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7.4 WATER QUALITY AFFECTED ENVIRONMENT

This section describes the water quality in the bypass and peaking reaches and reservoirs associated with the Middle Fork American River Project (MFP or Project). The information presented in this section includes: an overview of pertinent state and federal water quality objectives and standards; historical water quality data in the vicinity of the MFP; recent water quality data collected during MFP relicensing studies; and methylmercury fish tissue data collected from waterbodies associate with the MFP. Information on water temperature and dissolved oxygen in the bypass and peaking reaches and MFP reservoirs (profiles) are described in Section 7.5 – Fish and Aquatic Resources Affected Environment. Hydrologic conditions associated with the MFP are summarized in Section 7.3 – Water Use Affected Environment.

7.4.1 Information Sources

Existing information regarding water quality in the vicinity of the MFP was collected, reviewed, and evaluated. Relevant information used to prepare this section includes the following reports and data sources:

- Pre-Application Document (PAD) for the Middle Fork American River Project (PCWA 2007). The PAD includes a general description of water quality condition within the vicinity of the MFP, including historical water quality information.
- AQ 11 – Water Quality Technical Study Report (TSR) (2007) (AQ 11 – TSR) (PCWA 2010a; Supporting Document [SD] B). This report provides information on water quality in the bypass and peaking reaches and MFP reservoirs, as well as initial results of fish tissue methylmercury levels.
- AQ 11 – Contingency Water Quality TSR: Methylmercury Fish Tissue Sampling (2007–2009) (AQ 11 – Contingency TSR) (PCWA 2010b; SD B). Results of the methylmercury fish tissue sampling from 2007, 2008, and 2009 are summarized in this report.
- The United States Geological Survey (USGS) National Water Information System (NWIS) Online Database. This database provides water quality information that was collected by the USGS at sampling locations along the Middle Fork American River and tributaries in the general vicinity of the Auburn Dam site.
- The United States Environmental Protection Agency (USEPA) STOrage and RETrieval (STORET) Online Database. This database provides water quality information that was obtained by the United States Bureau of Reclamation (USBR) from sampling locations on the Middle Fork American River and the North Fork American River, and the California State Water Resources Control Board (State Water Board) from sampling locations located along the Middle Fork American River and tributaries.

- Documents prepared by the Sacramento Municipal Utility District (SMUD) in association with the relicensing of the Upper American River Project (UARP) (FERC Project No. 2101) (SMUD 2005). This report provides information on water quality conditions in the upper Rubicon River watershed area, including tributaries to rivers and reservoirs in the vicinity of the MFP.
- The 1998 and 2003 updates to the American River Watershed Sanitary Survey provides water quality condition information for the North Fork American River at the American River Pump Station.
- The Sacramento River Basin and San Joaquin River Basin Water Quality Control Plan (CVRWQCB, Fourth Edition revised February 2007). This document specified water quality objectives of allowable limits or levels of water quality constituents by the State Water Board for the waters in the Upper American River Watershed.
- California Toxics Rule (CTR) “Water Quality Standards: Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California” (Federal Register, 65 FR 31682, EPA 2000). This document provides toxicity standards for chemical constituents to protect aquatic life and human health.
- National Toxics Rule (NTR) “Water Quality Standards: Establishment of Numeric Criteria for Priority Toxic Pollutants” (Federal Register, 57 FR 60848, EPA 1992). This document provides toxicity standards for chemical constituents to protect aquatic life and human health.
- California’s Office of Environmental Health Hazard Assessment (OEHHA) guidelines (Cal/EPA 2005; Klasing and Brodberg 2006). These documents provide guidelines for methylmercury fish tissue analyses.

7.4.2 Pertinent State and Federal Water Quality Objectives and Standards

Existing water quality objectives for the physical, chemical, and bacterial constituents relevant to the MFP were identified by reviewing The Sacramento River Basin and San Joaquin River Basin Water Quality Control Plan (Basin Plan) (CVRWQCB, Fourth Edition revised February 2007), CTR “Water Quality Standards: Establishment of Numeric Criteria for Priority Toxic Pollutants for the State of California” (Federal Register, 65 FR 31682, EPA 2000), and the NTR “Water Quality Standards: Establishment of Numeric Criteria for Priority Toxic Pollutants” (Federal Register, 57 FR 60848, EPA 1992). The Basin Plan includes water quality objectives established by the State Water Board for waters in the Upper American River Watershed. The CTR and NTR, which consider background levels based on criteria that protect both human health and aquatic life, were also reviewed.

The State Water Board selects the most controlling (most stringent) of these values to determine compliance with the Clean Water Act. Table 7.4-1 presents the state and federal water quality objectives and standards pertinent to the MFP. The California’s

OEHHA guideline (Cal/EPA 2005; Klasing and Brodberg 2006) for methylmercury concentrations in fish tissue is a screening value of 0.08 mg/kg¹.

7.4.3 Historical Water Quality Data in the Vicinity of the MFP

Historical water quality data in the vicinity of the MFP are available from the USGS, USBR, State Water Board, and water quality studies performed for the relicensing of SMUD's UARP. Water quality data are also available from the American River Watershed Sanitary Surveys, which include water quality samples from the North Fork American River at Placer County Water Agency's (PCWA) American River Pump Station. These data are presented in detail in the MFP PAD (PCWA 2007). Recent water quality data collected as part of the MFP relicensing studies are discussed in the next section. A brief summary of pertinent data is provided below.

Review of the USGS data from the NWIS database indicated that generally all of the constituents analyzed complied with current regulatory standards with the exception of iron and manganese constituents (PCWA 2007). Elevated concentrations of iron and manganese were detected in water samples collected from the Middle Fork American River upstream of French Meadows Reservoir in 1979. Iron was reported in two samples at concentrations of 370 microgram per liter ($\mu\text{g/L}$) and 650 $\mu\text{g/L}$ and manganese was detected in three samples at concentration of 60 $\mu\text{g/L}$, 90 $\mu\text{g/L}$, and 140 $\mu\text{g/L}$. These concentrations are above the secondary Maximum Contaminant Level (MCL) taste and odor threshold levels for iron and manganese (300 $\mu\text{g/L}$ and 50 $\mu\text{g/L}$, respectively).

Review of the USBR data from the Middle Fork American River and the North Fork American River indicated that generally all of the constituents analyzed complied with current regulatory standards with the exception of a few pH measurements (7 out of 222 pH measurements) (PCWA 2007). Of these pH measurements, five measurements were below the 6.5 Basin Plan minimum criteria, ranging between 5.8 and 5 and two measurements were above the 8.5 Basin Plan maximum criteria, ranging between 8.6 and 9.2.

Review of the State Water Board data collected between 1960 and 1969 from waters in the vicinity of the MFP indicated that the sampling results comply with current regulatory standards (PCWA 2007).

¹A screening value is used to identify locations where methylmercury concentrations in fish may be harmful for consumption and further action is recommended by OEHHA, such as additional sampling or consumption advice.

Similarly, water quality data collected for the UARP in 2002 at the Rubicon River upstream of Hell Hole Reservoir and tributaries of the Rubicon River (South Fork Rubicon River and Gerle Creek) indicated that generally the constituents analyzed complied with current regulatory standards (SMUD 2005). The exceptions included: (1) the secondary MCL criteria for aluminum (200 µg/L) and iron (300 µg/L) were exceeded during some sampling events on the Rubicon River upstream of Hell Hole Reservoir; (2) dissolved metals (lead, copper, cadmium, silver and/or zinc) exceeded the acute and chronic toxicity criteria for aquatic life on the Rubicon River upstream of Hell Hole Reservoir and in the South Fork Rubicon River; and (3) pH measurements were not within the Basin Plan criteria range for some samples, with the majority of pH measurements less than 6.5.

