WATER QUALITY ASSESSMENT
STUDY REPORT
DON PEDRO PROJECT
FERC NO. 2299



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MID
Modesto Irrigation District

Prepared for:
Turlock Irrigation District – Turlock, California
Modesto Irrigation District – Modesto, California

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Water Quality Assessment
Study Report

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ac .....acres

ACEC.....Area of Critical Environmental Concern

AF .....acre-feet

ACOE.....U.S. Army Corps of Engineers

ADA.....Americans with Disabilities Act

ALJ.....Administrative Law Judge

APE.....Area of Potential Effect

ARMR.....Archaeological Resource Management Report

AWQC .....Ambient Water Quality Criteria

BA.....Biological Assessment

BDCP .....Bay-Delta Conservation Plan

BLM.....U.S. Department of the Interior, Bureau of Land Management

BLM-S .....Bureau of Land Management – Sensitive Species

BMI.....Benthic macroinvertebrates

BMP .....Best Management Practices

BO.....Biological Opinion

CalEPPC .....California Exotic Pest Plant Council

CalSPA.....California Sports Fisherman Association

CAS.....California Academy of Sciences

CCC.....Criterion Continuous Concentrations

CCIC .....Central California Information Center

CCSF.....City and County of San Francisco

CCVHJV .....California Central Valley Habitat Joint Venture

CD.....Compact Disc

CDBW.....California Department of Boating and Waterways

CDEC.....California Data Exchange Center

CDFA.....California Department of Food and Agriculture

CDFG.....California Department of Fish and Game (as of January 2013, Department of Fish and Wildlife)

CDMG.....California Division of Mines and Geology

CDOF.....California Department of Finance

CDPH.....California Department of Public Health
CDPR.....California Department of Parks and Recreation
CDSOD.....California Division of Safety of Dams
CDWR.....California Department of Water Resources
CE .....California Endangered Species
CEII.....Critical Energy Infrastructure Information
CEQA.....California Environmental Quality Act
CESA .....California Endangered Species Act
CFR.....Code of Federal Regulations
cfs.....cubic feet per second
CGS.....California Geological Survey
CMAP .....California Monitoring and Assessment Program
CMC.....Criterion Maximum Concentrations
CNDDB.....California Natural Diversity Database
CNPS.....California Native Plant Society
CORP .....California Outdoor Recreation Plan
CPUE .....Catch Per Unit Effort
CRAM.....California Rapid Assessment Method
CRLF.....California Red-Legged Frog
CRRF .....California Rivers Restoration Fund
CSAS.....Central Sierra Audubon Society
CSBP.....California Stream Bioassessment Procedure
CT .....California Threatened Species
CTR.....California Toxics Rule
CTS .....California Tiger Salamander
CVRWQCB .....Central Valley Regional Water Quality Control Board
CWA .....Clean Water Act
CWHR.....California Wildlife Habitat Relationship
Districts.....Turlock Irrigation District and Modesto Irrigation District
DLA .....Draft License Application
DO.....Dissolved Oxygen
DPRA.....Don Pedro Recreation Agency
DPS .....Distinct Population Segment

EA .....Environmental Assessment
EC .....Electrical Conductivity
EFH.....Essential Fish Habitat
EIR .....Environmental Impact Report
EIS.....Environmental Impact Statement
EPA.....U.S. Environmental Protection Agency
ESA.....Federal Endangered Species Act
ESRCD.....East Stanislaus Resource Conservation District
ESU .....Evolutionary Significant Unit
EWUA.....Effective Weighted Useable Area
FERC.....Federal Energy Regulatory Commission
FFS.....Foothills Fault System
FL.....Fork length
FMU.....Fire Management Unit
FOT.....Friends of the Tuolumne
FPC .....Federal Power Commission
ft/mi.....feet per mile
FWCA.....Fish and Wildlife Coordination Act
FYLF.....Foothill Yellow-Legged Frog
g.....grams
GIS .....Geographic Information System
GLO .....General Land Office
GPS .....Global Positioning System
HCP.....Habitat Conservation Plan
HHWP.....Hetch Hetchy Water and Power
HORB .....Head of Old River Barrier
HPMP.....Historic Properties Management Plan
ILP.....Integrated Licensing Process
ISR .....Initial Study Report
ITA.....Indian Trust Assets
kV.....kilovolt
m .....meters
M&I.....Municipal and Industrial

MCL.....Maximum Contaminant Level
mg/kg .....milligrams/kilogram
mg/L.....milligrams per liter
mgd .....million gallons per day
mi .....miles
mi^2.....square miles
MID.....Modesto Irrigation District
MOU .....Memorandum of Understanding
MPN.....Most Probable Number
MSCS.....Multi-Species Conservation Strategy
msl.....mean sea level
MVA .....Megavolt Ampere
MW .....megawatt
MWh .....megawatt hour
mya.....million years ago
NAE .....National Academy of Engineering
NAHC .....Native American Heritage Commission
NAS.....National Academy of Sciences
NAVD 88.....North American Vertical Datum of 1988
NAWQA .....National Water Quality Assessment
NCCP .....Natural Community Conservation Plan
NEPA .....National Environmental Policy Act
ng/g .....nanograms per gram
NGOs .....Non-Governmental Organizations
NHI .....Natural Heritage Institute
NHPA.....National Historic Preservation Act
NISC .....National Invasive Species Council
NMFS.....National Marine Fisheries Service
NOAA .....National Oceanic and Atmospheric Administration
NOI .....Notice of Intent
NPS .....U.S. Department of the Interior, National Park Service
NRCS .....National Resource Conservation Service
NRHP.....National Register of Historic Places

NRI.....Nationwide Rivers Inventory
NTU .....Nephelometric Turbidity Unit
NWI.....National Wetland Inventory
NWIS .....National Water Information System
NWR .....National Wildlife Refuge
NGVD 29.....National Geodetic Vertical Datum of 1929
O&M .....operation and maintenance
OEHHA.....Office of Environmental Health Hazard Assessment
ORV .....Outstanding Remarkable Value
PAD.....Pre-Application Document
PDO.....Pacific Decadal Oscillation
PEIR.....Program Environmental Impact Report
PGA.....Peak Ground Acceleration
PHG.....Public Health Goal
PM&E .....Protection, Mitigation and Enhancement
PMF.....Probable Maximum Flood
POAOR.....Public Opinions and Attitudes in Outdoor Recreation
ppb.....parts per billion
ppm .....parts per million
PSP.....Proposed Study Plan
QA.....Quality Assurance
QC.....Quality Control
RA.....Recreation Area
RBP.....Rapid Bioassessment Protocol
Reclamation .....U.S. Department of the Interior, Bureau of Reclamation
RM .....River Mile
RMP .....Resource Management Plan
RP.....Relicensing Participant
RSP .....Revised Study Plan
RST .....Rotary Screw Trap
RWF.....Resource-Specific Work Groups
RWG .....Resource Work Group
RWQCB.....Regional Water Quality Control Board

SC.....State candidate for listing under CESA

SCD.....State candidate for delisting under CESA

SCE .....State candidate for listing as endangered under CESA

SCT .....State candidate for listing as threatened under CESA

SD1 .....Scoping Document 1

SD2 .....Scoping Document 2

SE.....State Endangered Species under the CESA

SFP.....State Fully Protected Species under CESA

SFPUC .....San Francisco Public Utilities Commission

SHPO .....State Historic Preservation Office

SJRA .....San Joaquin River Agreement

SJRGA .....San Joaquin River Group Authority

SJTA .....San Joaquin River Tributaries Authority

SM.....Standard Methods

SPD .....Study Plan Determination

SRA.....State Recreation Area

SRMA .....Special Recreation Management Area or Sierra Resource Management Area (as per use)

SRMP.....Sierra Resource Management Plan

SRP .....Special Run Pools

SSC .....State species of special concern

ST.....California Threatened Species under the CESA

STORET .....Storage and Retrieval

su.....standard unit

SWAMP.....Surface Water Ambient Monitoring Program

SWE .....Snow-Water Equivalent

SWRCB.....State Water Resources Control Board

TAC.....Technical Advisory Committee

TAF .....thousand acre-feet

TCP .....Traditional Cultural Properties

TDS .....Total Dissolved Solids

TID.....Turlock Irrigation District

TMDL .....Total Maximum Daily Load

TOC.....Total Organic Carbon
TPH.....Total Petroleum Hydrocarbon
TRT.....Tuolumne River Trust
TRTAC .....Tuolumne River Technical Advisory Committee
UC.....University of California
USDA.....U.S. Department of Agriculture
USDOC.....U.S. Department of Commerce
USDOI .....U.S. Department of the Interior
USFS.....U.S. Department of Agriculture, Forest Service
USFWS .....U.S. Department of the Interior, Fish and Wildlife Service
USGS .....U.S. Department of the Interior, Geological Survey
USR.....Updated Study Report
UTM.....Universal Transverse Mercator
VAMP.....Vernalis Adaptive Management Plan
VELB.....Valley Elderberry Longhorn Beetle
VRM .....Visual Resource Management
WPT.....Western Pond Turtle
WSA.....Wilderness Study Area
WSIP.....Water System Improvement Program
WWTP .....Wastewater Treatment Plant
WY.....water year
µS/cm.....microSeimens per centimeter

1.0 INTRODUCTION

1.1 General Description of the Don Pedro Project

Turlock Irrigation District (TID) and Modesto Irrigation District (MID) (collectively, the Districts) are the co-licensees of the 168-megawatt (MW) Don Pedro Project (Project) located on the Tuolumne River in western Tuolumne County in the Central Valley region of California. The Don Pedro Dam is located at river mile (RM) 54.8 and the Don Pedro Reservoir formed by the dam extends 24-miles upstream at the normal maximum water surface elevation of 830 ft above mean sea level (msl; NGVD 29). At elevation 830 ft, the reservoir stores over 2,000,000 acre-feet (AF) of water and has a surface area slightly less than 13,000 acres (ac). The watershed above Don Pedro Dam is approximately 1,533 square miles (mi^2).

Both TID and MID are local public agencies authorized under the laws of the State of California to provide water supply for irrigation and municipal and industrial (M&I) uses and to provide retail electric service. The Project serves many purposes including providing water storage for the beneficial use of irrigation of over 200,000 ac of prime Central Valley farmland and for the use of M&I customers in the City of Modesto (population 210,000). Consistent with the requirements of the Raker Act passed by Congress in 1913 and agreements between the Districts and City and County of San Francisco (CCSF), the Project reservoir also includes a "water bank" of up to 570,000 AF of storage. CCSF may use the water bank to more efficiently manage the water supply from its Hetch Hetchy water system while meeting the senior water rights of the Districts. CCSF's "water bank" within Don Pedro Reservoir provides significant benefits for its 2.6 million customers in the San Francisco Bay Area.

