

**INITIAL STUDY REPORT**

**APPENDIX G**

**FISH PRESENCE AND STRANDING ASSESSMENT  
TECHNICAL MEMORANDUM**

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# **FISH PRESENCE AND STRANDING ASSESSMENT TECHNICAL MEMORANDUM**

## **LA GRANGE HYDROELECTRIC PROJECT FERC NO. 14581**



**Prepared for:**

**Turlock Irrigation District – Turlock, California  
Modesto Irrigation District – Modesto, California**

**Prepared by:  
FISHBIO**

**February 2016**

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## **1.0 INTRODUCTION**

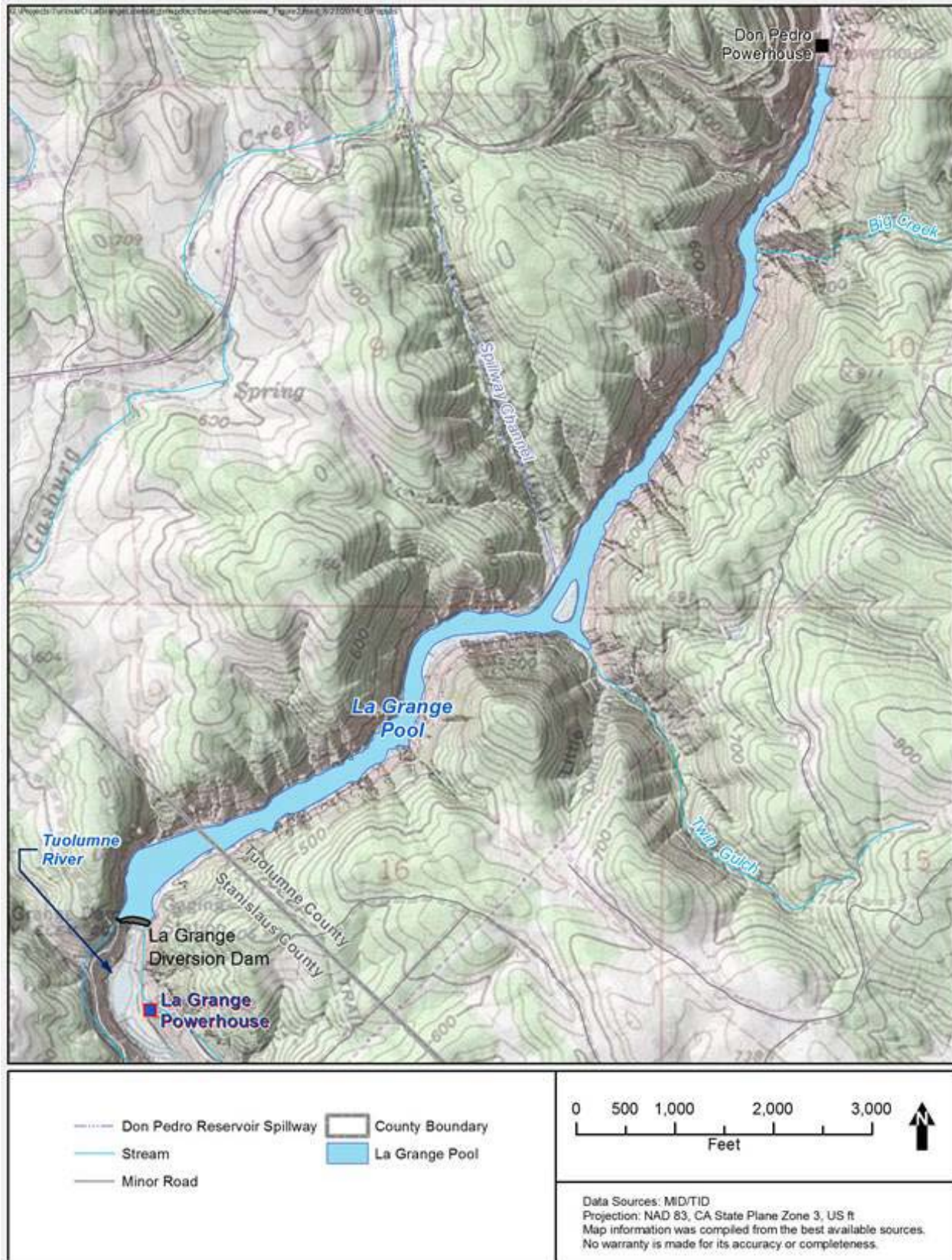
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### **1.1 Background**