7.4.4 Recent Water Quality Data Collected During MFP Relicensing Studies

As part of the AQ 11 – TSR (PCWA 2010a; SD B), a comprehensive water temperature monitoring program was conducted in the bypass and peaking reaches and reservoirs associated with the MFP in spring runoff and fall (base flow) 2007. The water quality field sampling program included: (1) *in-situ* measurements; (2) collection of water quality samples for laboratory chemical analysis, hereafter referred to as the general water quality sampling; (3) voluntary water quality sampling that enhanced the approach required in the FERC-approved AQ 11 – Technical Study Plan (TSP) (PCWA 2007); (4) coliform sampling; and (5) measurement of water temperature and dissolved oxygen (profiles) in Project reservoirs (discussed in Section 7.5 – Fish and Aquatic Resources Affected Environment). The voluntary water quality sampling included additional samples collected from immediately downstream of Hell Hole Dam and French Meadows Dam in the leakage channels and river locations upstream and downstream of the confluence of the leakage channel. The additional sites were added after rust color staining of the substrate and a precipitate was observed at select locations below Hell Hole Dam and French Meadows Dam. Water quality samples collected from the leakage and river channel were analyzed for hardness, dissolved metals (arsenic, cadmium, copper, iron, lead, manganese, nickel and total chromium), and total mercury.

A total of 33 parameters, which included a suite of *in-situ* measurements, general parameters, dissolved metals, and total mercury were analyzed at 39 locations on the bypass and peaking reaches in spring 2007 and 36 locations in fall 2007. The *in-situ* measurements included dissolved oxygen, pH, specific conductance, and water temperature. Samples were also collected and analyzed from unimpaired comparison reaches. In addition to these sampling locations, total coliform and fecal coliform were analyzed at 17 sites with substantial contact recreation (swimming, fishing, rafting, etc). A detailed description of the study methods used in the program and results are available in AQ 11 – TSR (PCWA 2010a; SD B).

Water quality results are summarized in (Tables 7.4-2 through 7.4-4). The laboratory results of the fecal coliform concentrations are provided in Tables 7.4-5. These results were compared to the most stringent water quality objectives identified in Table 7.4-1.

7.4.4.1 Reservoirs

Overall, water quality in MFP reservoirs is high and meets all applicable water standards and objectives. All *in-situ* measurements, general water quality parameters, and fecal coliform sampling met Basin Plan water quality objectives or were within the expected ranges for the ones that do not have established objectives (Tables 7-4.2 through 7.4-5).

7.4.4.2 Bypass and Peaking Reaches

Similarly, water quality in the bypass and peaking reaches associated with the MFP is high and met the Basin Plan, CTR, or NTR objectives, or were within the expected ranges for the criteria that do not have established objectives, with a few exceptions. These exceptions occurred in the bypass reaches as detailed below:

- The spring samples at the confluence of Duncan Creek and Middle Fork American River showed low dissolved oxygen. This was likely a sampling meter problem because these reaches are remote and are characterized by high gradients and relatively cool water temperatures, and data collected upstream and downstream of these sampling sites showed sufficient dissolved oxygen conditions. The field crew had extreme difficulty getting sampling gear to this remote and steep location;;
- Seepage water through the earth fill, French Meadows Dam (sampled from leakage channels) had high concentrations of manganese and iron and low pH and dissolved oxygen. The volume of seepage water is low and concentrations were diluted by instream flow releases and accretions downstream from the leakage channels (approximately 800 feet downstream);
- Total coliform exceeded the objective for fecal coliform at one location during the fall sampling event on North Fork Long Canyon Creek below the diversion (RM2.9); and
- Alkalinity concentrations were lower than water quality objectives at numerous locations in the vicinity of the MFP due to naturally low concentrations in the granitic watershed (Wetzel 2001).

7.4.5 Methylmercury in Fish Tissue

PCWA conducted a screening level assessment of methylmercury concentration in sport fish muscle tissue at French Meadows Reservoir, Hell Hole Reservoir, Middle Fork Interbay, Ralston Afterbay, and the Middle Fork American River at Otter Creek in 2007 as part of the MFP relicensing studies (PCWA 2010a; SD B). The field handling procedures used were consistent with those outlined by the California Environmental Protection Agency (Cal/EPA) (2005) and those used at the Department of Fish and Game Marine Pollution Studies Laboratory at Moss Landing (Method # MPSL-102a). Muscle tissue from individual fish (fillet with skin off and homogenized) and crayfish (tail

only) was analyzed for concentrations of methylmercury in accordance with the General Protocol for Sport Fish Sampling and Analysis developed by the Cal/EPA (2005) and with methods comparable to those used at the Department of Fish and Game Marine Pollution Studies Laboratory at Moss Landing (MPSL 2005). Methylmercury concentrations in the sampled fish and crayfish were compared to the California's OEHHA screening guidelines for methylmercury of 0.08 milligram per kilogram (mg/kg) (AQ 11 – TSR) (PCWA 2010a; SD B). Numerous fish tissue samples analyzed in 2007 exceeded this criterion (AQ 11 – TSR) (PCWA 2010a; SD B).

Sampling continued in 2008 and 2009 to collect crayfish and additional fish of legal/edible (AQ 11 – Contingency TSR [PCWA 2010b; SD B]). A total of 154 sport fish and crayfish from French Meadows Reservoir, Hell Hole Reservoir, Middle Fork Interbay, Ralston Afterbay, and the Middle Fork American River at Otter Creek were caught and analyzed in 2007–2009.

Methylmercury concentrations in at least one fish and crayfish from each location exceeded the OEHHA screening value of 0.08 mg/kg. In addition, approximately 55% of the fish analyzed had methylmercury concentrations that exceeded the screening value. The highest concentrations (up to 2.31 mg/kg) were measured in fish from Hell Hole Reservoir, where the largest fish were caught and 75% of the sampled fish weighed between one and five pounds. The lowest concentrations were found in rainbow trout from Ralston Afterbay. In general, the larger fish had higher methylmercury concentrations compared to the smaller fish. The results of the fish analyses are summarized by location in Table 7.4-6.

Fifteen of the 24 crayfish analyzed from Hell Hole and French Meadows reservoirs exceeded the screening value of 0.08 mg/kg. The highest concentrations were from Hell Hole Reservoir (up to 0.264 mg/kg). The results of the crayfish analyses are summarized in Table 7.4-6.

The Central Valley Regional Water Quality Control Board, Clean Water Act Section 305(b) and 303(d) Integrated Report for the Central Valley Region, includes the North Fork American River, Hell Hole Reservoir, and Oxbow Reservoir (Ralston Afterbay) on the 303(d) list of impaired waters for mercury (RWQCB 2009).

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TABLES

Table 7.4-1. Summary of Water Quality Analytical Tests, Including Laboratory Methods and Detection Limits, and Chemical Water Quality Objectives.