The Project also provides storage for flood management purposes in the Tuolumne and San Joaquin rivers in coordination with the U.S. Army Corps of Engineers (ACOE). Other important uses supported by the Project are recreation, protection of the anadromous fisheries in the lower Tuolumne River, and hydropower generation.

The Project Boundary extends from approximately one mile downstream of the dam to approximately RM 79 upstream of the dam. Upstream of the dam, the Project Boundary runs generally along the 855 ft contour interval which corresponds to the top of the Don Pedro Dam. The Project Boundary encompasses approximately 18,370 ac with 78 percent of the lands owned jointly by the Districts and the remaining 22 percent (approximately 4,000 ac) is owned by the United States and managed as a part of the U.S. Bureau of Land Management (BLM) Sierra Resource Management Area.

The primary Project facilities include the 580-foot-high Don Pedro Dam and Reservoir completed in 1971; a four-unit powerhouse situated at the base of the dam; related facilities including the Project spillway, outlet works, and switchyard; four dikes (Gasburg Creek Dike and Dikes A, B, and C); and three developed recreational facilities (Fleming Meadows, Blue Oaks, and Moccasin Point Recreation Areas). The location of the Project and its primary facilities is shown in Figure 1.1-1.

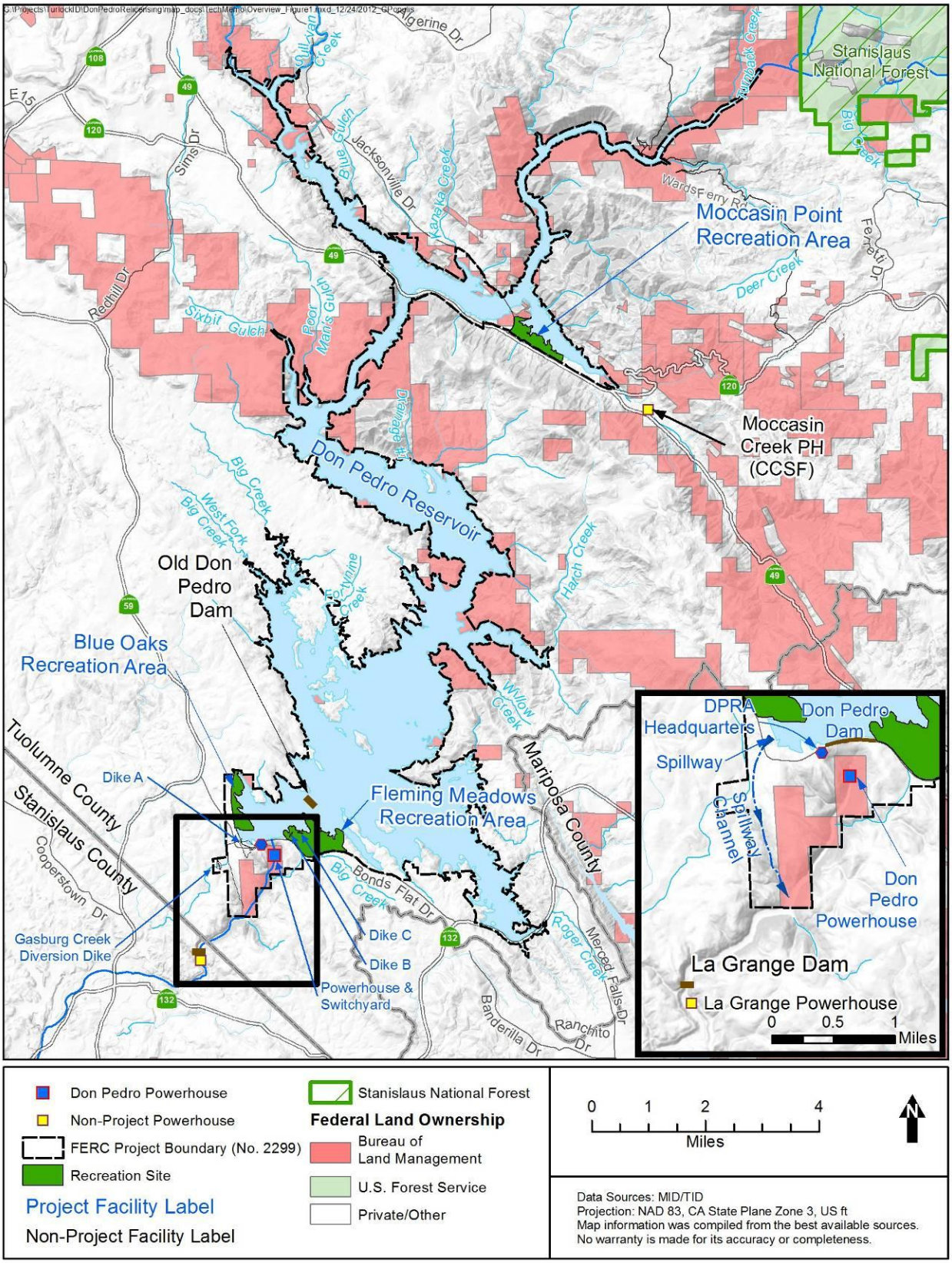

Figure 1.1-1. Don Pedro Project location.

1.2 Relicensing Process

The current FERC license for the Project expires on April 30, 2016, and the Districts will apply for a new license no later than April 30, 2014. The Districts began the relicensing process by filing a Notice of Intent and Pre-Application Document (PAD) with FERC on February 10, 2011, following the regulations governing the Integrated Licensing Process (ILP). The Districts' PAD included descriptions of the Project facilities, operations, license requirements, and Project lands as well as a summary of the extensive existing information available on Project area resources. The PAD also included ten draft study plans describing a subset of the Districts' proposed relicensing studies. The Districts then convened a series of Resource Work Group meetings, engaging agencies and other relicensing participants in a collaborative study plan development process culminating in the Districts' Proposed Study Plan (PSP) and Revised Study Plan (RSP) filings to FERC on July 25, 2011 and November 22, 2011, respectively.

On December 22, 2011, FERC issued its Study Plan Determination (SPD) for the Project, approving, or approving with modifications, 34 studies proposed in the RSP that addressed Cultural and Historical Resources, Recreational Resources, Terrestrial Resources, and Water and Aquatic Resources. In addition, as required by the SPD, the Districts filed three new study plans (W&AR-18, W&AR-19, and W&AR-20) on February 28, 2012 and one modified study plan (W&AR-12) on April 6, 2012. Prior to filing these plans with FERC, the Districts consulted with relicensing participants on drafts of the plans. FERC approved or approved with modifications these four studies on July 25, 2012.

Following the SPD, a total of seven studies (and associated study elements) that were either not adopted in the SPD, or were adopted with modifications, formed the basis of Study Dispute proceedings. In accordance with the ILP, FERC convened a Dispute Resolution Panel on April 17, 2012 and the Panel issued its findings on May 4, 2012. On May 24, 2012, the Director of FERC issued his Formal Study Dispute Determination, with additional clarifications related to the Formal Study Dispute Determination issued on August 17, 2012.

This study report describes the objectives, methods, and results of the Water Quality Assessment Study (W&AR-01) as implemented by the Districts in accordance with FERC's SPD and subsequent study modifications and clarifications. Documents relating to the Project relicensing are publicly available on the Districts' relicensing website at www.donpedro-relicensing.com.

1.3 Study Plan

The ongoing operation and maintenance (O&M) of the Project may affect water quality. The effect may be direct (e.g., release of a pollutant from a Project facility), indirect (e.g., due to public recreation), or cumulative (i.e., combined effect of a Project-related activity with a non-Project activity).

In accordance with the FERC-approved study plan, Water Quality Assessment (W&AR-01), the Districts investigated the quality of surface water potentially affected by the Project, including water within Don Pedro Reservoir and in the Tuolumne River immediately downstream of Don Pedro Dam. A sample was collected downstream of La Grange Dam. Background conditions

were also sampled, by sampling the Tuolumne River upstream of the Project. Woods Creek and Sullivan Creek, both tributaries to Don Pedro Reservoir, were dry during the sampling period and were not sampled.

The water quality investigation consisted of two elements: (1) a general water quality element and (2) a recreation-related water quality element. Each element of the study was conducted at the time and place where Project effects were expected to be most pronounced, if they occur. During the 2012 late summer season, surface water samples were collected from five locations upstream, within, and downstream of the Project and samples were analyzed for 55 general physical water quality parameters and chemical constituents. In-reservoir sites were sampled at two depths: within 1-2 meters of the reservoir's surface and within 1-2 meters of the bottom. During the 30 days surrounding and including the 2012 Independence Day holiday, five episodes of surface water samples were collected adjacent to 12 reservoir recreation sites and analyzed for bacteria and hydrocarbons.

This study addresses the following issues identified in Section 6.0 of the PAD:

- **Issue:** Effects of the Project and Project recreation on water quality (excluding water temperature) and compliance with the Central Valley Regional Water Quality Control Board's (CVRWQCB) Water Quality Control Plan for the Sacramento River and San Joaquin River Basins, fourth edition (Basin Plan).
- **Issue:** Effect of the Project on compliance with the State Water Resources Control Board's (SWRCB) Clean Water Act (CWA) Section 303(d) List of Total Maximum Daily Load (TMDL) Priority Schedule.
- **Issue:** Water temperature modeling downstream of Don Pedro Reservoir is the subject of the Lower Tuolumne River Temperature Model Study Plan (W&AR-16).

2.0 STUDY GOALS AND OBJECTIVES

This technical memorandum presents the results for the Water Quality Assessment consistent with the requirements set forth in FERC's Study Plan Determination. The goals of this study were (1) to characterize existing water quality conditions in Don Pedro Reservoir and the lower Tuolumne River, as measured at the point of discharge from the Project and (2) to determine the water's consistency with the CVRWCB's Basin Plan Objectives (CVRWQCB 1998). The objective of the study was to determine whether or not Project operations and maintenance (O&M) activities are in compliance with Basin Plan objectives.

3.0 STUDY AREA

The study area includes the Project Boundary and tributaries upstream of Don Pedro Reservoir, surface waters within the Don Pedro Reservoir, and the Tuolumne River immediately below Don Pedro Dam (Figure 3.0-1). Although no point-source discharges occur in or immediately downstream of the reservoir, the study area encompasses recreation-related facilities and Project O&M activities. Water quality just downstream of La Grange Dam, was also assessed .

