 30 days	
French Meadows Reservoir	USGS No. 11427400	Existing	Lat 39° 06'32", Long 120° 25'49" referenced to North American Datum of 1927, in SE ¼ NW ¼ sec.32, T.15 N., R.14 E., Placer County, CA, Hydrologic Unit 18020128, in Eldorado National Forest. Located at French Meadows-Hell Hole Tunnel intake on left bank, 2.2 mi upstream from the French Meadows Dam on Middle Fork American River.	Within 30 days	

¹Interim gage to remain in place until infrastructure modification and/or new or upgraded gage is completed. The gage will no longer be used once complete.

²Existing gage will be used for compliance with minimum instream flow releases prior to completion of infrastructure modification and for compliance with flow release requirements in the new license.

³All gages have 15-minute data collection with manual download and SCADA backup. PCWA consultants will maintain all gages according to USGS protocol.

MAPS