Analyte	Units ¹	Analysis Method ²	Method Detection Limit (MDL) ³	Practical Quantitation Limit (PQL) ⁴	State and Federal Criteria		
					Basin Plan ⁵	CA Toxics Rule (CTR) ⁶	National Toxics Rule (NTR) ⁷
In-Situ Measurements							
Oxygen, dissolved (DO)	mg/L	Water Quality Meter	Not Applicable	Not Applicable	7.0 ⁸	NS	NS ⁹
Secchi Depth	meter	Secchi Disc	Not Applicable	Applicable	NS	NS	NS
pH	unitless	Water Quality Meter	Not Applicable	Not Applicable	6.5 – 8.5 ¹⁰	NS	6.5 – 9.0 ¹¹
Water Temperature	Celsius	Water Quality Meter	Not Applicable	Not Applicable	NS	NS	NS
Specific Conductance	uS/cm at 25 °C	Water Quality Meter	Not Applicable	Not Applicable	NS	NS	NS
General Parameters							
Calcium	mg/L	EPA-200.7	Not Applicable	0.50	NS	NS	NS
Chloride	mg/L	EPA-300.0	Not Applicable	1.0	250 ¹²	NS	230/860 ¹³
Hardness (as CaCO ₃)	mg/L	SM2340B	Not Applicable	1.0	NS	NS	NS
Magnesium	ug/L	EPA-200.7	Not Applicable	100	NS	NS	NS
Nitrate/Nitrite (NO ₃)	mg/L	EPA-300.0	Not Applicable	0.20	1	NS	NS
Ammonia as N	mg/L	EPA-350.3	Not Applicable	0.1	1.5 ¹⁴	NS	(15)
Total Kjeldahl Nitrogen (TKN)	mg/L	EPA-351.2	Not Applicable	0.100	NS	NS	NS
Total Phosphorus	mg/L	EPA-365.3	Not Applicable	0.1	NS	NS	NS
Ortho-phosphate	mg/L	SM4500P-E	Not Applicable	0.010	NS	NS	NS
Potassium	mg/L	EPA-200.7	Not Applicable	2.0	NS	NS	NS
Sodium	mg/L	EPA-200.7	Not Applicable	0.50	NS	NS	NS
Sulfate (SO ₄)	mg/L	EPA-300.0	Not Applicable	0.50	250 ¹²	NS	NS
Total Dissolved Solids	mg/L	SM2540C	Not Applicable	10	500 ¹²	NS	NS
Total Suspended Solids	mg/L	SM2540D	Not Applicable	10	NS	NS	NS
Turbidity	NTU	EPA-180.1	Not Applicable	0.10	(16)	NS	NS
Organic Carbon, Total (TOC)	mg/L	SM5310B	Not Applicable	1.00	NS	NS	NS
Total Alkalinity (as CaCO ₃)	mg/L	SM2320B	Not Applicable	5.0	NS	NS	>20 ¹⁷
Metals-Dissolved							
Arsenic	ug/L	EPA-1368	0.06	0.20	10	150/340 ¹³	150/340 ¹³
Cadmium	ug/L	EPA-1368	0.004	0.01	5	Hardness Dependent ^{13, 18}	Hardness Dependent ^{13, 18}
Copper	mg/L	EPA-1368	0.00004	0.0002	1 ¹²	1.3 ²⁰ , Hardness Dependent ^{13, 18}	1.3 ²⁰ , Hardness Dependent ^{13, 18}
Iron	mg/L	EPA-1368	0.0014	0.005	0.3 ¹²	NS	1 ¹⁹
Lead	ug/L	EPA-1368	0.01	0.05	15	Hardness Dependent ^{13, 18}	Hardness Dependent ^{13, 18}
Manganese	ug/L	EPA-1368	0.01	0.05	50 ¹²	NS	NS
Nickel	ug/L	EPA-1368	0.04	0.20	100	610 ²⁰ , 4,600 ²¹ Hardness Dependent ^{13, 18}	610 ²⁰ , 4,600 ²¹ Hardness Dependent ^{13, 18}
Chromium-Total	ug/L	EPA-1368	0.03	0.15	50	NS	NS
Metals-Total							
Mercury	ug/L	EPA-1361e	0.00015	0.0004	NS	0.05	0.77/1.4 ¹³
Methyl mercury	mg/Kg fish	EPA-1630 mod./MSPL-102a	0.001-0.01	0.003-0.029	NS	NS	0.3 ²²
Hydrocarbons							
Methyl-tertiary-butyl Ether (MtBE)	ug/L	EPA-8260	Not Applicable	0.50	5 ¹²	NS	NS
Total Petroleum Hydrocarbons (as gasoline and as diesel)	ug/L	EPA-8020	Not Applicable	50	NS	NS	(23)
Oil and Grease	mg/L	EPA-1664	Not Applicable	4.8	(24)	NS	(25)

Table 7.4-1. Summary of Water Quality Analytical Tests, Including Laboratory Methods and Detection Limits, and Chemical Water Quality Objectives (continued).

Analyte	Units ¹	Analysis Method ²	Method Detection Limit (MDL) ³	Practical Quantitation Limit (PQL) ⁴	State and Federal Criteria		
					Basin Plan ⁵	CA Toxics Rule (CTR) ⁶	National Toxics Rule (NTR) ⁷
Bacteria							
Total Coliform (3x5, 6 hr hold)	MPN/100 mL ²⁶	EPA-SM9222B	Not Applicable	2	NS	NS	NS
Fecal Coliform (3x5)	MPN/100 mL ²⁶	EPA-SM922B	Not Applicable	2-1600	200	NS	NS

¹Units follow listed criterion standards. If standards were not available, laboratory supplied units were used. (Note:µg/L=ppb and mg/L=ppm)

²Analysis methods are periodically updated by the EPA. The most recent methods available were used for the water quality analysis.

³MDL: "the minimum concentration of a substance that can be reported with a 99% confidence that the analyte concentration is greater than zero." (40 CFR Part 136)

⁴PQL: "the lowest concentration of an analyte that can be reliably measured within specified limits of precision and accuracy during routine laboratory operating conditions." (50 FR 46906)

⁵The Basin Plan for the Sacramento and San Joaquin River Basins rely on California primary and secondary Maximum Concentration Level objectives as criteria for water quality to be used as a municipal and domestic supply for human consumption.

⁶California Toxics Rule (CTR) criteria are based primarily on USEPA standards developed under the Clean Water Act for human consumption of water and aquatic organisms with an adult risk for carcinogens estimated to be one in one million as contained in the Integrated Risk Information System (IRIS) as of October 1, 1996.

⁷The National Toxics Rule (NTR) criteria are based on USEPA standards developed under the Clean Water Act for human consumption of water and aquatic organisms with an adult risk for carcinogens estimated to be one in one million as contained in the IRIS as of October 1, 1996. These criteria are to be applied to all states not complying with the Clean Water Act section 303(c)(2)(B).

⁸For water designated as COLD.

⁹The water column concentration of 9.5 mg/L for a 7-day mean is recommended to achieve the required intergravel dissolved oxygen concentrations.

¹⁰pH shall not be depressed below 6.5 or raised greater than 8.5. Changes in normal ambient pH should not exceed 0.5.

¹¹Instantaneous maximum value. This limit has a range of values between the first and second numbers shown.

¹²The criteria listed are secondary Maximum Concentration Levels for California drinking water quality objectives that do not necessarily indicate a toxic amount of contaminate. Rather these standards dictate water quality objectives designed to preserve taste, odor, or appearance of drinking water.

¹³Freshwater Aquatic Life Protection, continuous concentration (4-day average)/maximum concentration (1-hour average).

¹⁴Taste and odor thres

¹⁵pH, temperature and life cycle dependent.

¹⁶Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits: where natural turbidity is between 0 and 5 NTU's, increases shall not exceed 1 NTU. Where natural turbidity is between 5 and 50 NTU's, increases shall not exceed 20%. Where natural turbidity is between 50 and 100 NTU's, increases shall not exceed 10 NTU's. Finally, where natural turbidity is greater than 100 NTU's, increases shall not exceed 10%.

¹⁷20 mg/L or more of CaCO₃ for freshwater aquatic life except where natural concentrations are less (USEPA's 1976 'Red Book'). The 'Red Book' also recommends that natural alkalinity not be reduced by more than 25%.

¹⁸Criterion is hardness dependent which is expressed as a function of hardness and decreases as hardness decreases. The actual criteria are calculated based on the hardness (as CaCO₃) of the sample water.

¹⁹NTR Freshwater Aquatic Life Protection, continuous concentration (4-day average).

²⁰CTR and NTR human health (30-day average); Drinking Water Sources (consumption of water an aquatic organisms).

²¹CTR human health (30-day average); Other Waters (aquatic organism consumption only).

²²This value is an Ambient Water Quality Criteria (AWQC) for methyl mercury and was published by the USEPA in a document titled Water Quality Criterion for the Protection of Human Health: Methyl mercury-Final (EPA-823-R-01-001, January 2001). This AWQC for total mercury published in 1980 and partially updated in 1997.

²³From Compilation of Water Quality Goals – TPH-diesel: taste and odor threshold and USEPA SNARL = 100 ug/L. TPH-gasoline: taste and odor threshold and proposed USEPA SNARL = 5 mg/L.