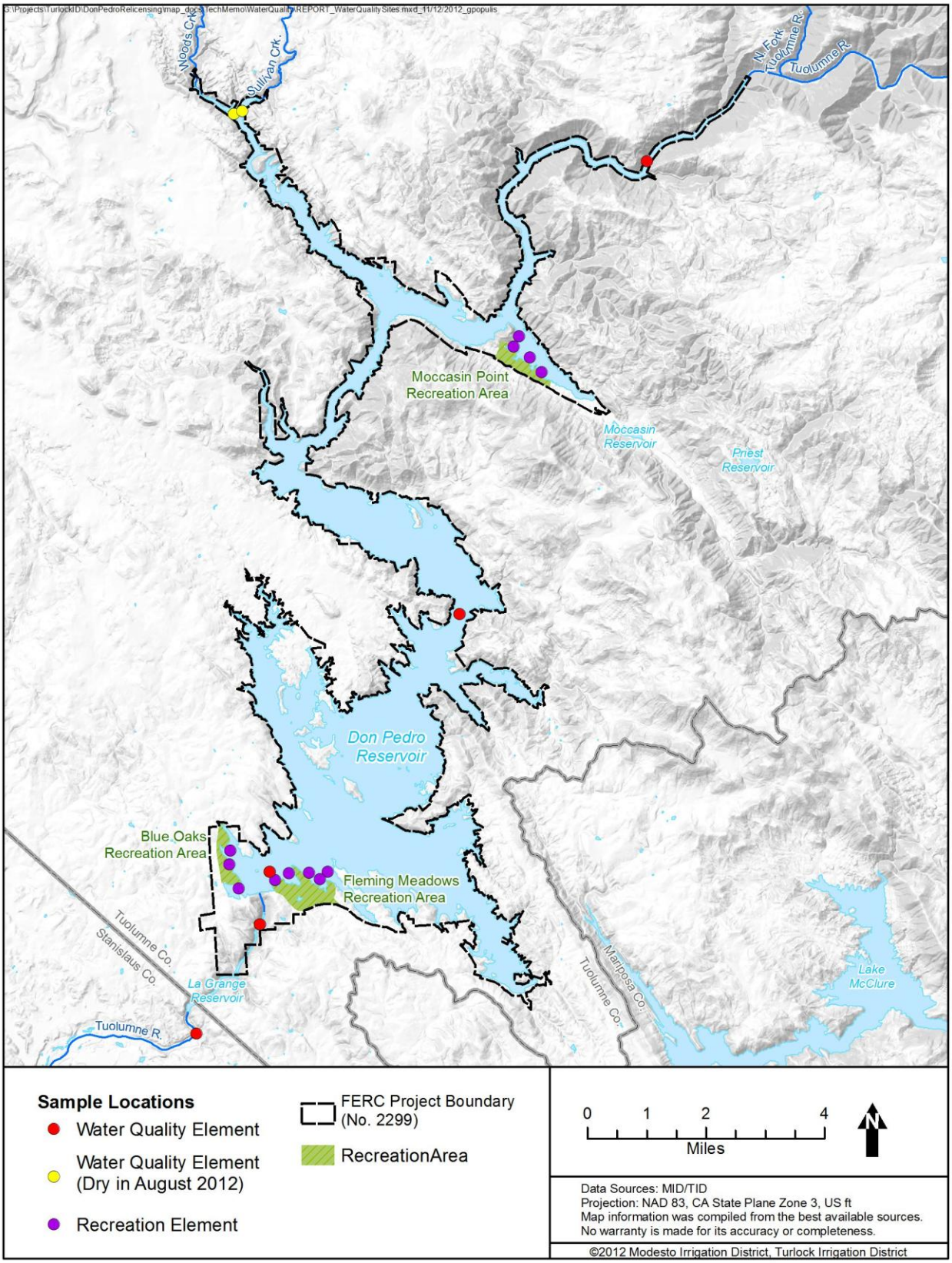

Figure 3.0-1. Study area.

4.0 METHODOLOGY

In 2012, the Districts investigated the quality of surface water potentially affected by Project O&M and recreation activities during periods when water quality effects are expected to be most pronounced, if they occur. The study consisted of two elements: a Water Chemistry Element and a Recreation Activity Element. Each is described below.

4.1 Water Chemistry Element

Water quality samples were collected between August 22 and 24, 2012, during summer low-inflow and high temperature conditions.

4.1.1 Sample Locations

The FERC-approved sampling plan called for sampling the locations listed in Table 4.1-1 and shown in Figure 3.0-1. Sampling occurred upstream, within, and downstream of Don Pedro Reservoir.

Table 4.1-1. Reservoir and stream reach sample locations.

Reservoir/Stream Reach	Sample Depth	Location
Woods Creek[1]	Just below surface	Just prior to entering Don Pedro Reservoir
Sullivan Creek[1]	Just below surface	Just prior to entering Don Pedro Reservoir
Tuolumne River above Don Pedro Reservoir	Just below surface	Upstream of Ward's Ferry Bridge at the first riffle
Don Pedro Reservoir	One meter below surface	Between Upper and Middle Bays (co-located with current CDFG temperature profile location)
	One meter above bottom	
Don Pedro Reservoir - near Dam	One meter below surface	At deepest point in the reservoir near the dam (co-located with current CDFG temperature profile location)
	One meter above bottom	
Tuolumne River just below Don Pedro Dam	Just below surface	Below Don Pedro powerhouse (co-located with current TID/MID water quality sonde)
Tuolumne River below La Grange Dam	Just below surface	Below La Grange at USGS gage USGS Gage 11289651 (about 0.5 miles below the dam)

[1] Location was eithe dry of had no flowing water between August 22 and 24, 2012.

Key:
CDFG = California Department of Fish and Game
USGS = U.S. Geological Survey

Of the three upstream sample locations, only the mainstem Tuolumne sample could be collected during the season investigated, as Woods and Sullivan Creeks were dry at that time. In-reservoir samples were collected at the deepest point near the dam and about 2/3 of the way upstream, between Upper Bay and Middle Bay. At each reservoir location, water quality samples were collected for laboratory analysis at two depths: within the hypolimnion and just below the surface in the epilimnion. *In situ* water quality measurements were made at the same depths using a Hydrolab DataSonde 5.

In-stream samples were taken upstream and downstream of Don Pedro Reservoir. Upstream sampling locations were limited to the Tuolumne River site, upstream of Ward's Ferry. Woods Creek and Sullivan Creek were not sampled because they either contained no flowing water or were dry during the sampling period. Water quality grab samples were collected for laboratory analysis from the moving water. *In situ* measurements were collected from the same locations using a Hydrolab Quanta or Hydrolab DataSonde 5.

4.1.2 In-Situ and Laboratory Analyses

Table 4.1-2 shows the method, target reporting limit,[1] method detection limit[2] and hold time associated with each constituent measured for this study. Water temperature, dissolved oxygen (DO), pH, specific conductance, and turbidity were measured in the field using a Hydrolab DataSonde 5 or Quanta. Laboratory analyses were conducted using U.S. Environmental Protection Agency (EPA) Analytical Methods (EPA 2010), Standard Methods (SM, APHA et al. 2010), or an equivalent method sufficiently sensitive to detect and report levels necessary for evaluation against state and federal water quality standards.

Table 4.1-2. Water quality parameters.

Parameter		Method	Target Reporting Limit/Method Detection Limit µg/L (or other)[1]	Hold Time
Dissolved Oxygen	DO	SM 4500-O	0.1 mg/L	Field (*in situ*)
Specific conductance		SM 2510A	0.001 µmhos	Field (*in situ*)
pH		SM 4500-H	0.1 su	Field (*in situ*)
Turbidity		SM 2130 B	0.1 NTU	Field (*in situ*)
Basic Water Quality – Laboratory				
Total Organic Carbon	TOC	SM 5310	0.5/0.02 mg/L	28 d
Dissolved Organic Carbon	DOC	EPA 415.1 D	0.5/0.02 mg/L	28 d
Total Dissolved Solids	TDS	EPA 2540 C/SM 2340 C	1 mg/L	7d
Total Suspended Solids	TSS	EPA 2520 D SM 2340 D	1 mg/L	7d
Inorganic Ions				
Total Alkalinity	--	SM 2340 B	1000	14 d
Hardness (measured value)	--	EPA 2340 B/SM 2340 C	2 mg/L as CaCO3	14 d
Calcium	Ca	EPA 6010 B	100	180 d
Magnesium	Mg	EPA 6010 B	100	180 d
Potassium	K	EPA 6010 B	500	180 d
Sodium	Na	EPA 6010 B	500	180 d
Chloride	Cl	EPA 300.0	1000 mg/L	28 d
Nutrients				
Nitrate-Nitrite	--	EPA 300.0	100	28 d <pH 2
Total Ammonia as N	--	EPA 4500-NH3/ SM 4500-NH3	100	28 d <pH 2
Total Kjeldahl Nitrogen as N	TKN	SM 4500 N	500	28 d <pH 2
Total Phosphorous	TP	SM 4500-P	100	28 d <pH 2
Dissolved Orthophosphate	PO_4	EPA 365.1/EPA 300.0	100	48 h at 4°C

[1] The reporting limit is the lowest concentration at which an analyte can be detected with a reliable precision and accuracy. At this concentration, both the identity of the analyte and its quantity are certain.

[2] The method detection limit is the lowest concentration that an analyte can be detected and distinguished from other chemicals. At this concentration, the identity of the analyte is certain, but its quantity is uncertain.

Parameter		Method	Target Reporting Limit/Method Detection Limit µg/L (or other)[1]	Hold Time
Dissolved Oxygen	DO	SM 4500-O	0.1 mg/L	Field (*in situ*)
Specific conductance		SM 2510A	0.001 µmhos	Field (*in situ*)
pH		SM 4500-H	0.1 su	Field (*in situ*)
Turbidity		SM 2130 B	0.1 NTU	Field (*in situ*)
Metals (Total and Dissolved)				
Arsenic (total and dissolved)	As	EPA 200.8/1632	0.15/0.04	180 d
Cadmium (total and dissolved)	Cd	EPA 200.8/1638	0.020/0.004	180 d
Copper (total and dissolved)	Cu	EPA 200.8/1638	0.10/0.010	180 d
Iron (total and dissolved)	Fe	EPA 200.8/1638	10/3.2	180 d
Lead (total and dissolved)	Pb	EPA 1638	0.040/0.003	180 d
Mercury (total)	Hg	EPA 1631	0.0005/0.00008	28 d
Methylmercury (total and dissolved)	CH3Hg	EPA 1630	0.00005/0.00002	90 d
Selenium (total)	Se	EPA 200.8/1638	0.60/0.2	180 d
Silver (total and dissolved)	Ag	EPA 200.8/1638	0.020/0.006	180 d
Zinc (total and dissolved)	Zn	EPA 200.8/1638	0.20/0.10	180 d
Herbicides and Pesticides				
Aldrin	--	EPA 8081A	3.0	7d
Alpha-BHC (=alpha-HCH)	--	EPA 8081A	0.08	7d
Beta-BHC (=beta-HCH)	--	EPA 8081A	0.08	7d
Chlordane	--	EPA 8081A	0.0043	7d
Chlorpyrifos	--	EPA 8141A	0.014	7d
Delta-BHC (=delta-HCH)	--	EPA 8081A	0.08	7d
Dieldrin	--	EPA 8081A	0.056	7d
Diazinon	--	EPA 8141A	0.05	7d
Endosulfan I	--	EPA 8081A	0.056	7d
Endosulfan II	--	EPA 8081A	0.056	7d
Endrin	--	EPA 8081A	0.036	7d
Gamma-BHC (=gamma-HCH)	--	EPA 8081A	0.08	7d
Heptachlor	--	EPA 8081A	0.0038	7d
Heptachlor Epoxide	--	EPA 8081A	0.0038	7d
Toxaphene	--	EPA 8081A	0.0002	7d

[1] When only one number is provided, it is the method detection limit.