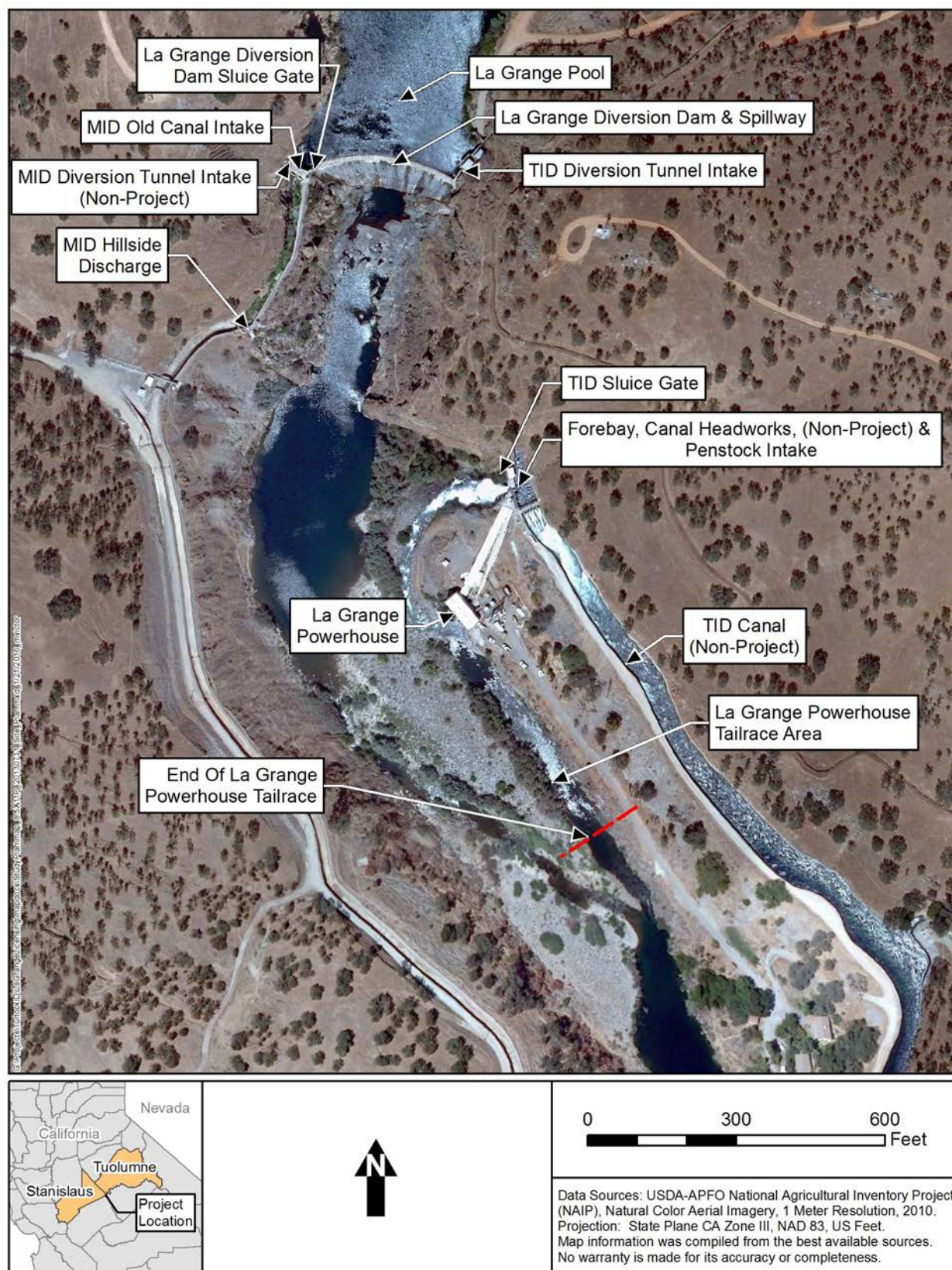
The Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, the Districts) own the La Grange Diversion Dam (LGDD) located on the Tuolumne River in Stanislaus County, California (Figures 1.1-1 and 1.1-2). LGDD is 131 feet high and is located at river mile (RM) 52.2 at the exit of a narrow canyon, the walls of which contain the pool formed by the diversion dam. Under normal river flows, the pool formed by the diversion dam extends for approximately one mile upstream. When not in spill mode, the water level upstream of the diversion dam is between elevation 294 feet and 296 feet approximately 90 percent of the time. Within this 2-foot range, the pool storage is estimated to be less than 100 acre-feet of water.

The drainage area of the Tuolumne River upstream of LGDD is approximately 1,550 square miles. Tuolumne River flows upstream of LGDD are regulated by four upstream reservoirs: Hetch Hetchy, Lake Eleanor, Cherry Lake, and Don Pedro. The Don Pedro Hydroelectric Project (Federal Energy Regulatory Commission [the Commission or FERC] No. 2299) is owned jointly by the Districts, and the other three dams are owned by the City and County of San Francisco (CCSF). Inflow to the La Grange pool is the sum of releases from the Don Pedro Project, located 2.3 miles upstream, and very minor contributions from two small intermittent streams downstream of Don Pedro Dam.

LGDD was constructed from 1891 to 1893 displacing Wheaton Dam, which was built by other parties in the early 1870s. LGDD raised the level of the Tuolumne River to permit the diversion and delivery of water by gravity to irrigation systems owned by TID and MID. The Districts' irrigation systems currently provide water to over 200,000 acres of prime Central Valley farmland and drinking water to the City of Modesto. Built in 1924, the La Grange hydroelectric plant is located approximately 0.2 miles downstream of LGDD on the east (left) bank of the Tuolumne River and is owned and operated by TID. The powerhouse has a capacity of slightly less than five megawatts. The La Grange Hydroelectric Project (La Grange Project or Project; FERC No. 14581) operates in a run-of-river mode. The LGDD provides no flood control benefits, and there are no recreation facilities associated with the Project or the La Grange pool.



**Figure 1.1-1. La Grange Hydroelectric Project location map.**



**Figure 1.1-2. La Grange Hydroelectric Project site plan.**

## 1.2 Licensing Process

On January 29, 2014, the Districts commenced the pre-filing process for the licensing of the La Grange Project by filing a Pre-Application Document (PAD) with FERC<sup>1</sup>. The Districts' PAD included descriptions of the Project facilities, operations, and lands as well as a summary of existing information available on Project area resources.

On September 5, 2014, the Districts filed their Proposed Study Plan (PSP) to assess Project effects on fish and aquatic resources, recreation, and cultural resources in support of their intent to license the Project. On October 6, 2014, the Districts held a PSP meeting at MID's offices in Modesto, California. Based on discussion at the PSP meeting, the Districts prepared an Updated Study Plan document that went to licensing participants (LP) for review and comment on November 21, 2014. On December 4, 2014, the National Marine Fisheries Service (NMFS), the Conservation Groups (CG), and the California Department of Fish and Wildlife (CDFW) filed comments on the PSP and/or Updated Study Plan.