²⁴Waters shall not contain oils, greases, waxes, or other materials in concentrations that cause nuisance, result in a visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses.

²⁵For domestic water supply: Virtually free from oil and grease, particularly from the tastes and odors that emanate from petroleum products (USEPA's 1986 'Gold Book').

²⁶MPN: Most probable number of bacterial colonies per 100 mL of water.

Items in parentheses () are footnotes.

NS: no standard available

MPN: Most probable number of bacterial colonies per 100 mL of water.

Table 7.4-2. Summary of Analytical Results for Water Quality Samples Collected during the Spring 2007 Sampling Event.

The data in bold do not meet the most stringent state and federal criteria.

	Station Date	DC-1	DC-2	DC-3	MFAR-1	FM-1(S)	FM-1	FM-2(S)	FM-2	FM-3(S)	FM-3	MFAR-2	MFAR-3	MFAR-4	MFAR-5	IR-1	MFAR-6	MFAR-7	RA-1(S)	RA-1	MFAR-8	MFAR-9	MFAR-10	MFAR-11	NFAR-1		
		RM8.9	RM8.8	RM0.2	RM51.6	5/31/2007	5/31/2007	5/31/2007	5/31/2007	5/31/2007	5/31/2007	5/31/2007	RM 46.6	RM39.9	RM39.5	RM36.3	RM35.7	RM35.5	RM26.1	5/29/2007	5/29/2007	RM24.7	RM24.3	RM9.1	RM0.1	RM20.6	
	Time	9:45	10:40	11:00	11:40	9:30	8:40	10:00	10:40	13:15	12:15	12:30	12:30	12:00	9:25	10:10	8:50	8:00	12:30	10:40	14:00	13:30	15:50	15:10	14:30		
General Parameters	Units	PQL	WQ Criteria																								
Calcium	mg/L	0.5	NS	2.7	2.8	4.8	2.3	2.1	2.3	2.2	2.2	2.2	2.6	4.5	4.7	5.3	4.9	3.5	7.4	5.7	4.3	4.8	4.8	4.7	5.1	6	
Chloride	mg/L	1.0	250 ¹	ND	ND	1.1	ND	ND	ND	ND	ND	ND	1.3	1.2	1.2	1.1	1.1	1.2	1.7	1.2	1.5	1.8	1.5	1.6	1.5		
Hardness (as CaCO ₃)	mg/L	1.0	NS	9.5	9.8	16	8.2	7.5	8.1	7.8	7.9	7.8	9	15	15	17	16	12	23	18	14	16	16	17	18	21	
Magnesium	µg/L	100	NS	680	690	910	600	540	570	560	580	570	620	800	890	970	920	730	1200	1000	810	980	910	1200	1300	1500	
Nitrate/Nitrite (NO ₃)	mg/L	0.20	1 ¹	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Ammonia as N	mg/L	0.100	1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Total Kjeldahl Nitrogen (TKN)	mg/L	0.100	NS	4.2	8.4	0.56	3.1	1.4	2	1.1	2.5	78	5	7	0.56	0.56	3.9	1.1	0.56	2.8	1.4	1.7	0.56	0.56	0.84	0.56	
Total Phosphorus	mg/L	0.100	NS	ND	0.49	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.13	ND	ND	ND	ND	ND	ND	
Ortho-phosphate	mg/L	0.010	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Potassium	mg/L	0.20	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Sodium	mg/L	0.50	NS	1.3	1.3	1.5	1.2	1.2	1.2	1.2	1.2	1.2	1.3	1.9	1.8	1.8	1.8	1.5	2	2.3	1.9	1.9	2	1.8	1.7	1.8	
Sulfate (SO ₄)	mg/L	0.50	250 ¹	0.56	0.58	0.98	ND	ND	ND	ND	ND	ND	0.73	0.88	0.74	0.75	0.72	2.9	1.4	0.76	1.5	1.3	1.7	1.8	2		
Total Dissolved Solids	mg/L	10	500 ¹	32	24	30	30	40	44	40	44	38	40	28	50	38	46	34	24	44	48	26	36	50	38	60	38
Total Suspended Solids	mg/L	10	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Turbidity	NTU	0.10	(5)	ND	0.16	3.8	ND	1.1	1.1	1.1	1.2	0.78	0.6	0.44	1.2	0.13	0.86	2.2	0.44	0.12	0.41	1.2	0.38	0.15	0.27	0.44	0.53
Organic Carbon, Total (TOC)	mg/L	1.00	NS	ND	ND	ND	1.3	1	1.1	1.6	1.2	1.6	1.4	1.1	ND	ND	ND	ND	1.4	1.3	1.9	ND	ND	ND	ND	ND	
Total Alkalinity	mg/L	5.0	>20 ³	16	14	16	14	22	22	24	20	20	22	14	18	20	22	18	16	20	22	16	20	20	16	22	26
Metals-Dissolved																											
Arsenic	µg/L	0.20	10 ¹	0.060 ^U	0.060 ^U	0.060 ^U	0.090 ^B	0.130 ^B	0.120 ^B	0.130 ^B	0.110 ^B	0.110 ^B	0.120 ^B	0.130 ^B	0.120 ^B	0.090 ^B	0.100 ^B	0.090 ^B	0.170 ^B	0.230	0.220	0.200 ^B	0.170 ^B	0.170 ^B	0.220	0.240	0.450
Cadmium	µg/L	0.010	(6)	0.005 ^B	0.005 ^B	0.004 ^U	0.006 ^B	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U
Copper	mg/L	0.00020	(6)	0.00015 ^B	0.00016 ^B	0.000130 ^B	0.000160 ^B	0.000190 ^B	0.000220	0.000190 ^B	0.000180 ^B	0.000180 ^B	0.000180 ^B	0.000190 ^B	0.000140 ^B	0.000160 ^B	0.000180 ^B	0.000590	0.000240	0.000330	0.000340	0.000390	0.000310	0.000340	0.000410	0.00030	0.000430
Iron	mg/L	0.005	0.3 ¹	0.0014 ^U	0.019300	0.0028 ^B	0.005 ^B	0.0014 ^U	0.0022 ^B	0.0014 ^U	0.0014 ^U	0.00410 ^B	0.0014 ^U	0.135000	0.013100	0.008400	0.006600	0.005300	0.007400	0.00260 ^B	0.005400	0.008300	0.071600	0.022100	0.008200	0.007400	0.014600
Lead	µg/L	0.050	(6)	0.010 ^U	0.010 ^U	0.010 ^U	0.030 ^B	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U
Manganese	µg/L	0.05	50 ¹	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Nickel	µg/L	0.20	(6)	0.180	0.170	0.160 ^B	0.080 ^B	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.060 ^B	0.070 ^B	0.110 ^B	0.100 ^B	0.120 ^B	0.090 ^B	0.210	0.090 ^B	0.090 ^B	0.150 ^B	0.130 ^B	0.230	0.250	0.380
Chromium-Total	µg/L	0.15	50 ¹	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U
Metals-Total																											
Mercury	µg/L	0.0004	0.05 ²	0.000360 ^B	0.000270 ^B	0.0004 ^B	0.000430	0.000290 ^B	0.000860	0.000350 ^B	0.000420	0.000340 ^B	0.000610	0.000330 ^B	0.000350 ^B	0.000400 ^B	0.000530	0.000380 ^B	0.000560	0.000330 ^B	0.000340 ^B	0.000680	0.000370 ^B	0.000360 ^B	0.000850	0.000610	0.001480
Hydrocarbons																											
Methyl-tertiary-butyl Ether (MtBE)	µg/L	0.50	5 ¹																								
Total Petroleum Hydrocarbons (as gasoline and as diesel)	µg/L	50	NS																								
Oil and Grease	mg/L	4.8	NS																								
Bacteria																											
Total Coliform (3x5, 6 hr hold)	MPN/100 mL	2	NS	<2	<2	<2	4	<2	70	<2	<2	<2	23	<2	4	<2	<2	4	<2	23	4	6	2	13	30	2	7
Fecal Coliform (3x5)	MPN/100 mL	2-1600	200/100 ¹	<2	<2	<2	4	<2	70	<2	<2	<2	23	<2	4	<2	<2	4	<2	23	4	6	2	13	30	2	7

Table 7.4-2. Summary of Analytical Results for Water Quality Samples Collected during the Spring 2007 Sampling Event (continued).