Key:
Field = in situ
d = days
h = hours
µg/L = micrograms per liter
mg/L = milligrams per liter
SM = Standard Method
EPA= Environmental Protection Agency

California-certified laboratories analyzed the water samples for basic water chemistry, inorganic ions, metals, nutrients, herbicides, and pesticides. Frontier Geosciences, Inc., Seattle, Washington, conducted laboratory analyses for trace metals. CalScience Environmental Laboratories, Inc., Garden Grove, California, conducted all other laboratory analyses.

4.1.3 Sample Collection

Sample and data collection procedures were detailed in the Water Quality Assessment Study Plan or Quality Assurance Project Plan (QAPP) provided as Attachment A, Part 1 to this document. Hydrolab sondes were rented from Hach Hydromet in Loveland, Colorado. Calibration of each sonde was performed by Hach Hydromet prior to deployment (Attachment A Part 1). Calibration was also verified in the field using the manufacturer's recommended calibration methods. The study team noted relevant conditions during each sampling event on the field data sheet (i.e., air temperature, water flow, description of location, floating material, and evidence of oil and grease).

Each laboratory sample was collected into laboratory-supplied clean containers. Water samples to be analyzed for metals were taken using "clean hands" methods consistent with the EPA Method 1669 sampling protocol as described in *Sampling Ambient Water for Trace Metals at EPA Water Quality Criteria* (EPA 1996). Samples collected for dissolved metals analysis were filtered in the field in accordance with standard protocols.

All sample containers were labeled with the date and time that the sample was collected, assigned a sample number, and handled in a manner consistent with appropriate chain-of-custody protocols. Samples were preserved as appropriate, stored, and delivered to a California-certified water quality laboratory for analyses of the parameters listed in Table 4.1-2 in accordance with maximum holding periods for each parameter. A chain-of-custody record was maintained with the samples at all times. The sampling site location was recorded using a hand-held Global Positioning System (GPS) unit and the coordinates were recorded in a field logbook.

4.1.4 Quality Assurance

As part of the field quality assurance program defined in the Quality Assurance Project Plan (QAPP) (Attachment A, Part 1), duplicate samples, field blanks and equipment rinsate samples were collected and submitted to the laboratory for analysis (Attachment B). A duplicate sample is a sample co-located with an investigation sample and the two are sent to the laboratory together. For homogenous matrices such as water, comparing laboratory results from the duplicate and investigation samples provides a way to assess the laboratory's consistency. A field blank is a sample of analyte-free water poured into a sample container in the field, preserved, and shipped to the laboratory along with collected samples. A field blank assesses sample contamination from field methods and conditions during sampling. An equipment rinsate is a sample of analyte-free water poured over or through decontaminated field sampling equipment prior to the collection of samples. Testing of this sample assesses the adequacy of the decontamination processes. Only equipment used for reservoir sampling was used for more than one sample site; stream samples did not require sharing equipment.

All field and laboratory data were verified and/or validated as appropriate. Following field surveys and laboratory analysis, which included the laboratory's own Quality Assurance/Quality Control (QA/QC**)** analysis, QA/QC procedures were applied to all data, including, but not limited to: spot-checks of transcription; review of electronic data submissions for completeness; comparison of Geographic Information System maps with field notes on locations; comparison

of results to field blank and rinsate results; and, identification of any data that seemed inconsistent with expectations and requiring resolution.

All verified chemical detections, including data whose results are "J" qualified,[3] were used for this assessment. Field-sampling conditions, as measured by the field blank and the rinsate sample results, were reviewed by the study scientist and, if appropriate, used to qualify detected concentrations.

4.2 Recreation Element

For the recreation element of the study, bacteria and total petroleum hydrocarbon (TPH) samplings were conducted at near-shore locations adjacent to recreation facilities receiving relatively lower levels of active management as identified by the recreation facility reconnaissance survey. During the survey, these locations were identified to have the potential to affect water quality. In accordance with bacteria sampling protocols (CVRWQCB 1998), bacteria samples were collected on five different days within a 30-day period including a holiday weekend. For this study, samples were collected in the 30 days surrounding and including the 2012 Independence Day holiday weekend. A single TPH sample was also collected at each location during the Independence Day holiday weekend.

4.2.1 Recreation Sample Locations

Recreation sample locations are listed in Table 4.2-1 and shown in Figure 3.0-1. At each sample location, water samples were collected from the near surface[4] for bacteria and at the surface for TPH.

Table 4.2-1. Recreation sample locations on Don Pedro Reservoir.

Recreation Area	Bacteria and TPH Sampling Site
Fleming Meadows	Marina
	Houseboat marina
	Boat launch
	Main campground loop
	Small campground loop
Blue Oaks	Boat ramp
	Picnic area
	Loop of campground
Moccasin Point	Boat ramp
	Marina
	Main campground loop
	Picnic area

TPH = Total Petroleum Hydrocarbon

[3] Results with a "J" qualifier are results where the chemical was detected, but there is uncertainty in the reported concentration. The quantity is above the method detection limit, but below the reporting limit.

[4] Approximately 6 inches below the surface.

4.2.2 Laboratory Analyses

Water samples associated with recreation activities were analyzed for bacteria and TPH (Table 4.2-2). Bacteria samples were delivered to JL Analytical, Inc., Modesto, California for analysis. TPH samples were sent to CalScience Environmental Laboratories, Inc., Garden Grove, California.

Table 4.2-2. Water quality parameters addressed in the Recreation Element of the study.

Parameter	Symbol or Abbreviation	Method	Target Reporting Limit/ Method Detection Limit	Hold time
Bacteria				
Total coliform	--	SM 9221B	2/100 mL	24 h
Fecal coliform	--	SM 9221E	2 MPN/100 mL	24 h
Escherichia coli	E. coli	SM 9221F	2 MPN/100 mL	24 h
Petroleum Hydrocarbons				
Total Petroleum Hydrocarbon—gasoline	TPH-g	EPA 8015B(Modified)	50/48 µg/L	14 d
Oil & Grease	O&G	Visual Observation	--	--

Key:
d = days
h = hours
ml= milliliters
µg/L = micrograms per liter
MPN = Most Probable Number
SM = Standard Method
EPA= Environmental Protection Agency

At each location, visual observations of oil and grease were recorded in the field notebook, if present.

4.2.3 Sample Collection

The Recreation Element followed the same sampling protocols as the Water Quality Element (Section 4.1.3).

4.2.4 Quality Assurance

All data were verified and/or validated as defined in the Study QAPP (Attachment A, Part 1). In brief, following field surveys and laboratory analysis, which included the laboratory's own QA/QC analysis, the Districts subjected all data to QA/QC procedures including, but not limited to: spot-checks of transcription; review of electronic data submissions for completeness; comparison of Geographic Information System (GIS) maps with field notes on locations; and, identification of any inconsistent data.

4.3 Consistency with Water Quality Objectives

Beneficial uses of surface water in the vicinity of the Project are designated by the CVRWQCB and listed in the Basin Plan (CVRWQCB 1998). The designated beneficial uses for the Project

Area[5] consist of municipal and domestic supply (MUN); agricultural supply (AGR); hydropower generation (POW); water contact recreation (REC-1); water non-contact recreation (REC-2); cold freshwater habitat (COLD); warm freshwater habitat (WARM); migration of aquatic organisms (MIGR), spawning, reproduction and/or early development (SPAWN), and wildlife habitat (WILD).

Because most Water Quality Objectives provided in the Basin Plan are narrative, to assess the consistency of analytical data with these beneficial uses, the Districts selected numeric standards, criteria, or benchmarks correlated with each beneficial use to compare to this study's results. Provided in Table 4.3-1, selected values were primarily taken from the California Toxics Rule (CTR) (EPA 2000) and the Basin Plan itself (CVRWQCB 1998), which incorporates Title 22 drinking water standards. When a study parameter did not have a corresponding value in one of these preferred sources, values were taken from *A Compilation of Water Quality Goals* (Marshack 2008), *Water Quality Standards for Recreational Waters* (EPA 2003, another compilation with multiple regional sources), and others as cited.

Table 4.3-1. Benchmark values suggested for evaluating the protection of designated beneficial uses of Project waters.[1]

Basin Plan Water Quality Objective (Potentially Affected Beneficial Uses)	Symbol or Abbreviation	Benchmark Values	Reference	Notes
Bacteria (MUN, REC-1)				
Total coliform	--	< 10,000 MPN per 100 mL < 240 MPN per 100 mL (geometric mean);	EPA 2003	Water contact recreation, single-day sample; Water contact recreation, 30-day geometric mean
Fecal coliform	--	< 200 MPN per 100 mL (geometric mean); < 10% of samples > 400 MPN per 100 mL	CVRWQCB 1998	Water contact recreation, 30-day geometric mean; with individual samples not > 400 MPN/100 mL
Escherichia coli	E. coli	<126 MPN per 100 mL (geometric mean) <235 MPN per 100 mL in any single sample	EPA 2003	Water contact recreation, 30-day geometric mean
Biostimulatory Substances (COLD, SPAWN)				
Total Kjeldahl Nitrogen	TKN	None	--	--
Total Phosphorous	TP	None	--	--
Chemical Constituents (AGR, COLD, MUN)				
Alkalinity	--	20 mg/L (minimum)	Marshack 2008	EPA AWQC; low alkalinity can affect water treatment
Arsenic	As	0.010 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Cadmium	Cd	5 µ/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Calcium	Ca	None	--	--

[5] The Project Area is defined as the area within and immediately adjacent to the FERC Project Boundary.