On January 5, 2015, in response to comments from LPs, the Districts filed their Revised Study Plan (RSP) containing three study plans: (1) Cultural Resources Study Plan; (2) Recreation Access and Safety Assessment Study Plan; and (3) Fish Passage Assessment Study Plan<sup>2</sup>. Comments on the RSP were received from CDFW on January 16, 2015, and from NMFS, the CGs and the City of Modesto on January 20, 2015.

On February 2, 2015, FERC issued the Study Plan Determination (SPD), approving or approving with modifications six studies (Table 1.2-1). Of those six studies, five had been proposed by the Districts in the RSP. The Districts note that although FERC's SPD identified the Fish Passage Barrier Assessment, Fish Passage Facilities Alternatives Assessment, and Fish Habitat and Stranding Assessment below La Grange Diversion Dam as three separate studies, all three assessments are elements of the larger Fish Passage Assessment as described in the RSP. The sixth study approved by FERC, Effects of the Project and Related Activities on the Losses of Marine-Derived Nutrients in the Tuolumne River, was requested by NMFS in its July 22, 2014 comment letter. Of the eight studies requested by LPs, FERC approved only the NMFS study noted above.

Although FERC's SPD did not require the Districts to undertake the Upper Tuolumne River Basin Habitat Assessment studies contained in the RSP, the Districts are voluntarily conducting the Upper River Barriers Study and the Water Temperature Monitoring and Modeling Study. Regarding the third component of the Upper Tuolumne River Basin Habitat Assessment, the ongoing upstream habitat characterization work being completed by NMFS, the Districts anticipate the results of this work becoming available for consideration in this licensing proceeding.

<sup>1</sup> On December 19, 2012, Commission staff issued an order finding that the La Grange Hydroelectric Project is required to be licensed under Section 23(b)(1) of the Federal Power Act. Turlock Irrigation District and Modesto Irrigation District, 141 FERC ¶ 62,211 (2012), aff'd Turlock Irrigation District and Modesto Irrigation District, 144 FERC ¶ 61,051 (2013). On May 15, 2015, the U.S. Court of Appeals for the District of Columbia Circuit denied the Districts' appeal and affirmed the Commission's finding that the La Grange Hydroelectric Project requires licensing. Turlock Irrigation District, et al., v. FERC, et al., No. 13-1250 (D.C. Cir. May 15, 2015).

<sup>2</sup> The Fish Passage Assessment Study Plan contained a number of individual, but related, study elements.

**Table 1.2-1. Studies approved or approved with modifications in FERC’s Study Plan Determination.**

No.	Study	Approved by FERC in SPD without Modifications	Approved by FERC in SPD with Modifications
1	Recreation Access and Safety Assessment		X
2	Cultural Resources Study		X
3	Fish Passage Barrier Assessment		X <sup>1</sup>
4	Fish Passage Facilities Alternatives Assessment		X
5	Fish Habitat and Stranding Assessment below La Grange Dam		X
6	Effects of the Project and Related Activities on the Losses of Marine-Derived Nutrients in the Tuolumne River	X <sup>2</sup>	

<sup>1</sup> Page A-1 of Appendix A of FERC’s SPD states that FERC approved with modifications the Fish Passage Barrier Assessment. However, the Districts found no modifications to this study plan in the SPD and page B-7 of the SPD states that “no modifications to the study plan are recommended.”

<sup>2</sup> FERC directed the Districts to conduct the study plan as proposed by NMFS.

In addition to the six studies noted in Table 1.2-1, the SPD required the Districts to develop a plan to monitor anadromous fish movement in the Project’s powerhouse draft tubes and to determine the potential for injury or mortality from contact with the turbine runners. Per the SPD, the Districts developed a study plan in consultation with NMFS and other LPs. The Districts filed the Investigation of Fish Attraction to La Grange Powerhouse Draft Tubes study plan with FERC on June 11, 2015, and on August 12, 2015, FERC approved the study plan as filed.

This technical memorandum describes the objectives, methods, and preliminary results of the Fish Presence and Stranding Assessment, which is one of four components of the Fish Habitat and Stranding Assessment below La Grange Diversion Dam being implemented by the Districts in accordance with FERC’s SPD. In addition to observations of fish presence and potential stranding during powerhouse outages, this technical memorandum reports daily fish observations and notation of any redds that may become dewatered. Documents relating to the Project licensing are publicly available on the Districts’ licensing website at [www.lagrange-licensing.com/](http://www.lagrange-licensing.com/).

### 1.3 Study Plan

FERC’s Scoping Document 2 (SD2) issued on September 5, 2014 identified potential effects of Project operations on the stranding or displacement of fish.

FERC’s SPD approved with modifications the Districts’ proposed Fish Habitat and Stranding Assessment below La Grange Diversion Dam. In its SPD, FERC ordered the Districts to: (1) continue monitoring existing flow conduits where flow monitoring is already occurring, conduct two years of flow monitoring at flow conduits not currently monitored (i.e., the Modesto hillside discharge and LGDD sluice gate), develop estimates of historical flows, data permitting, for each of the five flow conduits at the Project, and, based on existing information, to the extent available, characterize the magnitude and rate of flow and stage changes when Project conduits

are shut down; (2) collect topographic, depth, and habitat data downstream of, and in the vicinity of, the Project; (3) assess fish presence and the potential for stranding; and (4) in consultation with NMFS and other interested parties, develop and implement a plan for monitoring anadromous fish movement into the powerhouse draft tubes.