	Station	RR-1	HH-1(S)	HH-1	HH-2(S)	HH-2	HH-3(S)	HH-3	RR-2	RR-3	SFRR-1	RR-4	RR-5	RR-6	RR-7	NFLC-1	NFLC-2	NFLC-3	SFLC-1	SFLC-2	SFLC-3	LCC-1	LCC-2		
		RM35.9	HH-1(S)	HH-1	HH-2(S)	HH-2	HH-3(S)	HH-3	RM30.2	RM 22.8	RM0.2	RM22.5	RM3.8	RM3.5	RM0.7	RM3.2	RM2.9	RM0.3	RM3.4	RM3.1	RM0.2	RM11.3	RM0.3		
		Date	5/24/2007	5/22/2007	5/22/2007	5/22/2007	5/22/2007	5/22/2007	5/22/2007	5/22/2007	5/23/2007	5/23/2007	5/23/2007	5/21/2007	5/21/2007	5/21/2007	5/15/2007	5/15/2007	5/15/2007	5/15/2007	5/15/2007	5/15/2007	5/15/2007	5/21/2007	
	Time	10:40	13:45	13:00	11:00	10:30	12:00	11:30	14:00	11:40	11:00	12:20	9:20	10:15	14:45	13:30	14:10	10:20	11:30	11:55	9:30	8:50	9:40		
General Parameters	Units	PQL	WQ Criteria																						
Calcium	mg/L	0.5	NS	2.5	3.2	2.9	2.8	2.9	2.9	2.8	2.8	4.4	2.4	3.6	5.2	5	5.3	2.5	2.6	2.9	2.7	3.2	2.6	3	4.7
Chloride	mg/L	1.0	250 ¹	1.2	ND	ND	ND	ND	ND	ND	5.3	ND	4.2	3.5	3	2.9	1	1.1	1.2	1	1	1.1	1	1.4	
Hardness (as CaCO ₃)	mg/L	1.0	NS	8.3	11	9.6	9.3	9.6	9.6	9.3	9.3	14	8.2	12	17	16	17	9.2	9.6	11	10	12	9.7	11	17
Magnesium	µg/L	100	NS	ND	670	570	560	580	570	560	550	730	530	640	900	950	1000	730	750	830	810	970	780	880	1200
Nitrate/Nitrite (NO ₃)	mg/L	0.20	1 ¹	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.2	ND	ND	ND	ND	ND	ND	ND	
Ammonia as N	mg/L	0.100	1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.62	ND	ND	ND	ND	ND	ND	ND	ND	ND	
Total Kjeldahl Nitrogen (TKN)	mg/L	0.100	NS	ND	ND	ND	0.56	2.2	1.1	0.84	0.56	ND	ND	ND	ND	0.84	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56	0.56
Total Phosphorus	mg/L	0.100	NS	ND	ND	ND	ND	ND	ND	ND	0.56	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ortho-phosphate	mg/L	0.010	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	mg/L	0.20	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	mg/L	0.50	NS	ND	1.7	1.4	1.3	1.4	1.4	1.4	1.4	3.8	1.5	3	2.9	2.9	2.9	1.8	1.9	2.3	1.7	2.1	1.9	2.3	2.6
Sulfate (SO ₄)	mg/L	0.50	250 ¹	ND	0.59	0.62	0.66	0.62	0.69	0.61	0.77	0.74	ND	0.66	1.3	1.1	1.3	ND	ND	ND	ND	ND	ND	0.67	
Total Dissolved Solids	mg/L	10	500 ¹	40	38	20	20	20	20	16	28	50	34	90	62	60	48	22	50	48	48	40	44	36	86
Total Suspended Solids	mg/L	10	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Turbidity	NTU	0.10	(5)	0.16	0.44	0.25	0.32	0.35	0.19	0.15	0.15	0.29	0.24	0.15	0.25	0.12	0.11	0.18	0.22	0.46	ND	ND	0.3	0.44	0.19
Organic Carbon, Total (TOC)	mg/L	1.00	NS	2.3	1.7	1.9	1.7	2	1.7	2.1	1.2	ND	1	ND	ND	ND	1.1	ND	ND	ND	ND	ND	ND	ND	
Total Alkalinity	mg/L	5.0	>20 ³	22	12	12	9.8	9.8	12	12	12	16	12	14	22	22	20	12	12	18	18	16	14	16	22
Metals-Dissolved																									
Arsenic	µg/L	0.20	10 ¹	0.330	0.220	0.200 ^B	0.190 ^B	0.210	0.200 ^B	0.210	0.210	0.190 ^B	0.060 ^U	0.170 ^B	0.160 ^B	0.140 ^B	0.160 ^B	0.060 ^U	0.070 ^B	0.150 ^B	0.080 ^B	0.090 ^B	0.140 ^B	0.140 ^B	0.160 ^B
Cadmium	µg/L	0.010	(6)	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U
Copper	mg/L	0.00020	(6)	0.000200 ^B	0.000270	0.000490	0.000270	0.000290	0.000250	0.000260	0.000310	0.000430	0.000130 ^B	0.000380	0.000360	0.000330	0.000350	0.000100 ^B	0.000090 ^B	0.000200 ^B	0.000100 ^B	0.000110 ^B	0.000130 ^B	0.000150 ^B	0.000200 ^B
Iron	mg/L	0.005	0.3 ¹	0.014700	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U
Lead	µg/L	0.050	(6)	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.050 ^B	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U
Manganese	µg/L	0.05	50 ¹	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Nickel	µg/L	0.20	(6)	0.090 ^B	0.100 ^B	0.100 ^B	0.100 ^B	0.100 ^B	0.090 ^B	0.090 ^B	0.090 ^B	0.100 ^B	0.100 ^B	0.090 ^B	0.130 ^B	0.120 ^B	0.140 ^B	0.040 ^U	0.040 ^U	0.050 ^B	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.100 ^B
Chromium-Total	µg/L	0.15	50 ¹	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U
Metals-Total																									
Mercury	µg/L	0.0004	0.05 ²	0.000480	0.000510	0.000650	0.000350 ^B	0.000680	0.000520	0.000740	0.000480	0.000370 ^B	0.000410	0.000320 ^B	0.000230 ^B	0.000240 ^B	0.000200 ^B	0.000610	0.000770	0.001010	0.000310 ^B	0.000430	0.000440	0.000750	0.000540
Hydrocarbons																									
Methyl-tertiary-butyl Ether (MTBE)	µg/L	0.50	5 ¹	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Petroleum Hydrocarbons (as gasoline and as diesel)	µg/L	50	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Oil and Grease	mg/L	4.8	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Bacteria																									
Total Coliform (3x5, 6 hr hold)	MPN/100 mL	2	NS	7	<2	<2	<2	<2	<2	<2	8	30	8	17	30	23	4	<2	<2	2	<2	4	2	2	17
Fecal Coliform (3x5)	MPN/100 mL	2-1600	200/100 ¹	7	<2	<2	<2	<2	<2	<2	8	30	8	17	30	23	4	<2	<2	2	<2	4	2	2	17

PQL: Practical Quantitation Limit: the lowest concentration of an analyte that can be reliably measured within specified limits of precision and accuracy during routine laboratory operation conditions.

ND: Not Detected above the PQL

NS: No standard

*Not sampled

¹Results are less than or equal to the method detection limit (MDL) and are considered 'non-detect'.

²Results are above the MDL and less than or equal to the practical quantitation limit (PQL) and should be considered estimates.