Basin Plan Water Quality Objective (Potentially Affected Beneficial Uses)	Symbol or Abbreviation	Benchmark Values	Reference	Notes
Chloride	Cl	250 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Chromium (total)	Cr (total)	50 µg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Copper	Cu	1 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Lead	Pb	15 µg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Mercury (inorganic)	Hg	0.002 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Nickel	Ni	0.1 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Nitrate	NO_3	45 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Nitrite	NO_2	1 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Nitrate + Nitrite	$NO_3 + NO_2$	10 mg/L (combined total)	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Potassium	K	None	--	--
Selenium	Se	0.05 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL[2]
Sodium	Na	20 mg/L	Marshack 2008	Sodium Restricted Diet[3]
Specific conductance	--	150 µmhos	CVRWQCB 1998	Aquatic Life Protection
Zinc	Zn	5 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Dissolved Oxygen (COLD, SPAWN)				
Dissolved Oxygen	DO	7.0 mg/L (minimum)	CVRWQCB 1998	Aquatic life protection
Floating Material (REC-1, REC-2)				
Floating Material	--	Narrative Criteria	CVRWQCB 1998	Aesthetics - Absent by visual observation
Oil and Grease (REC-1, REC-2)				
Oil & Grease	--	Narrative Criteria	CVRWQCB 1998	Aesthetics - Absent by visual observation
Total Petroleum Hydrocarbons	TPH	None	--	--
pH (COLD, SPAWN, WILD)				
pH	--	6.5-8.5	CVRWQCB 1998	Aquatic life protection
Sediment and Settleable Solids (REC-2, SPAWN, WILD)				
Sediment	--	Narrative Criteria	CVRWQCB 1998	

Basin Plan Water Quality Objective (Potentially Affected Beneficial Uses)	Symbol or Abbreviation	Benchmark Values	Reference	Notes
Tastes and Odors (MUN)				
Aluminum	Al	0.2 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Chloride	Cl	250 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Copper	Cu	1.3 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Iron	Fe	0.3 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Silver	Ag	0.1 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Specific Conductance	--	900 umhos	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Sulfate	SO_4	250 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Total Dissolved Solids	TDS	500 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Zinc	Zn	5 mg/L	CDPH 2010 cited in CVRWQCB 1998	Title 22 Secondary MCL[2]
Temperature (COLD, SPAWN)				
Temperature	--	20°C (mean daily), T > 3-5°C (min)	Frost and Brown 1967; Elliott 1981	See Water Temperature Model (W&AR-16)
Toxicity (COLD, SPAWN, MUN) ***CTR values listed below generally assume Total Recoverable Concentrations (unfiltered)[4,5]***				
Ammonia as N (pH and Temp dependent)	NH_3-N	24.1 mg/L (CMC); 4.1-5.9 mg/L (CCC)	EPA 2000	CTR criteria over 0-20°C assuming pH 7.0
		5.6 mg/L (CMC); 1.7-2.4 mg/L (CCC)	EPA 2000	CTR criteria over 0-20°C assuming pH 8.0
		0.9 mg/L (CMC); 0.3-0.5 mg/L (CCC)	EPA 2000	CTR criteria over 0-20°C assuming pH 9.0
Arsenic	As	0.34 mg/L (CMC); 0.15 mg/L (CCC)	EPA 2000	CTR criteria

Basin Plan Water Quality Objective (Potentially Affected Beneficial Uses)	Symbol or Abbreviation	Benchmark Values	Reference	Notes
Cadmium (hardness dependent)	Cd	0.23 µg/L (CMC); 0.15 µg/L (CCC)	EPA 2000	CTR for unfiltered sample assuming hardness of 5 mg/L as $CaCO_3$
		0.4 µg/L (CMC); 0.34 µg/L (CCC)	EPA 2000	CTR for unfiltered sample assuming hardness of 10 mg/L as $CaCO_3$
		0.56 µg/L (CMC); 0.53 µg/L (CCC)	EPA 2000	CTR for unfiltered sample assuming hardness of 15 mg/L as $CaCO_3$
		0.83 µg/L (CMC); 0.95 µg/L (CCC)	EPA 2000	CTR for unfiltered sample assuming hardness of 25 mg/L as $CaCO_3$
Copper (hardness dependent)	Cu	0.83 µg/L (CMC); 0.72 µg/L (CCC)	EPA 2000	CTR for unfiltered sample assuming hardness of 5 mg/L as $CaCO_3$
		1.6 µg/L (CMC); 1.3 µg/L (CCC)	EPA 2000	CTR for unfiltered sample assuming hardness of 10 mg/L as $CaCO_3$
		2.34 µg/L (CMC); 1.84 µg/L (CCC)	EPA 2000	CTR for unfiltered sample assuming hardness of 15 mg/L as $CaCO_3$
		3.79 µg/L (CMC); 2.85 µg/L (CCC)	EPA 2000	CTR for unfiltered sample assuming hardness of 25 mg/L as $CaCO_3$
Lead (hardness dependent)	Pb	0.54 µg/L (CCC) 14 µg/L (CMC)	EPA 2000	CTR for unfiltered sample assuming hardness of 25 mg/L as $CaCO_3$
Mercury	Hg	0.050 µg/L	EPA 2000 40 CFR 131.38	CTR/Federal Register 5/18/00
Nitrate-Nitrite	NO_3-N+NO_2-N	10 mg/L (combined total)	CDPH 2010 cited in CVRWQCB 1998	Title 22 Primary MCL ("Blue baby Syndrome")

Basin Plan Water Quality Objective (Potentially Affected Beneficial Uses)	Symbol or Abbreviation	Benchmark Values	Reference	Notes
Silver (hardness dependent)	Ag	0.02 µg/L (CMC) instantaneous	EPA 2000	CTR for unfiltered sample assuming hardness of 5 mg/L as $CaCO_3$
		0.08 µg/L (CMC) instantaneous	EPA 2000	CTR for unfiltered sample assuming hardness of 10 mg/L as $CaCO_3$
		0.16 µg/L (CMC) instantaneous	EPA 2000	CTR for unfiltered sample assuming hardness of 15 mg/L as $CaCO_3$
		0.37 µg/L (CMC) instantaneous	EPA 2000	CTR for unfiltered sample assuming hardness of 25 mg/L as $CaCO_3$
Zinc (hardness dependent)	Zn	9.47 µg/L	EPA 2000	CTR for unfiltered sample assuming hardness of 5 mg/L as $CaCO_3$
		17.03 µg/L	EPA 2000	CTR for unfiltered sample assuming hardness of 10 mg/L as $CaCO_3$
		24.01 µg/L	EPA 2000	CTR for unfiltered sample assuming hardness of 15 mg/L as $CaCO_3$
		37.02 µg/L	EPA 2000	CTR for unfiltered sample assuming hardness of 25 mg/L as $CaCO_3$
Aldrin	--	3.0 µg/L	Marshack 2008	AWQC
Chlordane	--	0.0043 µg/L	Marshack 2008	AWQC
Chlorpyrifos	--	0.014 µg/L	Marshack 2008	AWQC
Diazinon	--	0.05 µg/L[5]	Marshack 2008	AWQC
Dieldrin	--	0.056 µg/L	Marshack 2008	AWQC
Endosulfan	--	0.056 µg/L	Marshack 2008	AWQC
Endrin	--	0.036 µg/L	Marshack 2008	AWQC
Heptachlor	--	0.0038 µg/L	Marshack 2008	AWQC
Heptachlor epoxide	--	0.0038 µg/L	Marshack 2008	AWQC
alpha-Hexachlorocyclohexane	--	0.08 µg/L	Marshack 2008	AWQC
beta-Hexachlorocyclohexane	--	0.08 µg/L[6]	Marshack 2008	AWQC
delta-Hexachlorocyclohexane	--	0.08 µg/L[6]	Marshack 2008	AWQC
gamma-Hexachlorocyclohexane	--	0.08 µg/L	Marshack 2008	AWQC
Toxaphene	--	0.0002 µg/L	Marshack 2008	AWQC

Basin Plan Water Quality Objective (Potentially Affected Beneficial Uses)	Symbol or Abbreviation	Benchmark Values	Reference	Notes
Turbidity (COLD, SPAWN, WILD, MUN)				
Turbidity	NTU	increase < 1 NTU for 1-5 NTU background; increase < 20% for 5-50 NTU background	CVRWQCB 1998	Aesthetics, disinfection, egg incubation

[1] Note a chemical may be listed under more than one beneficial use.
[2] CDPH Title 22 identified as minimum WQ thresholds, but acknowledged as insufficiently protective in some cases (CVRWQCB 1998).
[3] Guidance level to protect those individuals restricted to a total sodium intake of 500 mg/day (Marshack 2008).
[4] CMC: Criterion Maximum Concentration (one-hour acute exposure) for aquatic toxicity as defined by EPA (2000).
[5] CCC: Criterion Continuous Concentration (four-day chronic exposure) for aquatic toxicity as defined by EPA (2000).
[6] Value is for gama-hexachlorocyclohexane.

Key:
AGR = agricultural supply
AWQC = Ambient Water Quality Criteria
EPA = Environmental Protection Agency
$CaCO_3$ = Calcium carbonate
CMC = Criterion Maximum Concentration (1-hour acute exposure) for aquatic toxicity as defined by EPA (2000)
CCC = Criterion Continuous Concentration (4-day chronic exposure) for aquatic toxicity as defined by EPA (2000)
COLD = cold freshwater habitat
CTR = California Toxics Rule
MCL = Maximum Contaminant Level
MUN = municipal and domestic supply
REC-1 = water contact recreation
REC-2 = water non-contact recreation
µmhos = micromhos
µg/L = micrograms per liter
mg/L = milligrams per liter
MPN = Most Probable Number
NTU = Nephelometric turbidity units
SM = Standard Method
SPAWN = spawning, reproduction and/or early development
WILD = wildlife habitat

The CVRWQCB has adopted, by reference, California Title 22 maximum contaminant levels (MCL) for drinking water as Basin Plan objectives (CVRWQCB 1998), with the exception that more stringent criteria may apply as necessary for protection of specific beneficial uses. Hence, these values are adopted herein. It should be noted, however, that chemical concentrations that were originally intended to apply to finished tap water, rather than to untreated sources of drinking water, would be applied to the untreated reservoir or river water.