The Fish Presence and Stranding Assessment reported herein describes the work associated with Item (3) above.

## **2.0 STUDY GOALS AND OBJECTIVES**

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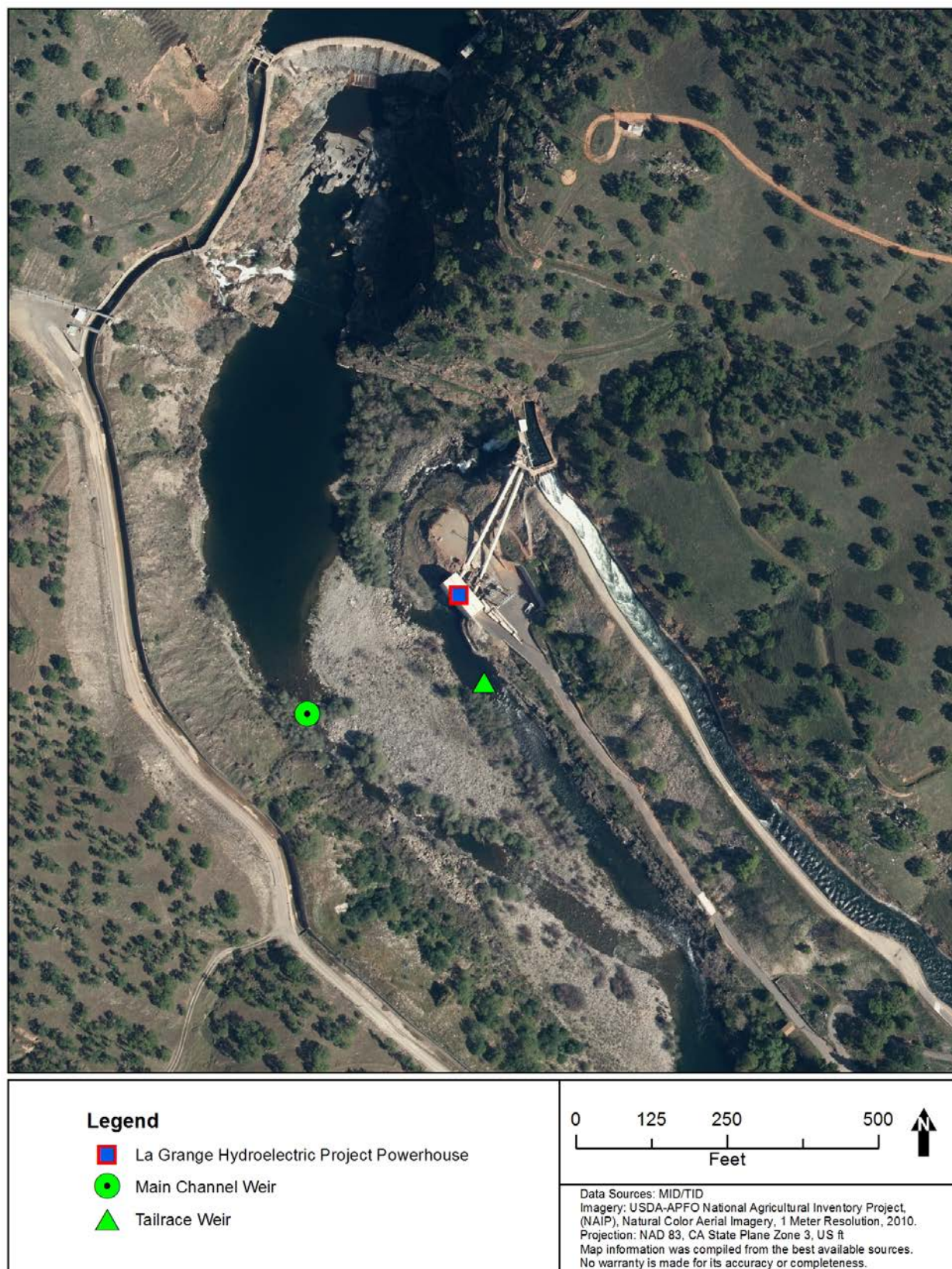
The goal of this study is to implement formal documentation of incidental fish observations in the vicinity of LGDD, La Grange powerhouse tailrace, and TID sluice gate channel through April/May 2016. Specific objectives of the assessment include:

- Daily observations of fish in the immediate vicinities of LGDD, La Grange powerhouse, and within the sluice gate channel;
- If the La Grange powerhouse trips offline, conduct sluice gate channel surveys to record fish presence and if necessary conduct relocation activities; and
- Notation of redds that become dewatered and the duration of any dewatering, due to changes in powerhouse operations.

### **3.0                    STUDY AREA**

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The study area includes the main channel of the Tuolumne River from the base of LGDD downstream to its confluence with the powerhouse tailrace channel near RM 51.8, the length of the tailrace channel, and the length of the TID sluice gate channel (Figure 3.0-1).



**Figure 3.0-1 Fish Presence and Stranding Assessment study area.**

## 4.0 METHODOLOGY

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### 4.1 Daily Fish Observations

Daily fish observation surveys in the immediate vicinities of LGDD, La Grange powerhouse, and within the TID sluice gate channel began on September 23, 2015. Surveys were conducted twice daily; morning surveys were conducted by FISHBIO fisheries biologists/technicians during daily operations and maintenance of the weir associated with the Fish Barrier Assessment (TID/MID 2016). The weir is comprised of two sections located in the tailrace channel and in the mainstem Tuolumne River. Afternoon surveys were conducted by TID Project operators, under supervision of the TID fisheries biologist.