³Basin Plan criteria for the Sacramento and San Joaquin Rivers Basins.

⁴California Toxics Rule Criteria (CTR)

⁵National Toxics Rule Criteria (NTR)

⁶pH, temperature and life cycle dependent. See Table 11-11 in AQ 11 - TSR (PCWA 2010a) for criteria and results.

⁷Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits: where natural turbidity is between 0 and 5 NTU's, increases shall not exceed 1 NTU. Where natural turbidity is between 5 and 50 NTU's, increases shall not exceed 20%. Where natural turbidity is between 50 and 100 NTU's, increases shall not exceed 10 NTU's. Finally, where natural turbidity is greater than 100 NTU's, increases shall not exceed 10%.

⁸Criteria is hardness dependent which is expressed as a function of hardness and decreases as hardness decreases. The actual criteria are calculated based on the hardness (as CaCO₃) of the sample water. Refer to Table 11-12 in AQ 11 - TSR (PCWA 2010a) for sample site criteria and results.

Table 7.4-3. Summary of Analytical Results of Water Quality Sampling for Fall 2007.
The data in bold do not meet the most stringent state and federal criteria.

Station	Date	DC-1 RM8.9	DC-2 RM8.8	DC-3 RM0.2	MFAR-1 RM51.6	FM-1(S)	FM-1	FM-2(S)	FM-2	FM-3(S)	FM-3	MFAR-2 RM 46.6	MFAR-3 RM39.9	MFAR-4 RM39.5	MFAR-5 RM36.3	IR-1 RM35.7	MFAR-6 RM35.5	MFAR-7 RM26.1	RA-1(S)	RA-1																				
																					Time	9/25/2007	9/25/2007	*	10/3/2007	10/3/2007	10/3/2007	10/3/2007	10/3/2007	10/3/2007	10/3/2007	10/3/2007	*	*	9/24/2007	9/24/2007	9/24/2007	9/26/2007	9/26/2007	9/26/2007
																					15:30	16:00	*	12:00	9:30	9:00	11:00	10:15	13:00	12:30	11:25	*	*	11:15	10:40	11:50	13:15	10:15	10:40	
General Parameters	Units	PQL	WQ Criteria																																					
Calcium	mg/L	0.5	NS																																					
Chloride	mg/L	1.0	250 ¹																																					
Hardness (as CaCO ₃)	mg/L	1.0	NS																																					
Magnesium	µg/L	100	NS																																					
Nitrate/Nitrite (NO ₃)	mg/L	0.20	1 ¹																																					
Ammonia as N	mg/L	0.100	1.5																																					
Total Kjeldahl Nitrogen (TKN)	mg/L	0.100	NS																																					
Total Phosphorus	mg/L	0.100	NS																																					
Ortho-phosphate	mg/L	0.010	NS																																					
Potassium	mg/L	0.20	NS																																					
Sodium	mg/L	0.50	NS																																					
Sulfate (SO ₄)	mg/L	0.50	250 ¹																																					
Total Dissolved Solids	mg/L	10	500 ¹																																					
Total Suspended Solids	mg/L	10	NS																																					
Turbidity	NTU	0.10	(5)																																					
Organic Carbon, Total (TOC)	mg/L	1.00	NS																																					
Total Alkalinity	mg/L	5.0	>20 ³																																					
Metals-Dissolved																																								
Arsenic	µg/L	0.20	10 ¹																																					
Cadmium	µg/L	0.010	(6)																																					
Copper	mg/L	0.00020	(6)																																					
Iron	mg/L	0.005	0.3 ¹																																					
Lead	µg/L	0.050	(6)																																					
Manganese	µg/L	0.05	50 ¹																																					
Nickel	µg/L	0.20	(6)																																					
Chromium-Total	µg/L	0.15	50 ¹																																					
Metals-Total																																								
Mercury	µg/L	0.0004	0.052																																					
Hydrocarbons																																								
Methyl-tertiary-butyl Ether (MtBE)	µg/L	0.50	5 ¹																																					
Total Petroleum Hydrocarbons (as gasoline and as diesel)	µg/L	50	NS																																					
Oil and Grease	mg/L	4.8	NS																																					
Bacteria																																								
Total Coliform (3x5, 6 hr hold)	MPN/100 mL	2	NS																																					
Fecal Coliform (3x5)	MPN/100 mL	2-1600	200/100 ¹																																					

Table 7.4-3. Summary of Analytical Results of Water Quality Sampling for Fall 2007 (continued).

Station	Date																		
	MFAR-8 RM24.7	MFAR-9 RM24.3	MFAR-10 RM9.1	MFAR-11 RM0.1	NFAR-1 RM20.6	RR-1 RM35.9	HH-1(S)	HH-1	HH-2(S)	HH-2	HH-3(S)	HH-3	RR-2 RM30.2	RR-3 RM 22.8	SFRR-1 RM0.2	RR-4 RM22.5			
	9/26/2007	9/26/2007	9/24/2007	9/25/2007	9/25/2007	10/2/2007	10/1/2007	10/1/2007	10/1/2007	10/1/2007	10/2/2007	10/2/2007	10/3/2007	9/25/2007	9/25/2007	9/25/2007			
General Parameters	Units	PQL	WQ Criteria																
Calcium	mg/L	0.5	NS	4.2	3.8	4.2	5	7	7.9	2.8	2.9	2.8	2.8	2.9	3	4.3	2.1	4	
Chloride	mg/L	1.0	250 ¹	1.4	1.6	1.5	1.5	1.8	24	1	ND	ND	ND	ND	2.4	6.1	ND	5.1	
Hardness (as CaCO ₃)	mg/L	1.0	NS	14	12	14	17	24	25	9.3	9.7	9.3	9.3	9.6	9.5	9.8	13	6.6	12
Magnesium	µg/L	100	NS	810	680	940	1100	1700	1200	550	590	570	560	570	560	560	620	330	600
Nitrate/Nitrite (NO ₃)	mg/L	0.20	1 ¹	ND	ND	ND	ND	ND	0.29	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ammonia as N	mg/L	0.100	1.5	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.118	ND	ND
Total Kjeldahl Nitrogen (TKN)	mg/L	0.100	NS	ND	0.462	0.277	0.253	0.324	ND	ND	0.341	0.246	0.293	ND	ND	ND	0.524	0.601	0.328
Total Phosphorus	mg/L	0.100	NS	0.106	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ortho-phosphate	mg/L	0.010	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	mg/L	0.20	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	mg/L	0.50	NS	1.7	1.7	1.8	1.9	2.5	7.3	1.4	1.5	1.4	1.4	1.5	1.4	1.3	3.5	1.1	3.2
Sulfate (SO ₄)	mg/L	0.50	250 ¹	1.2	1	1.5	1.6	2.4	1.2	0.67	0.63	0.72	0.63	0.63	0.65	0.94	0.77	0.86	0.78
Total Dissolved Solids	mg/L	10	500 ¹	36	60	44	34	46	94	46	44	46	50	34	38	86	52	14	32
Total Suspended Solids	mg/L	10	NS	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Turbidity	NTU	0.10	(5)	0.56	0.46	ND	0.2	0.27	ND	0.21	0.34	0.3	0.36	0.34	0.3	0.54	0.13	ND	ND
Organic Carbon, Total (TOC)	mg/L	1.00	NS	ND	ND	1.3	ND	ND	ND	ND	1.47	ND	ND	ND	ND	ND	ND	ND	ND
Total Alkalinity	mg/L	5.0	>20 ³	17	17	18	22	28	17	15	15	14	15	14	15	12	17	11	14
Metals-Dissolved																			
Arsenic	µg/L	0.20	10 ¹	0.170 ^B	0.180 ^B	0.210	0.240	0.340	0.280	0.210	0.210	0.220	0.190 ^B	0.220	0.200 ^B	0.190 ^B	0.180 ^B	0.060 ^U	0.160 ^B
Cadmium	µg/L	0.010	(6)	0.013	0.004 ^U	0.004 ^U	0.004 ^U	0.005 ^B	0.008 ^B	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U
Copper	mg/L	0.00020	(6)	0.000340	0.000310	0.000320	0.000290	0.000330	0.000140	0.000270	0.000280	0.000260	0.000280	0.000280	0.000270	0.000510	0.000370	0.000130	0.000290
Iron	mg/L	0.005	0.3 ¹	0.049400	0.012700	0.016600	0.014900	0.021300	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.001400 ^U	0.015700	0.008800	0.006400	0.007700
Lead	µg/L	0.050	(6)	0.015 ^B	0.010 ^U	0.010 ^U	0.012 ^B	0.015 ^B	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.025 ^B	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U
Manganese	µg/L	0.05	50 ¹	16.700	7.720	3.560	1.120	1.290	0.847	0.871	0.391	0.354	0.479	1.190	0.696	44.900	0.188	0.334	0.114
Nickel	µg/L	0.20	(6)	0.015 ^B	0.040 ^U	0.130 ^B	0.140 ^B	0.140 ^B	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.050 ^B	0.040 ^U
Chromium-Total	µg/L	0.15	50 ¹	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.130 ^B	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U
Metals-Total																			
Mercury	µg/L	0.0004	0.052	0.000320 ^B	0.000350 ^B	0.000740	0.000540	0.000460	0.000150 ^U	0.000350 ^B	0.000430	0.000320 ^B	0.000400 ^B	0.000300 ^B	0.000280 ^B	0.001260	0.000150 ^U	0.000200 ^B	0.000230 ^B
Hydrocarbons																			
Methyl-tertiary-butyl Ether (MtBE)	µg/L	0.50	5 ¹							ND	ND	ND	ND	ND	ND				
Total Petroleum Hydrocarbons (as gasoline and as diesel)	µg/L	50	NS							ND	ND	ND	ND	ND	ND				
Oil and Grease	mg/L	4.8	NS							ND	ND	ND	ND	ND	ND				
Bacteria																			
Total Coliform (3x5, 6 hr hold)	MPN/100 mL	2	NS	7	6	240	50	140	8	2	13	2	<2	<2	<2	4	30	8	27
Fecal Coliform (3x5)	MPN/100 mL	2-1600	200/100 ¹	<2	<2	4	7	4	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2