For water quality objectives related to aquatic toxicity,[6] the CTR (EPA 2000) will be evaluated. Section 131.38 of 40 California Code of Regulations (CCR) establishes Criterion Maximum Concentrations (CMC) as the highest concentration to which aquatic life can be exposed for a short period without deleterious effects and must be based on extended sample collection and one-hour averaging. The Criterion Continuous Concentration (CCC) is defined as the highest concentration to which aquatic life can be exposed for an extended period of time (i.e., four days) without deleterious effects. When single grab samples are collected, it is assumed that constituent concentrations are representative of the continuous ambient condition, and CCC

[6] Ammonia, nitrate, and trace metals.

values are therefore used as the appropriate criteria to compare against environmental samples. Because of differences in acute and chronic toxicity to aquatic organisms of many elements and compounds in Table 4.3-1 as well as variations with ambient water quality such as pH or hardness, several entries have multiple benchmarks to assist with their evaluation. The benchmarks for five of the metals addressed in this study plan (i.e., cadmium, copper, lead, silver and zinc) are reported for unfiltered (i.e., total metals) samples from the CTR (EPA 2000), and calculated in 5 mg/L increments of hardness since the level at which each of these metals is reportedly toxic to aquatic life is lower at lower hardness levels. In addition, the CMC and CCC levels for ammonia are a function of both pH and temperature and are presented over a range of 0 to 20°C in pH increments of 1 standard unit (su).

5.0 RESULTS

Study results are provided below by Water Quality Study Element and Recreation Water Quality Study Element. Analytical results are provided in their entirety, by reservoir and stream reach, in Attachment C.

5.1 Data Representativeness, Accuracy and Completeness

The QAPP specifies representativeness, completeness, and accuracy objectives for analytical data acquisition (Attachment A, Part 1). Representativeness was ensured via the location of sample sites as well as the season. Representative locations and measurement intervals were specified in the FERC-approved Study Plan and described above in Section 4.1 for the Water Quality Study Element and Section 4.2 for the Recreation Water Quality Study Element. The sampling design ensured representativeness of the data.

Accuracy for field and laboratory measurements is defined as the degree of conformity of a measured/calculated quantity to its actual (true) value. The accuracy objective provided in the QAPP for the study was 90 percent (Attachment A, Part 1). Calibration records for the field instruments are provided in Attachment B and show that field instruments were within acceptable limits. Though field filters and the vast majority of other sampling equipment were not shared between sites, rinsate and field blank data indicate that at the low detection and reporting limits used, some trace metals concentrations may have been introduced by the filters used for in-field filtration, field handling, or laboratory handling[7] (Attachment B). Data were not modified to reflect this observation; however, results were used to qualify the discussion in Section 6.0. For the laboratory data, quality assurance samples (method blanks, laboratory control samples, method spikes, and others) were analyzed as appropriate for each method. All quality control analyses were within acceptable limits for the laboratory data; some data are flagged, however, to account for concentrations found below reporting limits, but above detection limits, or when method blanks had detected concentrations. All verified chemical detections, including data whose results are "J" qualified,[8] were used in this assessment.

The completeness objective provided in the QAPP for the study was 90 percent (Attachment A, Part 1), and is defined as the number of valid measurements divided by the number of measurements collected. Though one non-conformance resulted in data loss—turbidity was not measured downstream of La Grange Dam-- the completeness objective for water quality sampling was met: valid results were obtained for > 99 percent of the data collection effort.

5.2 Water Quality Element

Analytical results and comparisons to their associated standards, criteria, and/ or benchmarks are provided in Attachment C and summarized below in Table 5.2-1. The summary consists of the parameter's frequency of detection, range of results (minimum, maximum) and average value by

[7] Filtering was performed in the field and not in the laboratory to address preservation and holding time concerns when sampling sites are remote from shipping sites.

[8] Results with a "J" qualifier are results where the chemical was detected, but there is uncertainty in the quantity. The quantity is above the method detection limit, but below the reporting limit.

season. The standard, criterion, or benchmark used for the comparison (from Table 4.3-1) and the location(s) of any value above or below the standard, criterion, or benchmark (as defined) were excerpted from Attachment C and are provided in the summary tables, as well. For completeness, analytes that were not detected in any sample are also listed in Table 5.2-1.

Results that exceeded the standards, criteria, or benchmarks of Table 4.3-1 are discussed in section 6.0.

Table 5.2-1. Summer 2012 summary of water quality element results.[1]

Analyte	Units	Detection Frequency[2,3]	Concentration Range			Standard, Criterion, or Benchmark[4]	Location(s) of Benchmark Exceedance(s)
			min	max	average		
In Situ Measurements							
Temperature	°C	7/7	9.67	27.13	17.00	--	--
Specific Conductance	µSiemans/cm	7/7	20	44	33.7	150	None
pH	stnd units	7/7	**6.40**	7.95	6.94	6.5-8.5	6.40 – Tuolumne River above Don Pedro 6.47 – Mid-reservoir (Bottom) 6.42 – Near Don Pedro Dam (Bottom)
Dissolved Oxygen	mg/L	7/7	**3.15**	12.6	7.85	7 (minimum)	3.2 – Mid-reservoir (Bottom) 4.8 – Near Don Pedro Dam (Bottom)
Turbidity	NTU	2/6	0	282	49	--	--
Basic Water Quality, Inorganic ions and Nutrients							
Alkalinity, Total (as $CaCO_3$)	mg/L	8/8	**3.5**	**15.5**	12.2	20 (minimum)	All results—upstream, downstream and within Don Pedro Reservoir
Ammonia (as N)	mg/L	0/8	0.10 ND	0.10 ND	0.10 ND	Temp & pH Dep't[6]	None
Calcium	mg/L	8/8	2.12	3.95	2.98	--	--
Carbon, Dissolved Organic	mg/L	8/8	3.1B	4.7	3.8	--	--
Carbon, Total Organic	mg/L	8/8	2.6B	4.6	3.5	--	--
Chloride	mg/L	8/8	0.58 J	0.83 J	0.70 J	230	None
Hardness, Total	mg/L	8/8	6	15	11.5	--	--
Magnesium	mg/L	8/8	0.443	1.55	1.26	--	--
Nitrate (as N)	mg/L	5/8	0.037 J	0.11	0.08	10	None
Nitrite (as N)	mg/L	0/8	0.10 ND	0.10 ND	0.10 ND	1	None
o-Phosphate (as P)	mg/L	1/8	0.051 J	0.10 ND	0.09	--	--
Phosphorus, Total	mg/L	6/8	0.025 J	0.10 ND	0.06	--	--
Potassium	mg/L	8/8	0.534	0.69	0.60	--	--
Sodium	mg/L	8/8	1.2	2.3	1.9	20	None
Solids, Total Dissolved	mg/L	8/8	20	47	29	500	None
Solids, Total Suspended	mg/L	4/8	0.10 ND	16.00	2.98	--	--
Total Kjeldahl Nitrogen	mg/L	8/8	0.50 ND	0.50 ND	0.50 ND	--	--

Analyte	Units	Detection Frequency[2,3]	Concentration Range			Standard, Criterion, or Benchmark[4]	Location(s) of Benchmark Exceedance(s)
			min	max	average		
Herbicides and Pesticides							
Aldrin	µg/L	0/8	0.010 ND	0.010 ND	0.010 ND	3.0	None
Alpha-BHC	µg/L	0/8	0.010 ND	0.010 ND	0.010 ND	0.08	None
Beta-BHC	µg/L	0/8	0.010 ND	0.010 ND	0.010 ND	0.08	None
Chlordane	µg/L	0/8	0.025 ND	0.025 ND	0.025 ND	0.0043	None[8]
Chlorpyrifos	µg/L	0/8	0.005 ND	0.010 ND	0.006 ND	0.014	None
Delta-BHC	µg/L	0/8	0.010 ND	0.010 ND	0.010 ND	0.08	None
Diazinon	µg/L	0/8	0.005 ND	0.010 ND	0.006 ND	0.05	None
Dieldrin	µg/L	0/8	0.010 ND	0.010 ND	0.010 ND	0.056	None
Endosulfan I	µg/L	0/8	0.010 ND	0.010 ND	0.010 ND	0.056	None
Endosulfan II	µg/L	0/8	0.010 ND	0.010 ND	0.010 ND	0.056	None
Endrin	µg/L	0/8	0.010 ND	0.010 ND	0.010 ND	0.036	None
Gamma-BHC	µg/L	0/8	0.010 ND	0.010 ND	0.010 ND	0.08	None
Heptachlor	µg/L	0/8	0.010 ND	0.010 ND	0.010 ND	0.0038	None
Heptachlor Epoxide	µg/L	0/8	0.010 ND	0.010 ND	0.010 ND	0.0038	None
Toxaphene	µg/L	0/8	0.12 ND	0.12 ND	0.12 ND	0.0002	None[8]
Metals (Total)							
Arsenic	µg/L	8/8	0.25	0.33	0.29	10	None
Cadmium	µg/L	8/8	0.003 J	0.006 J	0.004 J	5	None
Copper	µg/L	8/8	0.48	1.18	0.71	1000	None
Iron	µg/L	8/8	18	**314**	72.50	300	314 – Tuolumne River above Don Pedro
Lead	µg/L	8/8	0.005 J	0.142 J	0.02 J	15	None
Mercury	ng/L	8/8	0.08 J	4.57	1.43	50	None
Methyl Mercury	ng/L	3/8	0.029 J	0.053	0.05 ND	--	--
Selenium	µg/L	0/8	0.6	0.60	0.60	50	None
Silver	µg/L	4/8	0.002 J	0.02 ND	0.01 J	100	None
Zinc	µg/L	8/8	0.14 J	6.35	1.07	5000	None
Metals (Dissolved)							
Arsenic	µg/L	8/8	0.23	0.34	0.28	--	--
Cadmium	µg/L	3/8	0.003 J	0.020 ND	0.01 J	Hardness Dep't[6]	None
Copper	µg/L	8/8	0.4	**8.16**	2.25	Hardness	6.25 – Mid-reservoir (Bottom)

Analyte	Units	Detection Frequency[2,3]	Concentration Range			Standard, Criterion, or Benchmark[4]	Location(s) of Benchmark Exceedance(s)
			min	max	average		
						Dep't[6]	8.16 – Near Don Pedro Dam (Bottom)
Iron	µg/L	8/8	1 J	96	18	--	--
Lead	µg/L	5/8	0.008 J	0.04 ND	0.02 J	Hardness Dep't[6]	None
Methyl Mercury	ng/L	2/8	0.05 ND	0.35	0.12	--	--
Silver	µg/L	0/8	0.02 ND	0.02 ND	0.02 ND	Hardness Dep't[6]	None
Zinc	µg/L	8/8	0.18 J	0.90	0.46	Hardness Dep't[6]	None

[1] All data are provided in Attachment C.
[2] Five locations were sampled. Two locations were sampled at two depths.
[3] For duplicate sample results, the highest concentration of the two samples was used for benchmark comparisons. A duplicate sample was collected downstream of Don Pedro Dam.
[4] The most protective standard, criterion, or benchmark of those given in Table 4.3-1 was used for this analysis. With few exceptions, aquatic life protective benchmarks were the most protective number.
[5] Minimum concentration except where natural concentrations are less (Marshack 2008).
[6] See Attachment C for sample specific criteria. Ammonia criteria are temperature and pH dependent. Metals Criteria are hardness dependent for cadmium, copper, lead, silver, and zinc.
[7] The gamma-BHC benchmark was selected as the alpha-, beta-BHC, and delta-BHC benchmarks.
[8] Benchmark is below the method detection limit for this analyte.