FISHBIO surveys included observation of the tailrace channel area above the weir, sluice gate channel, and the mainstem Tuolumne River channel from LGDD downstream to where it meets the tailrace channel. Surveys consisted of walking the length of the sluice gate channel, and floating both channels from LGDD to 0.3 miles downstream of the weir locations. Surveys conducted by TID project operators included the tailrace channel area above the weir and the sluice gate channel. These afternoon surveys consisted of walking the length of the sluice gate channel, and observing the tailrace channel from the road above the channel.

Observation surveys recorded on standardized datasheets included the following:

- Observer;
- Date and time of survey;
- Approximate discharge and sluice gate conduit status at time of survey (flow observations were also post-processed using data from the Project);
- Powerhouse output at time of survey;
- Number of fish observed and their approximate size;
- Identification of species, if possible; at a minimum each fish was identified as either a salmonid or non-salmonid;
- Locations of fish (to be indicated on a previously-generated base map);
- Description of general fish behaviors, such as moving upstream or downstream, spawning, holding in one specific location, or leaping/jumping;
- Notation of any observations of fish swimming into the La Grange powerhouse tailrace; and
- Notation of any observations of fish swimming into the TID sluice gate channel.

In addition to the observations listed above, surveys of the tailrace channel also included daily redd observations.

## **4.2 Sluice Gate Channel Stranding Surveys**

In the event that La Grange powerhouse trips offline (i.e., unexpectedly stops operating) and water stops flowing through the powerhouse, the TID sluice gate opens immediately to bypass the powerhouse and maintain river flow. In addition, TID currently maintains in an open position an 18-inch pipe that continuously delivers flow from the TID forebay to the sluice gate channel. The flow quantity is not measured and is unknown, but is roughly estimated to be about five cubic feet per second (cfs). Direct observations in the TID sluice gate channel downstream to the end of the La Grange powerhouse tailrace channel (i.e., to the confluence of the tailrace channel and the mainstem Tuolumne River) for the presence and potential stranding of salmonids were conducted during any flow transition from the time of maximum flow in the sluice gate channel through the subsequent closing of the sluice gate and until complete cessation of the sluice gate flow release. Once powerhouse operations were restored and the sluice gate had been closed, an additional survey was conducted to ensure fish were not stranded in the sluice gate channel.

Powerhouse operators conducted sluice gate channel stranding surveys. A qualified biologist was present during the first five surveys to ensure that surveys were conducted effectively.

Data collected during sluice gate channel stranding surveys included:

- Presence of fish;
- Species;
- Fish location;
- Estimated length;
- Presence of adipose clip;
- General condition of fish;
- Photo documentation; and if appropriate; and
- Relocation time.

## **4.3 Redd Dewatering**

To evaluate redd dewatering, and the duration of any dewatering, due to a change in powerhouse operations, a water level data logger (Onset Computer Corporation) was deployed in the tailrace channel on September 30, 2015. Water level data was recorded every 15-minutes and correlated with salmonid redd mapping data collected in the tailrace channel. Bi-weekly redd mapping surveys recorded Global Positioning System (GPS) redd coordinates and depth at the estimated egg pocket location of each redd. River stage was compared to the elevation of each documented redd to determine the frequency and duration of any potential dewatering events.

## 5.0 RESULTS

### 5.1 Daily Fish Observations

Twice daily fish observation surveys began on September 23, 2015. Observation data through November 15, 2015, are presented in this technical memorandum (Attachment A). Fish species observed in the tailrace during this period included Chinook salmon (*Oncorhynchus tshawytscha*), *Oncorhynchus mykiss* (*O. mykiss*), Sacramento pikeminnow (*Ptychocheilus grandis*), Sacramento sucker (*Catostomus occidentalis*), and striped bass (*Morone saxatilis*). Fish observed in the main channel surveys included bluegill (*Lepomis macrochirus*), Chinook salmon, hardhead (*Mylopharodon conocephalus*), sculpin (*Cottidae spp.*), Sacramento pikeminnow, Sacramento sucker, and threespine stickleback (*Gasterosteus aculeatus*). No incidences of fish attempting to enter into the La Grange powerhouse or the TID sluice gate channel were observed.

### 5.2 Sluice Gate Channel Stranding Surveys

On September 30, 2015, operators increased the opening of the 18-inch pipe to allow for a minimum channel maintenance flow of approximately 5 to 10 cfs to be provided in the sluice gate channel at all times. It was determined that this flow level would significantly reduce the risk of stranding or dewatering any fish that may enter the channel during a high flow event and would allow fish to volitionally exit the channel at all times, thereby minimizing the need for handling and relocating Chinook salmon or *O. mykiss*. In the event that fish were observed stranded in the sluice gate channel, a qualified biologist would be contacted to conduct salvage activities and relocate any stranded Chinook salmon or *O. mykiss* to the tailrace channel.

La Grange powerhouse tripped offline, and the TID sluice gate opened, four times during the current monitoring period (September 23, 2015 through November 15, 2015). The duration of flow events in the sluice gate channel (above the minimum flow maintained at all times) ranged from 8.25 hours to 484.4 hours, and average flow ranged from 73 to 143 cfs (Table 5.2-1). TID operators and a qualified biologist were on-site each time the sluice gate channel was closed and flow was reduced to the minimum flow of approximately 5 to 10 cfs. No fish were observed in the sluice gate channel during stranding surveys.

**Table 5.2-1. Sluice gate channel stranding survey data.**

Event #	Sluice Gate Opened		Sluice Gate Closed		Duration (hours)	Avg. flow (cfs)	Stranding Survey		Fish Observed
	Date	Time	Date	Time			Date	Time	
1	9/29	0:30	9/29	8:45	8.25	73	9/29	8:50	No
2	10/17	23:15	10/19	9:45	34.5	138	10/19	11:00	No
3	10/21	5:15	10/23	14:15	57.0	142	10/23	14:00	No
4	11/4	10:30	11/24	15:05	484.4	143	11/24	15:30	No

### **5.3 Redd Dewatering**

Bi-weekly salmonid redd mapping surveys began on October 14, 2015. As of November 15, 2015, no redds have been identified in the tailrace channel during bi-weekly redd mapping surveys.