Table 7.4-3. Summary of Analytical Results of Water Quality Sampling for Fall 2007 (continued).

				Station	RR-5 RM3.8	RR-6 RM3.5	RR-7 RM0.7	NFLC-1 RM3.2	NFLC-2 RM2.9	NFLC-3 RM0.3	SFLC-1 RM3.4	SFLC-2 RM3.1	SFLC-3 RM0.2	LCC-1 RM11.3	LCC-2 RM0.3
				Date	9/27/2007	9/27/2007	9/26/2007	10/2/2007	10/2/2007	10/2/2007	10/2/2007	10/2/2007	10/2/2007	10/2/2007	9/27/2007
				Time	9:45	10:20	13:45	12:10	12:30	11:10	13:00	13:20	11:20	10:00	10:00
General Parameters	Units	PQL	WQ Criteria												
Calcium	mg/L	0.5	NS		5	5.2	5.8	5.8	5.7	3.7	4.6	4.7	3.7	3.6	9.6
Chloride	mg/L	1.0	250 ¹		5.2	5.2	4.9	ND	ND	1.5	ND	ND	1.9	1.7	3.8
Hardness (as CaCO ₃)	mg/L	1.0	NS		16	17	19	21	21	13	17	18	13	13	33
Magnesium	µg/L	100	NS		870	930	1100	1700	1700	980	1400	1400	1000	970	2100
Nitrate/Nitrite (NO ₃)	mg/L	0.20	1 ¹		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Ammonia as N	mg/L	0.100	1.5		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Kjeldahl Nitrogen (TKN)	mg/L	0.100	NS		2.72	0.34	0.267	ND	ND	ND	ND	ND	0.123	0.108	0.32
Total Phosphorus	mg/L	0.100	NS		ND	ND	ND	ND	ND	ND	0.103	ND	ND	ND	ND
Ortho-phosphate	mg/L	0.010	NS		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Potassium	mg/L	0.20	NS		2	ND	2.2	ND	ND	ND	ND	ND	ND	ND	ND
Sodium	mg/L	0.50	NS		3	3.1	3.3	4	4	3.9	2.7	2.7	3.3	3.5	4.2
Sulfate (SO ₄)	mg/L	0.50	250 ¹		1.4	1.5	1.8	0.98	ND	0.63	ND	ND	1	0.88	2.1
Total Dissolved Solids	mg/L	10	500 ¹		38	46	50	64	92	84	84	66	66	66	72
Total Suspended Solids	mg/L	10	NS		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Turbidity	NTU	0.10	(5)		ND	0.1	0.27	ND	0.28	0.15	0.16	0.1	ND	0.2	ND
Organic Carbon, Total (TOC)	mg/L	1.00	NS		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Alkalinity	mg/L	5.0	>20 ³		19	20	22	35	32	24	29	28	23	23	40
Metals-Dissolved															
Arsenic	µg/L	0.20	10 ¹		0.120 ^B	0.130 ^B	0.130 ^B	0.150 ^B	0.140 ^B	0.260	0.100 ^B	0.110 ^B	0.180 ^B	0.210	0.210
Cadmium	µg/L	0.010	(6)		0.004 ^U	0.004 ^U	0.005 ^B	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U
Copper	mg/L	0.00020	(6)		0.000280	0.000270	0.000280	0.00013 ^B	0.00012 ^B	0.000400	0.000150	0.00012 ^B	0.0002 ^B	0.000300	0.000300
Iron	mg/L	0.005	0.3 ¹		0.001400 ^U	0.001400 ^U	0.013100	0.001400 ^U	0.007100	0.001400 ^U	0.001400 ^U	0.015200	0.001400 ^U	0.001400 ^U	0.001400 ^U
Lead	µg/L	0.050	(6)		0.010 ^U	0.011 ^B	0.064	0.010 ^U	0.010 ^U	0.048 ^B	0.011 ^B	0.010 ^U	0.010 ^U	0.015 ^B	0.015 ^B
Manganese	µg/L	0.05	50 ¹		0.183	0.203	0.404	0.097	21.200	0.716	1.020	6.700	0.434	0.703	0.636
Nickel	µg/L	0.20	(6)		0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U	0.040 ^U
Chromium-Total	µg/L	0.15	50 ¹		0.060 ^B	0.060 ^B	0.030 ^U	0.030 ^U	0.030 ^U	0.030 ^U	0.050 ^B	0.040 ^B	0.050 ^B	0.040 ^B	0.030 ^U
Metals-Total															
Mercury	µg/L	0.0004	0.052		0.000150 ^U	0.000170 ^B	0.000150 ^U	0.00050	0.001040	0.001230	0.000180 ^B	0.000260 ^B	0.000320 ^B	0.000770	0.000360
Hydrocarbons															
Methyl-tertiary-butyl Ether (MTBE)	µg/L	0.50	5 ¹												
Total Petroleum Hydrocarbons (as gasoline and as diesel)	µg/L	50	NS												
Oil and Grease	mg/L	4.8	NS												
Bacteria															
Total Coliform (3x5, 6 hr hold)	MPN/100 mL	2	NS		300	900	170	4	300	80	170	11	13	23	30
Fecal Coliform (3x5)	MPN/100 mL	2-1600	200/100 ¹		<2	<2	2	<2	300	2	170	2	2	8	2

PQL: Practical Quantitation Limit: the lowest concentration of an analyte that can be reliably measured within specified limits of precision and accuracy during routine laboratory operating conditions.

ND: Not detected above the PQL.

NS: No standard.

¹Sample location was not sampled during the fall sampling event due to dangerous access conditions.

²Results less than or equal to the method detection limit (MDL) and are considered 'non-detect'.