Key:
B = Analyte was present in the associated method blank
J = Analyte was detected at a concentration below the reporting limit and above the laboratory method detection limit. Reported value is estimated.
ND = Analyte was not detected at the reporting limit.
µg/L micrograms per Liter
mg/L milligrams per Liter
ng/L nanograms per liter
< less than the reporting limit for this analysis
-- not available or not applicable

5.3 Recreation Element

Bacteria samples were collected in surface water adjacent to 12 recreation sites five times within 30 days, including one day of the Independence Day holiday weekend (See Figure 3.0-1). The geometric mean was then calculated from the five results to allow comparison with the Water Quality Objective (fecal coliform) or benchmark (total coliform, e coli). TPH samples and visual observations for oil and grease were also recorded. Results of these comparisons are shown in Table 5.3-1.

Table 5.3-1. 2012 Independence Day bacteria sampling results and oil and grease observations.[1,2]

Sample Date	Sample Location											
	Fleming Meadows					Blue Oaks			Moccasin Point			
	Marina	Houseboat Marina	Boat Launch	Main camp loop	Small Camp loop	Boat Launch	Picnic Area	Camp Loop	Boat Launch	Marina	Main camp loop	Picnic Area
TOTAL COLIFORM < 240 MPN per 100 mL (geometric mean)												
6/14/12	230	220	23	79	3500	2800	220	940	7.8	2	17	33
	--	--	--	--	--	1300	--	--	--	10	--	--
7/2/12	22	7.8	7.8	2	7.8	14	4.5	7.8	23	33	2	7.8
	--	--	--	--	--	170	--	--	4.5	--	--	--
7/4/12	49	13	46	17	33	< 1.8	< 1.8	< 1.8	11	33	4.5	13
	7.8	--	--	--	--	--	--	--	--	--	4.5	--
7/7/12	70	49	26	17	130	7.8	11	23	14	23	4.5	13
	--	--	--	9.3	--	--	--	--	--	34	--	--
7/18/12	4.5	23	4	7.8	49	33	2	4.5	4.5	2	11	< 1.8
	--	--	6.8	--	--	--	2	--	--	--	--	--
Geometric Mean[1]	29	30	13	12	89	63	7	17	9	12	6	10
FECAL COLIFORM < 200 MPN per 100 mL (geometric mean)												
6/14/12	1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	4.5	2	6.8	6.8
	--	--	--	--	--	< 1.8	--	--	--	< 1.8	--	--
7/2/12	< 1.8	2	< 1.8	< 1.8	< 1.8	4.5	< 1.8	< 1.8	< 1.8	2	2	< 1.8
	--	--	--	--	--	170	--	--	< 1.8	--	--	--
7/4/12	< 1.8	2	4.5	4.5	7.8	< 1.8	< 1.8	< 1.8	11	4.5	2	7.8
	2	--	--	--	--	--	--	--	--	--	2	--
7/7/12	11	49	14	11	79	< 1.8	4	4.5	14	4.5	2	7.8
	--	--	--	4.5	--	--	--	--	--	15	--	--
7/18/12	4	< 1.8	4	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	2	< 1.8	4	< 1.8
	--	--	6.8	--	--	--	< 1.8	--	--	--	--	--
Geometric Mean[1]	2.8	3.6	4.2	3.3	5.1	3.9	2.1	2.2	4.1	3.3	2.8	4.2
ESCHERICHIA COLI < 126 MPN per 100 mL (geometric mean)												
6/14/12	1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	4.5	< 1.8
	--	--	--	--	--	< 1.8	--	--	--	< 1.8	--	--
7/2/12	< 1.8	2	< 1.8	< 1.8	< 1.8	4.5	< 1.8	< 1.8	< 1.8	2	2	< 1.8

Sample Date	Sample Location											
	Fleming Meadows					Blue Oaks			Moccasin Point			
	Marina	Houseboat Marina	Boat Launch	Main camp loop	Small Camp loop	Boat Launch	Picnic Area	Camp Loop	Boat Launch	Marina	Main camp loop	Picnic Area
	--	--	--	--	--	170	--	--	< 1.8	--	--	--
7/4/12	< 1.8	< 1.8	2	4.5	< 1.8	< 1.8	< 1.8	< 1.8	2	1.8	< 1.8	< 1.8
	< 1.8	--	--	--	--	--	--	--	--	--	< 1.8	--
7/7/12	2	< 1.8	< 1.8	< 1.8	2	< 1.8	< 1.8	2	< 1.8	< 1.8	< 1.8	< 1.8
	--	--	--	< 1.8	--	--	--	--	--	< 1.8	--	--
7/10/12												
7/18/12	< 1.8	< 1.8	4	< 1.8	< 1.8	< 1.8	< 1.8	< 1.8	2	< 1.8	4	< 1.8
			< 1.8				< 1.8					
Geometric Mean[1]	1.8	1.8	2.1	2.1	1.8	3.9	1.8	1.8	1.9	1.8	2.4	1.8
OIL AND GREASE ***Aesthetics – Present or absent by visual observation***												
6/14/12	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent
7/2/12	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent
7/4/12	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent
7/7/12	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent
7/10/12	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent	absent
Total Petroleum Hydrocarbons (µ/L) ***Reporting Limit = 50 µ/L (micrograms per Liter)***												
7/4/12	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50	< 50

[1] Geometric mean values in bold were greater than the water quality objective or benchmark.
[2] Duplicate sample results are provided below original sample results.
Key:
-- = No count performed for this location and time
MPN – Most Probable Number.

6.0 DISCUSSION AND FINDINGS

When developing the Pre-Application Document, the Districts found that limited analyses had been performed on water samples collected in the Project Area, but those existing data indicated that surface water is of low specific conductivity and hardness, prone to acidification, and with limited potential sources of local contamination. This study confirms those results. Water quality in the Project Area is very good, i.e., most analytes were reported from non-detectable to just above reporting limit concentrations. Further, there does not appear to be a pattern of increasing chemical concentrations from upstream to downstream of Don Pedro Dam.

Beneficial uses of surface water in the vicinity of the Project are designated by the CVRWQCB and listed in the Basin Plan (CVRWQCB 1998). The designated beneficial uses for the Project Area were introduced above Section 4.3 and consist of municipal and domestic supply; agricultural supply; hydropower generation; water contact recreation; water non-contact recreation; cold freshwater habitat; warm freshwater habitat; migration of aquatic organisms; spawning; reproduction and/or early development; and wildlife habitat.

To assess the consistency of analytical data with these beneficial uses, the Basin Plan's Water Quality Objectives were compared to the results of the study. Basin Plan Water Quality Objectives and beneficial uses were linked to each other above in Table 4.3-1 where, for situations where the Basin Plan does not provide a numeric Water Quality Objective, a pertinent regulatory standard, criteria or benchmark was selected for this evaluation. Results of these comparisons are provided in Attachment C, summarized in Section 5, and discussed below.

6.1 Biostimulatory Substances

The Basin Plan requires that water shall not contain biostimulatory substances which promote aquatic growth in concentrations that cause nuisance or adversely affect designated beneficial uses.

In August 2012, nitrate concentrations ranged between 0.037 mg/L (estimated) and 0.11 mg/L, while nitrite concentrations and Total Kjeldahl Nitrogen were not detectable. Total phosphorous levels were similarly low, ranging between 0.025 mg/L (estimated) and the reporting limit of 0.10 mg/L. Orthophosphate concentrations were only detected in one sample at 0.051 mg/L (estimated). These low nutrient levels suggest that biostimulatory substances are not currently present in sufficient quantities to cause nuisance conditions related to algal blooms or decreased water clarity. The Districts are unaware of any instances where algal bloom or decreased water clarity has been reported as a nuisance.

6.2 Chemical Constituents

The Basin Plan requires that water shall not contain chemical constituents in concentrations that adversely affect designated beneficial uses. The Basin Plan requires that water designated for use as domestic or municipal supply shall not contain concentrations of chemical constituents in excess of the MCLs specified in the provisions of Title 22 of the CCR (CDPH 2010).

MCLs are intended to be applied to finished tap water, but were applied to untreated water in this study. Samples collected in August 2012 had concentrations less than the primary MCLs for all analytes; water quality was found to be consistent with drinking water standards (See Attachment C). Analytes with secondary MCLs for tastes and odors are addressed below under "Taste & Odor." Aquatic toxicity is discussed below under "Toxicity."

6.3 Color

The Basin Plan includes a narrative Water Quality Objective regarding color.

The FERC-approved study did not require sampling for color. The Districts are unaware of any instances where the color of the water in the vicinity of the Project has been reported as a nuisance or has adversely affected designated beneficial uses.

6.4 pH

The Basin Plan requires that pH shall not be depressed below 6.5 nor raised above 8.5.

During August 2012 sampling, three locations had a pH value outside of these limits: the inflow sample of the Tuolumne River above Don Pedro Reservoir (6.40 su), the mid-reservoir hypolimnion of Don Pedro Reservoir (6.47 su), and the near-dam hypolimnion of Don Pedro Reservoir (6.43 su). Not unexpected for a low nutrient snow-melt derived reservoir, these values are within the sonde's measurement error of ± 0.1 mg/L and are considered consistent with the objective.

6.5 Pesticides

The Basin Plan includes extensive discussions related to Water Quality Objectives for pesticides. Significant pesticide use does not occur within the study area, or in association with Project O&M activities. Further, the Districts are unaware of any instances where pesticide use in the vicinity of the Project has been reported to cause a nuisance or adversely affect designated beneficial uses.

Downstream of the Project, the section of the Tuolumne River from Don Pedro Reservoir to the San Joaquin River is included in the State of California's CWA § 303(d) list regarding the non-point discharge of some agricultural pesticides (SWRCB 2010). Agricultural chemicals on the 303(d) list are chlorpyrifos, diazinon, and the Group A Pesticides—aldrin, dieldrin, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorocyclohexanes (including lindane), endosulfan, and toxaphene.