## **6.0                    STUDY VARIANCES AND MODIFICATIONS**

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This study was conducted consistent with the FERC-approved study plan. No variances or modifications occurred.

## **7.0 REFERENCES**

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Turlock Irrigation District and Modesto Irrigation District (TID/MID). 2016. Fish Barrier Assessment Progress Report. Prepared by FISHBIO. Attachment to La Grange Hydroelectric Project Initial Study Report. February 2016.

**FISH PRESENCE AND STRANDING ASSESSMENT  
TECHNICAL MEMORANDUM**

**ATTACHMENT A**

**DAILY FISH OBSERVATIONS SURVEY INFORMATION**

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**Table A-1. Daily fish observation survey information.**

Date	Time	No. of Fish Observed	Species <sup>1</sup>	Life Stage <sup>1</sup>	Location <sup>1, 2</sup>
9/23/15	9:15	25	Sacramento pikeminnow	Juvenile	MC Below Weir
		55	Sacramento sucker	Juvenile	MC Below Weir
		15	Sacramento sucker	Juvenile	MC Below Weir
9/23/15	12:00	0	N/A	N/A	N/A
9/24/15	9:30	50	Sacramento sucker	Juvenile	MC Below Weir
		30	Sacramento pikeminnow	Juvenile	MC Below Weir
		15	Sacramento sucker	Juvenile	MC Below Weir
9/24/15	15:00	0	N/A	N/A	N/A
9/25/15	8:30	50	Sacramento sucker	Juvenile	MC Below Weir
		30	Sacramento pikeminnow	Juvenile	MC Below Weir
		10	Sacramento sucker	Juvenile	MC Below Weir
9/26/15	8:45	1	sculpin	Juvenile	MC Below Weir
		1	sculpin	Adult	MC Below Weir
		1	Sacramento sucker	Juvenile	MC Below Weir
		4	Sacramento sucker	Juvenile	MC Below Weir
		6	Sacramento pikeminnow	Juvenile	MC Below Weir
9/26/15	15:15	0	N/A	N/A	N/A
9/27/15	9:15	1	rainbow trout	Adult	TR Below Weir
		10	Sacramento pikeminnow	Juvenile	MC Below Weir
		5	Sacramento sucker	Juvenile	MC Below Weir
9/27/15	14:45	0	N/A	N/A	N/A
9/28/15	11:00	0	N/A	N/A	N/A
9/28/15	16:00	0	N/A	N/A	N/A
9/29/15	10:30	10	Sacramento pikeminnow	Juvenile	MC Below Weir
		25	Sacramento sucker	Juvenile	MC Below Weir
9/29/15	15:30	0	N/A	N/A	N/A
9/30/15	11:15	11	Sacramento sucker	Juvenile	MC Below Weir
		4	Sacramento sucker	Juvenile	MC Below Weir
9/30/15	12:30	0	N/A	N/A	N/A
10/1/15	9:00	9	Sacramento pikeminnow	Juvenile	MC Below Weir
		4	Sacramento pikeminnow	Juvenile	MC Below Weir
10/1/15	18:00	0	N/A	N/A	N/A
10/2/15	9:15	20	Sacramento sucker	Juvenile	MC Below Weir
		15	Sacramento pikeminnow	Juvenile	MC Below Weir
10/2/15	13:45	0	N/A	N/A	N/A
10/3/15	8:45	15	Sacramento sucker	Juvenile	MC Above Weir

Date	Time	No. of Fish Observed	Species <sup>1</sup>	Life Stage <sup>1</sup>	Location <sup>1, 2</sup>
10/3/15	14:45	2	Sacramento pikeminnow	Juvenile	MC Above Weir
		40	Sacramento sucker	Juvenile	MC Below Weir
		14	Sacramento pikeminnow	Juvenile	MC Below Weir
10/3/15	14:45	0	N/A	N/A	N/A
10/4/15	8:30	6	Sacramento sucker	Adult	MC Above Weir
		50+	Sacramento sucker	Juvenile	MC Below Weir
10/4/15	14:30	0	N/A	N/A	N/A
10/5/15	9:45	50+	Sacramento sucker	Juvenile	MC Below Weir
		3	Sacramento pikeminnow	Juvenile	MC Above Weir
		1	Bluegill	Juvenile	MC Above Weir
10/5/15	15:30	0	N/A	N/A	N/A
10/6/15	9:15	1	Sacramento sucker	Adult	TR Above Weir
		2	Sacramento pikeminnow	Juvenile	TR Above Weir
		50+	Sacramento sucker	Juvenile	MC Below Weir
		25	Sacramento pikeminnow	Juvenile	MC Below Weir
		15	Sacramento pikeminnow	Juvenile	MC Above Weir
		4	Sacramento sucker	Juvenile	MC Above Weir
		1	bluegill	Adult	MC Above Weir
10/7/15	9:30	1	Sacramento pikeminnow	Juvenile	TR Above Weir
		50+	Sacramento sucker	Juvenile	MC Below Weir
		20	Sacramento pikeminnow	Juvenile	MC Below Weir
		6	Sacramento sucker	Juvenile	MC Below Weir
		10	Sacramento pikeminnow	Juvenile	MC Below Weir
		2	Bluegill	Juvenile	MC Below Weir
10/7/15	13:30	0	N/A	N/A	N/A
10/8/15	9:00	1	Sacramento sucker	Adult	TR Below Weir
		25	Sacramento sucker	Juvenile	MC Below Weir
		15	Sacramento pikeminnow	Juvenile	MC Below Weir
		4	Sacramento sucker	Juvenile	MC Below Weir
		3	Sacramento pikeminnow	Juvenile	MC Below Weir
10/8/15	18:30	0	N/A	N/A	N/A
10/9/15	9:00	20	Sacramento sucker	Juvenile	MC Below Weir
		40	Sacramento pikeminnow	Juvenile	MC Below Weir
		6	Sacramento sucker	Juvenile	MC Above Weir
		4	Sacramento pikeminnow	Juvenile	MC Above Weir
10/9/15	17:30	0	N/A	N/A	N/A
10/10/15	9:00	50+	Sacramento sucker	Juvenile	MC Below Weir