³Results are above the MDL and less than or equal to the practical quantitation limit (PQL) and should be considered estimates.

⁴Basin Plan criteria for the Sacramento and San Joaquin Rivers Basins.

⁵California Toxics Rule Criteria (CTR)

⁶National Toxics Rule Criteria (NTR)

⁷pH, temperature and life cycle dependent. See Table 11-14 for criteria and results.

⁸Increases in turbidity attributable to controllable water quality factors shall not exceed the following limits: where natural turbidity is between 0 and 5 NTU's, increases shall not exceed 1 NTU. Where natural turbidity is between 5 and 50 NTU's, increases shall not exceed 20%. Where natural turbidity is between 50 and

⁹Criteria are hardness dependent which is expressed as a function of hardness and decreases as hardness decreases. The actual criteria are calculated based on the hardness (as CaCO₃) of the sample water. Refer to Table 11-15 in AQ 11 - TSR (PCWA 2010a) for sample site criteria and results.

Table 7.4-4. Summary of Analytical Results for Voluntary Enhanced Water Quality Samples.

The data in bold do not meet the most stringent state and federal criteria.

Water Quality Parameters	Units	PQL	WQ Criteria	RR-2A	RR-2EC	RR-2DEC	FM-A	FM-B	FM-C	FM-D	FM-E
				5/22/2007	5/22/2007	5/22/2007	8/7/2007	8/7/2007	8/7/2007	8/7/2007	8/7/2007
Metals-Dissolved											
Arsenic	ug/L	0.20	10 ¹	0.210	0.060 ^U	0.230	2.760	5.540	4.800	0.160 ^B	0.120 ^B
Cadmium	ug/L	0.01	(3)	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U	0.004 ^U
Copper	mg/L	0.0002	(3)	0.000320	0.000300	0.000300	0.000110 ^B	0.000060 ^B	0.000060 ^B	0.000190 ^B	0.000180 ^B
Iron	mg/L	0.0014	0.3 ¹	0.001400 ^U	0.001400 ^U	0.001400 ^U	20.400	16.000	19.400	0.137	0.0348
Lead	ug/L	0.05	(3)	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U	0.010 ^U
Manganese	ug/L	0.05	50 ¹	NS	NS	NS	4040	3610	3860	62.600	22.000
Nickel	ug/L	0.20	(3)	0.080 ^B	0.300	0.090 ^B	0.390	0.310	0.240	0.070 ^B	0.060 ^B
Chromium-Total	ug/L	0.15	50 ¹	0.030 ^U	0.030 ^U	0.030 ^U	0.140 ^B	0.100 ^B	0.090 ^B	0.030 ^U	0.030 ^U
Metals-Total											
Mercury	ug/L	0.0004	0.05 ²	0.000540	0.000750	0.000630	0.000100 ^U	0.000100 ^U	0.000100 ^U	0.000410	0.000220 ^B

NS: Not sampled

^UResults are less than or equal to the method detection limit (MDL) and are considered 'non-detect'.^BResults are above the MDL and less than or equal to the practical quantitation limit (PQL) and should be considered estimates.¹Basin Plan criteria for the Sacramento and San Joaquin Rivers Basins.²California Toxics Rule Criteria³Criteria is hardness dependent which is expressed as a function of hardness and decreases as hardness decreases. The actual criteria are calculated based on the hardness (as CaCO₃) of the sample water. Refer below for sample site criteria and results.

Table 7.4-5. Summary of 30-Day, 5-Sample Fecal Coliform Results (MPN).

Sample ID	Location	GPS Coordinates		Sampling Period					Geometric Mean ¹
		UTM10_ NAD 83 X	UTM10_ NAD 83 Y	Week 1	Week 2	Week 4	Week 4	Week 5	
FC-1	Middle Fork American River below Ahart Campground	724066	4336067	4	13	2	11	<2	5 ²
FC-2	Middle Fork American River below Gates Group Campground	723679	4335535	8	2	<2	8	<2	3 ²
FC-3	Middle Fork American River below Coyote and Lewis Campground	723578	4334312	2	<2	13	2	<2	3 ²
FC-4	French Meadows Reservoir near McGuire Picnic Area	722892	4333328	<2	4	2	<2	<2	2 ²
FC-5	French Meadows Reservoir near McGuire Boat Ramp	722565	4333376	<2	<2	<2	<2	<2	<2
FC-6	French Meadows Reservoir near French Meadows Campground	722654	4332703	<2	<2	<2	2	<2	<2 ²
FC-7	French Meadows Reservoir near French Meadows Boat Ramp	722249	4332433	<2	<2	<2	<2	<2	<2
FC-8	French Meadows Reservoir near Poppy Campground	721628	4333151	<2	<2	<2	<2	2	<2 ²
FC-9 ³	Hell Hole Reservoir near Upper Hell Hole Reservoir Campground	728501	4329059	23	30	17	4	8	13
FC-10	Hell Hole Reservoir near Hell Hole Boat Ramp	723737	4326842	<2	<2	<2	2	<2	<2 ²
FC-11 ³	South Fork Long Canyon Creek above Big Meadows Campground	722744	4328540	4	7	30	130	23	19
FC-12	South Fork Long Canyon Creek below Big Meadows Campground	722119	4328056	<2	<2	<2	2	<2	<2 ²
FC-13	South Fork Long Canyon Creek above Middle Meadows Campground	719274	4325849	2	80	50	80	17	26
FC-14	South Fork Long Canyon Creek below Middle Meadows Campground	718907	4325560	8	13	8	23	22	13
FC-15	Ralston Afterbay near Ralston Picnic Area	696326	4319720	110	<2	4	1600	17	30 ²
FC-16	Middle Fork American River below Oxbow Powerhouse (Horseshoe Bar Area)	695159	4320291	2	<2	<2	<2	<2	<2 ²
FC-17	Middle Fork American River below the Drivers Flat Road Camping and Rafting Take-out	679156	4314631	13	30	13	4	11	12

MPN: Most Probable Number of Bacterial colonies per 100 mL of water.

Criteria: Geometric mean of 5 samples within a 30-day period shall not exceed a geometric mean of 200 MPN/100 mL, nor shall >10% of total samples exceed 400/100mL.

¹Geometric Mean: nth root of the product of 'n' numbers.

²Values of '<2' were changed to '2' for the calculation of the geometric mean to represent the maximum geometric mean possible.

³Sampling location was adjusted during the first week of sampling and a sample was not collected. A sample was collected at this site for 5 subsequent weeks.

Table 7.4-6 Average Methylmercury Concentrations (mg/kg Sampling Location and Species¹).

A bold number indicates that the screening level criteria of 0.08 mg/kg were exceeded (based on Cal EPA 2005 and Klasing and Brodberg 2006).

Species	French Meadows Reservoir	Hell Hole Reservoir	Middle Fork American River near Otter Creek	Middle Fork Interbay	Ralston Afterbay	Species Average
Fish Species						
Brown Trout (No.)	0.211 (12)	1.032 (12)	0.126 (10)	0.079 (12)	0.083 (12)	0.312 (58)
Lake Trout (No.)	-	0.57 (6)	-	-	-	0.57 (6)
Rainbow Trout (No.)	0.042 (9)	0.049 (1)	0.049 (11)	0.059 (9)	0.037 (7)	0.047 (37)
Kokanee (No.)	-	0.167 (12)	-	-	-	0.167 (12)
Sacramento Pikeminnow (No.)	-	-	-	-	0.247 (4)	0.247 (4)
Fish Average	0.139 (21)	0.576 (31)	0.085 (21)	0.07 (21)	0.097 (23)	0.225 (177)
	-21	-31	-21	-21	-23	-117
Crayfish						
Crayfish (No.)	0.072 (12)	0.223 (12)	-	-	-	0.148 (24)

¹Only includes fish that were larger than the minimum size limits (see Table AQ 11-2 in AQ 11- Contingency TSR 2007-2009 [PCWA 2010b; SD B]).