Pesticides on the 303(d) list for the lower Tuolumne River were not detected in any of the August 2012 samples analyzed at the commercially available reporting limits. However, because the detection limits for chlordane and toxaphene exceeded the reporting limits for those analytes (See Attachment C), consistency with benchmarks could not be determined. However, as stated above, since significant pesticide use does not occur in association with the Project, these non-detects are considered applicable—chlordane and toxaphene are not present in Project waters.

6.6 Sediment and Settleable Solids

The Basin Plan requires that suspended sediment load and suspended sediment discharge to surface waters shall not alter surface waters in such a manner as to cause a nuisance or adversely affect beneficial uses of Project or other water.

Total dissolved solids and total suspended solids were low in August 2012 (10 to 38 mg/L and 1.0 to 3.1 mg/L, respectively). The Districts are unaware of any sediment discharges to surface water related to the Project. Additionally, the Districts are unaware of any circumstances that suspended sediment levels or discharges of such cause a nuisance or adversely affect any designated beneficial uses of Project or other water.

6.7 Tastes and Odor

The Basin Plan requires that waters shall not contain taste- or odor-producing substances in concentrations that impart undesirable tastes or odors to domestic or municipal water supplies or to fish flesh or other edible products of aquatic origin, or that cause nuisance, or otherwise adversely affect beneficial uses of Project or other water.

During the 2012 sampling, iron was measured at a level less than its secondary MCL of 0.3 mg/L for taste and odors at all locations, but one. Above Don Pedro, the inflow sample had an iron concentration of 3.14 mg/L. Secondary MCLs are routinely applied at the point of use (i.e., "at the tap") and existing water treatment methods appear to be adequate to meet these secondary water quality criteria. The Districts are unaware of any reports that taste or odor of water or fish caught in Don Pedro Reservoir cause a nuisance or otherwise adversely affect designated beneficial uses of Project or other water.

6.8 Toxicity

The Basin Plan requires that waters shall be maintained free of toxic substances in concentrations that produce detrimental physiological responses in human, plant, animal, or aquatic life.

The FERC-approved study states that study water quality data would be compared to the aquatic life protective benchmarks from the EPA (2000) *California Toxics Rule (CTR)* or benchmarks excerpted from Marshack (2008) *A Compilation of Water Quality Goals*. The low levels of hardness found throughout the study area are expected to increase the aquatic toxicity of some metals due to the greater proportion of free ions found in many trace metals. At the low hardness levels found in the study (i.e., 6 to 15 mg/L), sample specific dissolved cadmium, copper, lead, silver, and zinc CTR criteria were calculated (see Attachment C, Table C.2**)**. Of these five metals, only copper exhibited a concentration greater than its sample specific CTR—and only in two samples. The mid-reservoir hypolimnion of Don Pedro Reservoir had copper (dissolved) concentration of 6.25 micrograms per liter (µg/L), as compared to a CTR guideline of 1.8 µg/L, and the near-dam hypolimnion of Don Pedro Reservoir had copper (dissolved) concentration of 8.16 µg/L, as compared to a CTR guideline of 1.8 µg/L.

The Districts are unaware of any Project O&M activity that may affect levels of copper. As reported in the PAD, algaecides are not used to manage algae in project waters.

6.8.1 Mercury and Methylmercury

Downstream of the Project, the section of the Tuolumne River included in the State of California's CWA Section 303(d) list regarding the non-point discharge of pollutants/stressors is the section below the outlet of Don Pedro Reservoir to the San Joaquin River. The pollutant stressors identified in the 303(d) list are primarily related to agricultural use, but the list also includes mercury, a legacy contaminant of the gold mining era (SWRCB 2010). Mercury can affect the nervous system of higher trophic organisms and is bioaccumulated and transferred to higher trophic organisms through the food-web.

In August 2012, mercury was detected at all locations at concentrations that ranged between 0.08 J and 4.57 nanograms per Liter (ng/L). These total mercury concentrations were far less than the MCL of 0.002 mg/L (2,000 ng/L) indicating that drinking water beneficial use is being met everywhere in the Project Area for mercury. In addition, the samples were below the CTR benchmark of 50 ng/L.

However, even in trace quantities, mercury is bioaccumulative in its methylated form; samples were also analyzed for methylmercury (total) and methylmercury (dissolved). Methylmercury (total) was detected in three of the eight samples. Samples that contained methylmercury were collected from the Tuolumne Riveri nflow sample, above Don Pedro Reservoir (0.029 J ng/L), the mid-reservoir hypolimnion of Don Pedro Reservoir (0.042 J ng/L), and the near-dam hypolimnion of Don Pedro Reservoir (0.053 ng/L), while methylmercury (dissolved) was detected at higher concentrations in the mid-reservoir hypolimnion of Don Pedro Reservoir (0.293 ng/L), and the near-dam hypolimnion of Don Pedro Reservoir (0.394 ng/L). These data show that methylmercury is present; however the exact concentration is uncertain. The reported dissolved concentrations are greater than total concentrations and the laboratory cannot explain why, other than the results reflecting the difficulty of measuring methylmercury near its reporting limits.

These data are consistent with reports of water quality and fish tissue data collected by Stillwater Sciences between fall 2008 and spring 2009 in which water quality samples and higher trophic level fish species were collected from nines sites within Don Pedro Reservoir and upstream and downstream of the reservoir (TID/MID 2009). Like this study, methylmercury was not detected below either the Don Pedro or La Grange dams and methylmercury was detected in hypolimnetic samples in the Moccasin Creek arm (0.15 ng/L) and Woods Creek (0.145 ng/L) arm of Don Pedro Reservoir. However, unlike this study, no mercury was detected in water samples collected from the Tuolumne River upstream of Don Pedro Reservoir.

In addition, Stillwater Sciences (TID/MID 2009) found evidence of fish mercury bioaccumulation. Concentrations in excess of the EPA (2001) fish tissue residue criterion (0.3 mg/kg[9]) were found at all sites with Don Pedro Reservoir, as well as downstream of La Grange

[9] Since 2001, the California Office of Environmental Health Hazard Assessment (OEHHA) has issued Advisory Tissue Levels (ATLs) that are lower than the EPA (2001) mercury criterion. ATLs are screening values developed by OEHHA to help public

Dam in the lower Tuolumne River, with the highest fish tissue mercury concentrations (0.29 to 0.99 milligrams/kilogram [mg/kg]) observed in largemouth bass sampled from the shallow Moccasin Creek and Woods Creek arms of Don Pedro Reservoir. OEHHA has not issued a fish ingestion advisory for Don Pedro Reservoir (OEHHA 2009).

The Districts are unaware of any Project O&M activity that may affect mercury methylation and do not propose any activities associated with the release or mobilization of mercury.

6.9 Turbidity

The Basin Plan requires that waters be free of changes in turbidity that cause nuisance or adversely affect beneficial uses. This objective is expressed in terms of changes in turbidity (NTU) in the receiving water body: where natural turbidity is 0 to 5 NTUs, increases shall not exceed 1 NTU; where natural turbidity is 5 to 50 NTUs, increases shall not exceed 20 percent; where natural turbidity is 50 to 100 NTUs, increases shall not exceed 10 NTUs; and where natural turbidity is greater than 100 NTUs, increase shall not exceed 10 percent.

Spatial upstream-to-downstream turbidity trends are best seen in the data as it is presented in Attachment C, which provides sample results by location. In August 2012, turbidity was 8.6 NTU upstream of the Project (Tuolumne River above Don Pedro) and 0 NTU downstream of the Project (Below Don Pedro Dam). Three of the four intermediate locations also exhibited no turbidity. The Mid-reservoir (surface) sample had a turbidity reading of 283 NTU; review of temperature profiles indicated that this reading was near the thermocline, a location where plankton reportedly accumulate. Downstream of the La Grange Dam, turbidity data were not recorded when the sonde's probe did not properly record).

The Districts are unaware of any reports that turbidity causes a nuisance or adversely affects beneficial uses in the study area or immediately downstream of the Project.

6.10 Bacteria

The Basin Plan includes a Water Quality Objective (< 200 MPN per 100 mL) for fecal coliform in waters designated for contact recreation (Table 5.3-1), but does not provide a Water Quality Objective for total coliform or *Escherichia coli* (*E. coli*).

In 2012, all twelve recreation sites sampled had fecal coliform counts below the Water Quality Objective for the time surrounding and including Independence Day. Likewise, all total coliform counts and *E. coli* levels were below their respective benchmarks. *E. coli* counts are thought to be better indicators of human impacts (EPA 2003).

6.11 Floating Material

The Basin Plan includes a narrative Water Quality Objective regarding floating material that states water shall be free of floating material in amounts that cause nuisance or adversely affect

health managers decide whether or not to ask OEHHA to evaluate the need for a fish ingestion advisory for water bodies under the manager's jurisdiction (Klasing and Brodberg 2008).

beneficial uses. The FERC-approved study did not include a provision for measuring floating material. The Districts are unaware of any instances where floating material in Project waters has been reported as a potential problem.

6.12 Oil and Grease

The Basin Plan requires that the water not contain oils, greases, waxes or other material in concentrations that cause nuisance, result in visible film or coating on the surface of the water or on objects in the water, or otherwise adversely affect beneficial uses. In 2012, the Districts looked for and did not observe any oil and grease in Don Pedro Reservoir. Samples collected adjacent to 12 recreation sites on and around the Independence Day holiday and analyzed for TPH. TPH was not detected at any of the sites.

6.13 Dissolved Oxygen

The general DO Water Quality Objective of 7.0 mg/L applies to the Tuolumne River and its tributaries (CVRWQCB 1998).

Synoptic measurements of DO in August 2012 samples were all above Basin Plan numerical limits except the mid-reservoir hypolimnion of Don Pedro Reservoir (3.2 mg/L), and the near-dam hypolimnion of Don Pedro Reservoir (4.8 mg/L). These results were expected, since large, deep reservoirs/lakes generally form strong thermoclines with oxygen poor hypolimnions in the late summer/fall period and Don Pedro Reservoir is no exception to this rule (See PAD Section 5.2.1.5, Water Temperature). DO values were above the Basin Plan Objective in all surface samples.

7.0 STUDY VARIANCES AND MODIFICATIONS

The study was conducted in conformance to the FERC-approved Water Quality Assessment Study Plan (W&AR-01), with one variance. The FERC-approved study required collection of single samples at nine sites. During the sampling period, two of the three sites upstream of Don Pedro, Woods Creek and Sullivan Creek (Figure 3.0-1), contained no flowing water. However, the Tuolumne River above Don Pedro sample was collected and reflected inflow water quality conditions.

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