Date	Time	No. of Fish Observed	Species <sup>1</sup>	Life Stage <sup>1</sup>	Location <sup>1, 2</sup>
10/10/15	12:45	1	sculpin	Juvenile	MC Below Weir
		20	Sacramento pikeminnow	Juvenile	MC Below Weir
		15	Sacramento sucker	Juvenile	MC Below Weir
10/10/15	12:45	0	N/A	N/A	N/A
10/11/15	8:45	75	Sacramento sucker	Juvenile	MC Below Weir
		25	Sacramento pikeminnow	Juvenile	MC Below Weir
		15	Sacramento sucker	Juvenile	MC Above Weir
10/11/15	15:00	0	N/A	N/A	N/A
10/12/15	9:00	65	Sacramento sucker	Juvenile	MC Below Weir
		40	Sacramento pikeminnow	Juvenile	MC Below Weir
		25	Sacramento sucker	Juvenile	MC Above Weir
10/12/15	17:15	0	N/A	N/A	N/A
10/13/15	8:45	12	Sacramento sucker	Juvenile	MC Below Weir
		18	Sacramento pikeminnow	Juvenile	MC Below Weir
		6	Sacramento sucker	Juvenile	MC Above Weir
		6	Sacramento pikeminnow	Juvenile	MC Above Weir
10/13/15	15:45	0	N/A	N/A	N/A
10/14/15	9:15	125	Sacramento sucker	Juvenile	MC Below Weir
		60	Sacramento pikeminnow	Juvenile	MC Below Weir
		25	Sacramento sucker	Juvenile	MC Above Weir
10/14/15	18:00	0	N/A	N/A	N/A
10/15/15	8:45	50+	Sacramento pikeminnow	Juvenile	MC Below Weir
		30	Sacramento sucker	Juvenile	MC Below Weir
		4	Sacramento pikeminnow	Juvenile	MC Above Weir
		12	Sacramento sucker	Juvenile	MC Above Weir
10/15/15	17:15	0	N/A	N/A	N/A
10/16/15	8:45	2	N/A	N/A	N/A
		50+	Sacramento sucker	Juvenile	MC Below Weir
		50+	Sacramento pikeminnow	Juvenile	MC Below Weir
		2	Sacramento sucker	Juvenile	MC Above Weir
10/16/15	17:45	0	N/A	N/A	N/A
10/17/15	8:45	50+	Sacramento sucker	Juvenile	MC Below Weir
		30	Sacramento pikeminnow	Juvenile	MC Below Weir
		5	Sacramento sucker	Juvenile	MC Above Weir
10/17/15	14:30	0	N/A	N/A	N/A
10/18/15	11:00	50+	Sacramento sucker	Juvenile	MC Below Weir
		30	Sacramento pikeminnow	Juvenile	MC Below Weir

Date	Time	No. of Fish Observed	Species <sup>1</sup>	Life Stage <sup>1</sup>	Location <sup>1, 2</sup>
		5	Sacramento sucker	Juvenile	MC Above Weir
10/18/15	15:45	0	N/A	N/A	N/A
10/19/15	11:15	50+	Sacramento sucker	Juvenile	MC Below Weir
		40	Sacramento pikeminnow	Juvenile	MC Below Weir
		20	Sacramento sucker	Juvenile	MC Above Weir
10/19/15	16:00	0	N/A	N/A	N/A
10/20/15	10:00	50+	Sacramento sucker	Juvenile	MC Below Weir
		35	Sacramento pikeminnow	Juvenile	MC Below Weir
		4	Sacramento sucker	Juvenile	MC Above Weir
10/20/15	16:00	0	N/A	N/A	N/A
10/21/15	9:30	4	Sacramento sucker	Juvenile	MC Above Weir
		16	Sacramento sucker	Juvenile	MC Below Weir
		25	Sacramento pikeminnow	Juvenile	MC Below Weir
10/21/15	16:15	0	N/A	N/A	N/A
10/22/15	10:00	4	Sacramento pikeminnow	Juvenile	MC Above Weir
		1	Sacramento sucker	Juvenile	MC Above Weir
		37	Sacramento pikeminnow	Juvenile	MC Below Weir
		29	Sacramento sucker	Juvenile	MC Below Weir
10/22/15	17:45	0	N/A	N/A	N/A
10/23/15	8:30	16	Sacramento sucker	Juvenile	MC Below Weir
		4	Sacramento pikeminnow	Juvenile	MC Above Weir
10/23/15	16:00	0	N/A	N/A	N/A
10/24/15	8:45	50+	Sacramento sucker	Juvenile	MC Below Weir
		25	Sacramento pikeminnow	Juvenile	MC Below Weir
		10	Sacramento sucker	Juvenile	MC Above Weir
10/24/15	15:15	0	N/A	N/A	N/A
10/25/15	8:45	30	Sacramento sucker	Juvenile	MC Below Weir
		20	Sacramento pikeminnow	Juvenile	MC Below Weir
10/25/15	15:45	0	N/A	N/A	N/A
10/26/15	8:45	2	Chinook salmon	Adult	MC Above Weir
		29	Sacramento sucker	Juvenile	MC Below Weir
		47	Sacramento pikeminnow	Juvenile	MC Below Weir
10/26/15	16:45	0	N/A	N/A	N/A
10/27/15	8:45	5	Threespine Stickleback	Juvenile	MC Below Weir
		6	hardhead	Adult	MC Below Weir
10/28/15	9:15	39	Sacramento sucker	Juvenile	MC Below Weir
		17	Sacramento pikeminnow	Juvenile	MC Below Weir

Date	Time	No. of Fish Observed	Species <sup>1</sup>	Life Stage <sup>1</sup>	Location <sup>1, 2</sup>
10/28/15	17:30	0	N/A	N/A	N/A
10/29/15	8:00	1	striped bass	Adult	TR Below Weir
10/29/15	16:00	0	N/A	N/A	N/A
10/30/15	10:30	6	Unknown	Juvenile	MC Above Weir
10/30/15	17:45	0	N/A	N/A	N/A
10/31/15	9:15	50+	Sacramento sucker	Juvenile	MC Below Weir
		20	Sacramento pikeminnow	Juvenile	MC Below Weir
		2	Sacramento sucker	Juvenile	MC Above Weir
10/31/15	16:15	0	N/A	N/A	N/A
11/1/15	11:00	50+	Sacramento sucker	Juvenile	MC Below Weir
		35	Sacramento pikeminnow	Juvenile	MC Below Weir
11/1/15	16:15	0	N/A	N/A	N/A
11/2/15	10:00	-- <sup>3</sup>	N/A	N/A	N/A
11/2/15	16:00	0	N/A	N/A	N/A
11/3/15	8:45	1	Chinook salmon	Adult	TR Above Weir
		1	Sacramento pikeminnow	Adult	MC Below Weir
		50+	Sacramento pikeminnow	Juvenile	MC Below Weir
		40	Sacramento sucker	Juvenile	MC Below Weir
		1	Sacramento sucker	Juvenile	MC Above Weir
11/3/15	12:15	0	N/A	N/A	N/A
11/4/15	7:30	33	Sacramento pikeminnow	Juvenile	MC Below Weir
		21	Sacramento sucker	Juvenile	MC Below Weir
		6	Threespine stickleback	Adult	MC Below Weir
11/4/15	12:00	0	N/A	N/A	N/A
11/5/15	9:15	50+	Sacramento sucker	Juvenile	MC Below Weir
		50+	Sacramento pikeminnow	Juvenile	MC Below Weir
11/5/15	12:30	0	N/A	N/A	N/A
11/6/15	9:00	19	Sacramento sucker	Juvenile	MC Below Weir
		27	Sacramento pikeminnow	Juvenile	MC Below Weir
11/6/15	12:30	0	N/A	N/A	N/A
11/7/15	9:30	50+	Sacramento sucker	Juvenile	MC Below Weir
		15	Sacramento pikeminnow	Juvenile	MC Below Weir
11/7/15	12:15	0	N/A	N/A	N/A
11/8/15	9:45	50+	Sacramento sucker	Juvenile	MC Below Weir
		20	Sacramento pikeminnow	Juvenile	MC Below Weir
11/8/15	12:15	0	N/A	N/A	N/A
11/9/15	9:30	50+	Sacramento sucker	Juvenile	MC Below Weir

Date	Time	No. of Fish Observed	Species <sup>1</sup>	Life Stage <sup>1</sup>	Location <sup>1, 2</sup>
11/9/15	12:00	25+	Sacramento pikeminnow	Juvenile	MC Below Weir
		6	Sacramento sucker	Juvenile	MC Above Weir
		0	N/A	N/A	N/A
11/10/15	9:00	1	Sacramento sucker	Juvenile	MC Below Weir
		3	Sacramento sucker	Adult	MC Below Weir
		50+	Sacramento pikeminnow	Juvenile	MC Below Weir
		2	Sacramento pikeminnow	Adult	MC Below Weir
11/10/15	12:15	0	N/A	N/A	N/A
11/11/15	8:30	8	Sacramento sucker	Adult	MC Below Weir
		50+	Sacramento sucker	Juvenile	MC Above Weir
11/11/15	11:45	0	N/A	N/A	N/A
11/12/15	11:00	50	Sacramento sucker	Juvenile	MC Below Weir
		3	Prickly sculpin	Adult	MC Below Weir
		1	Chinook salmon	Adult	MC Below Weir
11/12/15	12:00	0	N/A	N/A	N/A
11/13/15	9:15	50+	Sacramento sucker	Juvenile	MC Below Weir
		10	Prickly sculpin	Adult	MC Below Weir
11/13/15	12:15	0	N/A	N/A	N/A
11/14/15	9:45	20	Sacramento sucker	Juvenile	MC Below Weir
		40	Sacramento pikeminnow	Juvenile	MC Below Weir
11/14/15	12:15	0	N/A	N/A	N/A
11/15/15	13:30	20	Sacramento sucker	Juvenile	MC Below Weir
		4	Sacramento pikeminnow	Juvenile	MC Below Weir
11/15/15	12:15	0	N/A	N/A	N/A

<sup>1</sup> N/A – Data not applicable.

<sup>2</sup> MC – Location is the main channel of the Tuolumne River; TR – Location is the tailrace channel.

<sup>3</sup> Survey not conducted due to heavy rain causing low visibility conditions.